

**CEKENAS**

**121/1**

**MATHEMATICS PAPER 1**

**JULY 2017**

**2 ½ HOURS**

**FORM 4 END OF TERM 2 EVALUATION EXAM**

**MATHEMATICS PAPER 1**

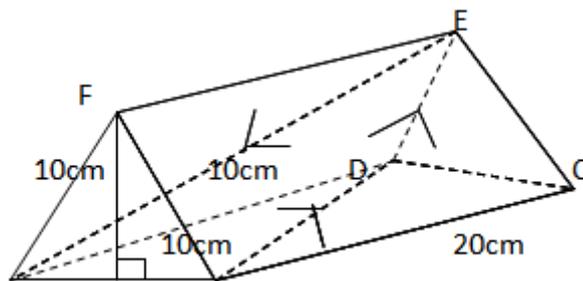
**SECTION I (50 Marks)**

**Answer all the questions in the space provided.**

- Evaluate  $\frac{8 \times \frac{1}{3} \text{ of } 9 \div 12}{(12 + 2 \times 3) - 2/3 \text{ of } 144 \div 12}$  (3 marks)
- Momanyi spent one eighth of his February salary on farming, half on school; fees and two thirds of the remainder on food. Calculate his February salary and the amount he spent on school fees if he spent sh. 3200 on food. (3 marks)
- Makau, Wanjiru and Kemboi started a race at 9.03 am in the same direction to run around a circular course. Makau makes the circuit in 252 seconds, Wanjiru in 308 seconds and Kemboi in 198 seconds. If they start from the same point, at what time will they next be all at starting point together? (3 marks)
- The size of an interior angle of a regular polygon is 5 times the size of its exterior angle. Find the number of sides of this polygon. (3 marks)
- Simplify  $\frac{a^4 - b^4}{A^3 - ab^2}$  (3marks)
- A square based brass is 2 mm high and has a mass of 1.05 kg. the density of the brass is 8.4g/cm<sup>3</sup>. Calculate the length of the plate in centimeters. (3 marks)
- The currency exchange rates of a given bank in Kenya are as follows:
 

Currency	Buying	Selling
1 sterling pound	135.50	135.97
1 US dollar	72.23	72.65

 A tourist arrived in Kenya with 5,000 US dollars which he converted to Kenya shillings upon arrival. He spent Ksh. 214,500 and converted the remaining to sterling pounds. How much pounds did he receive? (3 marks)
- A shopkeeper mixes 3 kg of beans costing Sh 120 and 6kg of maize costing ksh. 60 per kg. At what price must he sell the mixture so as to make a 30% profit. (3 marks)
- he figure below shows a simple tent AF=FB=10 cm. AB =12 and BC = FE = AD = 20 cm. On the tent, a tight rope is tied as shown on the diagram from BD, DE, and EA. Draw the net of the tent and show the path of the rope on the net using a scale of 1 cm to represent 5 cm. (3 marks)



- Without using calculator or mathematical tables, simplify  $\frac{\cos 30^\circ - \sin 45^\circ}{\sin 230^\circ + \tan 245^\circ}$  (4 marks)
- A metal rod of length 30m is cut into pieces of length 0.157 m, another different type of rod of length 247 m is cut into pieces of length 5.899 m. Use reciprocal tables to find the total number of whole pieces. (3 marks)
- Solve for x in  $\left(\frac{4}{9}\right)^x \times \left(8\right)^{1-x} = 486$  (4 marks)
- Solve for x, given that  $0^\circ \leq x \leq 90^\circ$   $4 \cos^2 x - 4 \cos x + 1 = \sin^2 x$  (4 marks)
- Make S the subject of the fomula in  $P = \sqrt{\frac{r(1-S)}{S+1}}$  (3 marks)

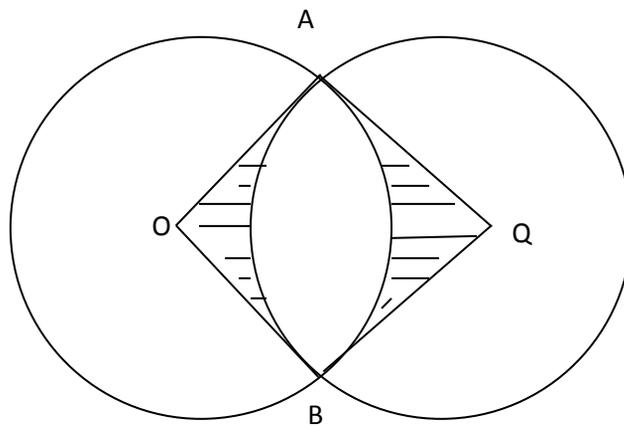
$$P = \sqrt{\frac{r(1-S)}{S+1}}$$

15. The diameter of a circle has its ends with coordinates A (6, 10) and B (0, 2). Determine the equation of the circle giving your answer in the form of  $x^2 + y^2 + ax + by + c = 0$  (3 marks)
16. The equation of a curve is  $y = 2x^2 - 3x + 2$ . Find the equation of the normal to the curve at the point (3, 11). (3 marks)

**Attempt any 5 questions in this section.**

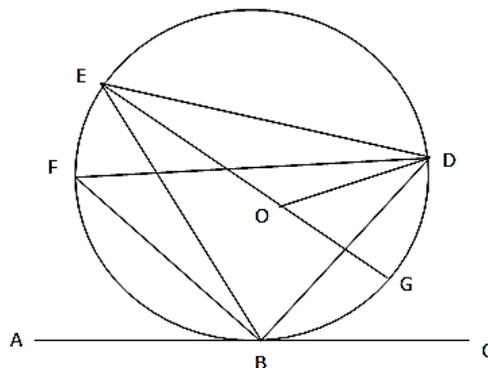
**SECTION II (50 Marks)**

17. a) A line L passes through the points (5,7) and (3,10)  
Determine the gradient of line L. (1 mark)
- b) Another line K is perpendicular to line L and passes through the point (1,0). Write down the equation of line K leaving your answer in form of  $\frac{x}{a} + \frac{y}{b} = 1$  (3 marks)
- c) From (b) above determine  
i) the coordinates of the x - intercept. (2 marks)  
ii) The coordinates of the y intercept. (2 marks)
- d) Calculate the angle that the line K makes with the x axis. (2 marks)
18. Two circles with centres O and Q and radii 8 cm intersect at points A and B as shown below.



Given the distance between O and Q is 12 cm and that the line AB meets OQ at X, find:

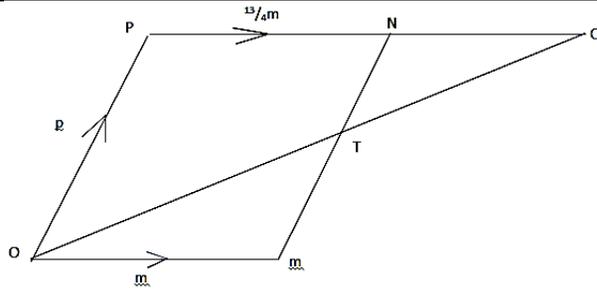
- a) The length of the chord AB. (3 marks)
- b) The reflex angle AOB. (3 marks)
- c) The area of the shaded region.  $\pi = 3.142$  (4 marks)
19. In the figure below, EG is the diameter of the circle centre O. Points B, G, D, E and F are on the circumference of the circle.  $\angle BFD = 50^\circ$ ,  $\angle BEO = 25^\circ$  and line ABC is a tangent to the circle at B.



Giving reasons, calculate the size of

- a)  $\angle CBD$  (2 marks)
- b)  $\angle BED$  (2 marks)
- c) The reflex angle BOD (2 marks)
- d)  $\angle EBA$  (2 marks)
- e)  $\angle BGD$  (2 marks)

20. Quadrilateral OMNP is such that  $OM = m$   $OP = p$  and  $PN = \frac{13}{4}m$  PN is produced to Q such that  $PN:PQ = 13:15$   
T is a point on MN such that  $MN = 3TN$   
Show that O, T and Q are collinear. (10 marks)



21. Four points A, B, C, and D are located on a horizontal plane such that B is 200 m on a bearing of  $065^\circ$  from A, C is 300 m on a bearing of  $120^\circ$  from B and D is 150m due west of C.

- a) Using a scale of 1cm to 50m draw an accurate drawing representing the positions of A, B, C and D. (4 marks)
- b) From your diagram, find the distance and bearing of
  - i) D from A (3 marks)
  - ii) B from D (3 marks)

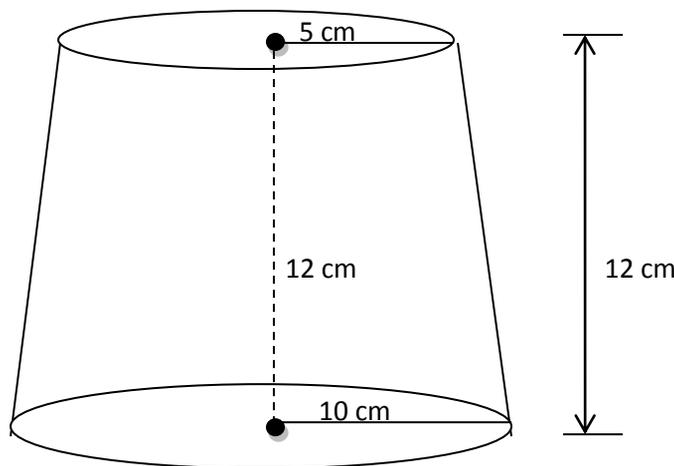
22. Complete the table below for the function

- a)  $Y = 2 + 3x - x^2$  in the range  $-3 \leq x \leq 6$  (2 marks)

x	-3	-2	-1	0	1	2	3	4	5	6
$2+3x$	-7			2		8		14	17	20
$-x^2$		-4	-1	0		-4		-16		-36
y	-16			2		4		-2		

- b) On the grid provided, draw a graph of the function  $y = 2 + 3x - x^2$  in the range  $-3 \leq x \leq 6$  (3 marks)
- c) By drawing a suitable straight line graph, estimate the roots of the equation  $x^2 - 4x = 0$  (3 marks)
- d) i) Determine the value of x for which y is greatest. (1 mark)
- ii) Determine the integral value of  $2 + 3x - x^2 \geq 0$  (1 mark)

The figure below shows a frustrum. Given that the top radius is 5 cm and the bottom radius is 10 cm, and the vertical height of the frustrum is 12 cm (Take  $\pi = \frac{22}{7}$ )



- i) Find the slanting height of the frustrum. (3 marks)
  - ii) Find curved surface area of the frustrum. (3 marks)
  - iii) Find Volume of the frustrum. (3 marks)
  - iv) Find the ratio of the volume of the frustrum to that of the cone of which the frustrum, is made from. (1 mark)
23. The distance S metres from a fixed point O covered by a particle after t seconds is given by the equation  $S = t^3 - 6t^2 + 9t + 5$
- a) Calculate the gradient to the curve at  $t = 0.5$  seconds (3 marks)
  - b) Determine the values of S at the maximum and minimum turning points of the curve. (4 marks)
  - c) Sketch the curve of  $S = t^3 - 6t^2 + 9t + 5$  (3 marks)

CEKENAS  
 121/2  
 MATHEMATICS PAPER 2  
 JULY 2017  
 2 ¾ HOURS  
**FORM 4 END OF TERM 2 EVALUATION EXAM**  
**MATHEMATICS PAPER II**

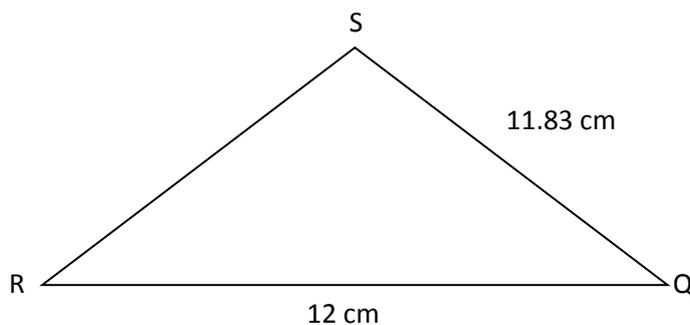
**SECTION I (50 MARKS)**

1. Use logarithm tables to evaluate (4 marks)  

$$5 \sqrt[5]{75.4 \times (4.83)^2}$$

$$\sqrt{0.00521}$$
2. The points A'(3,2) and B'(4,-1) are the images of A and B respectively under a translation. Given that the coordinates of A are (0, 1), find the coordinates of B. (3 marks)
3. Without using a mathematical table or a calculator, simplify (3 marks)  

$$\frac{\sqrt{2} - \sqrt{3}}{\sqrt{2 - \sqrt{3}}} - \frac{\sqrt{3}}{\sqrt{3 + \sqrt{2}}}$$
4. Solve for x in the equation (4 marks)  
 $\log_2 x + \log x^2 = 2$
5. Use completing the square method to solve the equation (3 marks)  
 $4 - 3x - 2x^2 = 0$
6. Kenya airways bought eleven Boeing aircrafts for twenty two billion, nine hundred and seventy five million, twenty eight thousand, two hundred and forty shillings.  
 a) Write the total cost of the eleven aircrafts in figures. (1 mark)  
 b) Calculate the cost of each aircraft. (2 marks)
7. The number 5.81 contains an integral part and a recurring decimal. Convert the number into an improper fraction and hence a mixed fraction. (3 marks)
8. a) Expand  $(1-3t)^6$  upto  $t^4$  (2 marks)  
 b) Use your expansion to estimate  $(0.94)^6$  to 4 d.p. (2 marks)
9. Points A(x°N, 30°E) and B(x°N, 50°E) are 1935 kilometers apart. Taking R=6370 km and  $\pi = \frac{22}{7}$ , find the value of x. (3 marks)
10. The third term and sixth term of a geometric series are  $3^{1/3}$  and  $11^{1/4}$  respectively. Calculate the common ratio and hence find its first term. (3 marks)
11. Use the figure below to answer the questions that follows.



Given that angle RSQ = 50°, SQ = 11.83 cm and QR = 12 cm. A circumcircle is drawn on the triangle. Find the radius of the circle. (2 marks)

12. A transformation  $T = \begin{pmatrix} -5 & -2 \\ 6 & 3 \end{pmatrix}$  maps points u and v onto u' (-18, 24) and v' (-37, 45) respectively.  
 Find the coordinates of u and v (4 marks)
13. The surface area of two similar solid shapes are 9 cm<sup>2</sup> and 16 cm<sup>2</sup> respectively. One side of the smaller solid is 4.5 cm long. Find the corresponding length of the larger one. (3 marks)
14. Find the integrals that satisfy the inequality (3 marks)  
 $2x + 3 \geq 5x - 3 > -8 - 2x$
15. Mwangi and Otieno live 60 km apart Mwangi leaves home at 7.00 a.m cycling towards Otieno's house at 20km/hr. Otieno leaves his home at 8.00 a.m cycling towards Mwangi's house at 10 km/hr. At what time did they meet? (2 marks)
16. Find the gradient function of the curve  $y = \frac{1}{3}x - 4x^2 + 9x + 4$  and hence find the gradient of the curve at (1, -4) (3 marks)

**SECTION II (50 MARKS)**

**ANSWER ONLY FIVE QUESTIONS IN THIS SECTION**

17. The table below shows the income tax rates that were used in 2009.

Monthly Taxable Pay (Ksh)	Rate (%)
1 – 10,164	10
10,165 – 19,740	15
19,741 – 29,316	20
29,317 – 38,892	25
Over 38,892	30

Mwangi earned a basic salary of sh 23,500 and a house allowance of Ksh. 4000 per month the paid of a premium of sh. 18,000 p.a toward his life insurance policy and claimed life insurance relief. The amount of insurance relief was 15% of the premiums paid. He claimed a personal tax relief of Ksh. 1162 per month.

a) Find:

- i) His monthly taxable income. (1 mark)
- ii) The gross tax (4 marks)
- iii) The net tax (2 marks)

b) Other deductions included

- Service charge of sh. 150
- Health insurance fund sh 250

Find

- i) Total monthly deductions made from Mwangi's income. (2 marks)
- ii) Mwangi's Net income. (1 mark)

18. Three variables P,Q and R are such that P varies directly as the cube of Q and inversely as the square of R.

- a) Given that P=16 when Q=2 and R=3, determine the value of R when P=288 and Q=4. (5 marks)
- b) decreases by 30% while R increases by 40%. Find the percentage decrease or increase in P. (5 marks)

19. Albert, Bonny and Charles competed in a game of chess. Their probabilities of winning the game are  $\frac{2}{5}$ ,  $\frac{3}{5}$  and  $\frac{1}{10}$  respectively.

- a) Draw a probability tree diagram to show all the possible outcomes. (2 marks)
- b) Calculate the probability that:
  - i) No one loses the game. (2 marks)
  - ii) Only one of them wins the game. (2 marks)
  - iii) At least one of them wins the game. (2 marks)
  - iv) At most two of them lost the game. (2 marks)

20. Construct rhombus ABCD such that AB=BC=6cm and  $\angle ABC=60^\circ$

- a) Measure BD (1 marks)
- b) On the same diagram, construct the inscribed circle of triangle ACD. (3 marks)
- c) Construct the locus of points equidistant from A and C. (3 marks)
- d) If x is a point on the circle in b above such that AX=XD and angle AXD is acute, find the locus of x and show it on the diagram. (3 marks)

21. (a) Complete the table below.

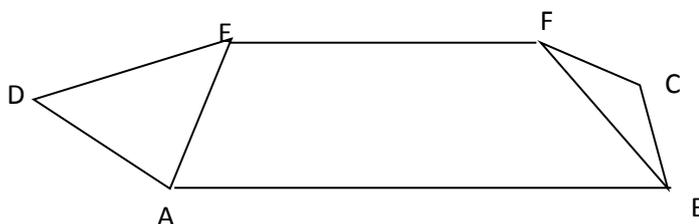
X	$-180^\circ$	$-150^\circ$	$-120^\circ$	$-90^\circ$	$-60^\circ$	$-30^\circ$	$0^\circ$	$30^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$150^\circ$	$180^\circ$
$Y=2\cos x$		-1.73			1		2		1	0			
$Y=\cos(x-60)$	-0.5			-0.9		0			1				-0.5

- (b) On the same axes plot the graphs of  $y=\cos(x-60^\circ)$  and  $y=2\cos x$  (use a scale of 1 unit for  $30^\circ$  on the x axis and 1 unit for 0.5 units on the y axis) (4 marks)
- (c) Describe the transformation which maps  $y=\cos(x-60^\circ)$  to  $y = 2\cos x$ . (2 marks)
- (d) State the period and amplitude of each of the waves above. (1 mark)

	Amplitude	Period
$Y=2\cos x$		
$Y=\cos(x-60)$		

- (e) Using the graph above determine the values of x for which  $\cos(x-60^\circ) - 2\cos x=0$  (1 mark)

22.



The roof of a building is as shown in the figure above with a rectangular base ABCD.  $AB=20\text{m}$  and  $AD=8\text{m}$ . The ridge  $EF=10\text{m}$  and is centrally placed. The faces ADE and BFC are equilateral triangles. Calculate:

- (i) The height of E above the base ABCD (2 marks)
- (ii) The angle between the planes ABCD and ADF (3 marks)
- (iii) The angle between the planes AED and ABCD (2 marks)
- (iv) The acute angle between lines DB and EF (3 marks)

23. The two variables  $x$  and  $V$  are known to satisfy the relation  $V=Kx^n$  where  $k$  and  $n$  are constants. The table below shows data collected from an experiment.

X	3.01	3.98	5.01	6.02	7.08	8.94
V	10.5	101	989	9600	95000	854000

- a) Write down the function  $V=Kx^n$  in linear form and make a suitable table of values correct to one decimal place. (3 marks)
- b) Draw a suitable graph to represent the relation  $V=Kx^n$  (3 marks)
- c) Use your graph to determine the values of  $k$  and  $n$  (4 marks)

24. a) Complete the table below for  $y=x^2 - 3x+5$  in the range  $2 \leq x \leq 8$  (2 marks)

$x$	2	3	4	5	6	7	8
$y$	3		9		23	33	

- b) Use the trapezium rule with six strips to estimate the area enclosed by the curve, x-axis and the lines  $x=2$  and  $x=8$ . (2 marks)
- c) Find the exact area of the region given in (b). (4 marks)
- d) Calculate the percentage error in the area. (2 marks)

**NYERI CENTRAL**

**121/1**

**MATHEMATICS ALT 'A'**

**PAPER 1**

**JULY/AUGUST 2017**

**2 ½ HOURS**

**SECTION 1 (50 MARKS) ANSWER ALL THE QUESTIONS**

1. Solve for x in the equation  $2^{(3x-2)} \times 8^x = 4^{(x+1)}$  (3mks)
2. The interior angle of a regular polygon is 4 times the exterior angle. How many sides does the polygon have. (3mks)
3. A point A(-3,2) is the image of a point B(7,4) after a reflection. Find the mirror line. (4mks)
4. Two similar cylinders have total surface areas of 45cm<sup>2</sup> and 20cm<sup>2</sup>. If the larger has a mass of 81g. Find the mass of the smaller one. (3mks)
5. Use reciprocal and cube root tables to evaluate  $5 \frac{5}{63.34} - \sqrt[3]{0.0169}$  (3mks)
6. Find all integral values of x which satisfy the following inequality.  $10 > 3x - 2 < 19$  (3mks)
7. Given  $\tan \theta = \frac{2}{\sqrt{5}}$ , without using tables evaluate  $\cos(90 - \theta)$  leaving your answer in surd form. (3mks)
8. Simplify the expression  $\frac{x^2 + 3x + 2}{x^2 - 1}$
9. Nine men working 8 hours a day can weed a field in 30 days. How many hours a day must 27 men work in order to weed the same field in 5 days? (2mks)
10. Three litres of water (density 1g/cm<sup>3</sup>) is added to twelve litres of alcohol (density 0.8g/cm<sup>3</sup>). What is the density of the mixture. (3mks)
11. How long will it take a car 4 meters long moving at 75km/h to completely overtake a heavy commercial truck 11m long moving in the opposite direction at 45 km/h if the car is 5m in front of the truck? (3mks)
12. Three girls Mary, Jane and Ann contributed money to purchase a machine. Mary contributed  $\frac{1}{3}$  of the total amount, Jane contributed  $\frac{3}{8}$  of the remaining amount and Ann contributed the rest of the money. The difference in the contribution between Jane and Ann was sh40,000. Calculate the price of the machine.
13. A math examination takes 2 ½ hrs. In Nyeri Baptist the examination ended at 1522hrs. At what time had the examination started in 12 hours clock system? (2mks)
14. The radius of small circle of frustrum is 2.5 cm while that of large circle its 3.5cm. The height of the frustrum is 5 cm. Find the volume of the frustrum. (Use  $\pi = \frac{22}{7}$ ) (4mks)
15. Schools A, B and C are such that B is 12km south of A and C is 15 km from A. C on a bearing of 330° from B. Calculate the bearing of C from A. (3mks)
16. Given that  $(x + 2) : (y - 7) = 5 : 2$ . Find the ratio  $x + 3y : 2x$ . (2mks)

**SECTION II (50 MARKS)**

Answer only five Questions in this section in the space provided.

17. Mr. Wambogo is a civil servant on a monthly basic salary of Kshs60,000 a house allowance of Ksh12,000, a medical allowance of Ksh4,800, a commuter allowance of Ksh.6,200 and risk allowance of Ksh1,500. He is entitled a personal relief of Ksh1,162. Below is a tax table that was in effect in a certain year.

Income in K£ per month	Rate(Kshs. Per pound)
1.....1,000	2
1,001..... 1,750	3
1,751 ..... 2,250	4
2,251..... 2,500	5
Excess over 2,500	6

- (a) Calculate the taxable income in K£ per month. (2mks)
- (b) Calculate his monthly PAYE in Kshs (6mks)
- (c) In addition to the PAYE the following deductions are made on his pay every month:
  - (i) NHIF Kshs. 400
  - (ii) NSSF Kshs. 200
 Calculate his monthly net pay. (2marks)
18. (a) Three points A(0,4) , B(2,3) and C(-2, -1) are vertices of a triangle. Find
  - (i) The gradient of AC (1mk)
  - (ii) The gradient of the perpendicular bisector of line AC (1mk)
  - (iii) The co-ordinates of the mid-point of line AC (1mk)
- (b) (i) The gradient of AB (1mk)

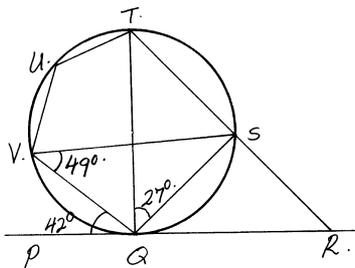
- (ii) The gradient of the perpendicular bisector of lines AB (1mk)
  - (iii) The co-ordinates of the mid- point of AB. (1mk)
  - (c) (i) Find the equation of the perpendicular bisector of AC. (1mk)
  - (ii) The equation of perpendicular bisector of AB. (1mk)
  - (iii) Hence find the co-ordinates of the circumcentre of the triangle. (2mks)
19. (a) Complete the table below for the equation  $y=x^3 - 2x^2 - 4x + 7$

x	-3	-2	-1	0	2	2	3	4
-1	-26	-1		7				23

- (b) Using the scale 1 cm to represent 1 unit on the x-axis and 1 cm to represent 5 units on the y-axis, draw the graph of  $y=x^3-2x^2-4x+7$
  - c) Use your graph to estimate the roots of the equation  $x^3 - 4x + 7 = 0$  (1mk)
  - d) By drawing appropriate straight lines, use your graph to solve the equations
    - (i)  $x^3-2x^2-4x+2=0$  (2mks)
    - (ii)  $x^3-2x^2-3x+3=0$  (2mks)
20. In an English test 41 students scored the following marks

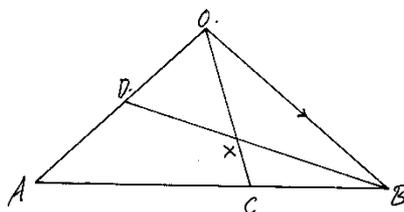
72	50	43	58	62	49	69	60	84	62	55
89	67	92	81	75	63	77	95	65	54	35
45	73	41	56	50	36	49	58	61	85	54
38	64	76	86	51	43	72	37			

- (a) Using a class width of 11 and 35-45 as the first class, make a frequency table of the grouped data (2mks)
  - (b) Estimate the mean (5mks)
  - (c) Estimate the median (3mks)
21. In the figure below PQR is a tangent to the circle at Q.



Given that  $\angle PQV=42^\circ, \angle TQS=27^\circ, \angle VQS=49^\circ$ . Find the following angles giving reasons.

- (a)  $\angle SVT$  (2mks)
  - (b)  $\angle SQR$  (2mks)
  - (c)  $\angle VUT$  (3mks)
  - (d)  $\angle QRS$  (3mks)
22. In the figure below C is a point on AB such that  $BA=3BC$  and D is the mid-point of OA, OC and BD intersect at x.



Given that  $\vec{OA}=\vec{a}$  and  $\vec{OB}=\vec{b}$

- (a) Write the vectors below in terms of  $\vec{a}$  and  $\vec{b}$ .

- (a)  $\vec{AB}$  (1mk)
- (b)  $\vec{OC}$  (2mks)
- (c)  $\vec{BD}$  (1mk)
- (b) If
  - (a)  $\vec{BX}=h \vec{BD}$ , express  $\vec{OX}$  in terms of  $\vec{a}$ ,  $\vec{b}$  and  $h$ . (1mk)
  - a.  $\vec{OX} = k\vec{OC}$ , find  $h$  and  $k$ . (4marks)
  - b. Hence express  $\vec{OX}$  in terms of  $\vec{a}$  and  $\vec{b}$  only. (1mark)

23. Given the simultaneous equations

$$5x + y = 19$$

$$-x + 3y = 9$$

- (a) Write the equations in matrix form. Hence solve the simultaneous equations by matrix method. (5mks)  
(b) Find the distance of the point of intersection of a line  $5x + y = 19$  and  $-x + 3y = 9$  from the point  $(11, -2)$  (2mks)  
(c) Determine the value of  $x$  for which the matrix below has no inverse. (3mks)

$$\begin{pmatrix} 2x & x^2 \\ 2 & 1 \end{pmatrix}$$

24. (i) A particle moves in a straight line in such a way that its distance,  $S$  meters after  $t$  seconds is given by the equation

$$S = \frac{t^3}{3} - 3t^2 + 5t, \text{ find the times when:}$$

- (a) The particle is stationary (3mks)  
(b) Its velocity is  $5\text{m/s}$  (2mks)  
(c) Its acceleration is  $10\text{m/s}^2$  (2mks)  
ii) Find the equations of the tangent and normal to the curve  $y = 2x^2 + 1$  at the point where  $x = 2$  (3marks)

**NYERI CENTRAL**  
**121/2**  
**MATHEMATICS ALT 'A'**  
**PAPER 2**  
**JULY/AUGUST 2017**  
**2 ½ HOURS**

1. Use logarithm table to evaluate to four significant figure (4mks)

$$\sqrt{\frac{82.06 - 64}{184.5}}$$

2. Make q the subject of the formula  $r = \sqrt{\frac{-}{+}}$  (3mks)

3. Expand and simplify  $(1 - 3x)^2$ . (2mks)

4. Find the quartile deviation for the set of data below. (3mks)  
 3,4,2,6,8,8,1,5,2,7

5. Given that  $\frac{2\sqrt{2}}{1 + \sqrt{2}} - \frac{\sqrt{2}}{1 - \sqrt{2}} = a + b\sqrt{c}$  Find the values of a, b and c (3mks)

6. Evaluate  $\int_2 x^2 + 2x - 15 dx$  (3mks)

7. Use matrices to solve the simultaneous equations. (4mks)

$$5x + 2y = 1$$

$$8x + 3y = 1$$

The figure shows a pair of chords PQ and RS which intersect externally at point O. If PQ=5cm, OS=4cm and OQ =6cm. Calculate the length of chord RS.

9. Find the value of x given that  $\log(x - 2) + 2 = \log(3x + 2) + \log 25$

10. Given that  $4 \leq A \leq 5$  and  $0.2 \leq B \leq 0.5$  if  $K=A|B$  calculate the limits within which k lies. (3mks)

11. Find the coordinates of the centre and the radius of the circle whose equation is  $x^2 + y^2 + 4y - 6x + 12 = 0$  (4mks)

12. Find the value of x in the equation  $10 \sin^{-2} x - 7 \cos x + 2 = 0$  for the range  $0 \leq x \leq 360^\circ$  (4mks)

13. P varies directly as the cube of t and inversely as the square root of n. When  $p=16$   $t=2$   $n=9$ . Express p in terms of t and n and hence find p when  $t=3$  and  $n=4$  (3mks)

14. A trader has three grades of tea P,Q and R. Grade P costs sh140 per kg. grade Q costs sh160 per kg and grade R costs sh256 per kg. The trader mixes grade P,Q and R in the ratio 5:3:x to make a brand of tea which he sells at sh211.50 per kg hence making a profit of sh42.30. Find the value of x. (3mks)

15. Find the equation of a curve which passes through (0,0) whose gradient function is given by  $\frac{dy}{dx} = 4x - 3x^2$  (3mks)

16. Wanarua invested Ksh24 000 for two years at 12% P.a. Compounded quarterly. Determine to the nearest shilling the amount of interest earned. (3mks)

**SECTION B**

17. The figure below shows a pyramid ABCDV with rectangular base AB=12 cm, BC=5 cm, and AV=BV= CV =DV =15 cm

- (a) Calculate the length of AC (1mk)

- (b) Calculate the angle between VA and ABCD (2mks)

- (c) Calculate the angle between VBC and ABCD.

- (d) Calculate the angle between VAB and VDC. (4mks)

18. The marks of 50 students in a maths test were taken from a form 4 class and recorded in the table below.

Marks	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	2	5	7	9	11	8	5	3

Draw a cumulative frequency curve to represent the data. (4mks)

19. A triangle PQR whose vertices are P(2,2) Q(5,3) and R(4,1) is mapped onto triangle P'Q'R' by a transformation whose matrix is  $\begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$

- (a) On the grid provided below draw triangle PQR and P' Q' R' (4mks)

- (b) Triangle P' Q' R' is mapped onto a triangle whose vertices are P'(-2,-2), Q''(-5,-3) and R''(-4,-1)

- (i) Draw triangle P'' Q'' R'' on the same grid. (1mk)

- (ii) Find the matrix representing transformation that maps triangle P' Q' R' onto triangle P'' Q'' R''. (2mks)

- (c) Describe the transformation that maps PQR onto triangle P'' Q'' R'' (3mks)

20. The first , fourth and thirteenth terms of Arithmetic progression

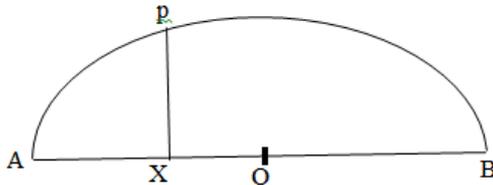
(AP) correspond to the first three consecutive terms of an increasing Geometric progression(G,P). Given the first term of the A.P is a and the common difference is d

- (a) Write down the first three terms of the G.P in terms of  $a$  and  $d$ . (1mk)
- (b) The sum of the third and the eleventh terms of the A.P is 30.  
Calculate
- (i) the common difference of the A.P (4mks)
- (ii) the first term of the A.P (2mks)
- (iii) the common ratio of the G.P. (1mk)
- (iv) Sum of the first 10 terms of the G.P. (2mks)
21. A aircraft leaves A( $60^{\circ}\text{N}$ ,  $13^{\circ}\text{W}$ ) at 1300 hours and arrives at B( $60^{\circ}\text{N}$ ,  $47^{\circ}\text{E}$ ) at 1700 hrs.
- (a) Calculate the average speed of the aircraft in knots. (3mks)
- (b) Town C( $60^{\circ}\text{N}$ ,  $133^{\circ}\text{N}$ ) has a helipad. Two helicopters S and T leaves B at the same time. S moves due West to C while T moves due North to C. If the two helicopters are moving at 600 knots.  
Find
- (i) The time taken by S to reach C (2mks)
- (ii) The time taken by T to reach C (2mks)
- (c) The local time at a town D( $23^{\circ}\text{N}$ ,  $5^{\circ}\text{W}$ ) is 1000 hours. What is the local time at B. (3mks)
22. An examination involves a written test and a practical test. The probability that a candidate passes the written test is  $\frac{6}{11}$ . If the candidate passes the written test, then the probability of passing the practical test is  $\frac{3}{5}$ , otherwise it would be  $\frac{2}{7}$
- (a) Illustrate this information on a tree diagram (2mks)
- (b) Determine the probability that a candidate is awarded
- (i) Credit for passing both tests. (2mks)
- (ii) Pass for passing the written test. (2mks)
- (iii) Retake for passing one test. (2mks)
- (iv) Fail for not passing the written test. (2mks)
24. The diagram below is a frustrum of a right pyramid of rectangular base ABCD measuring 24cm by 18cm. The frustrum was made by cutting off a small pyramid along the plane EFGH which is parallel to ABCD and exactly two thirds way up the vertical height of the original pyramid. EFGH is a rectangle measuring 8cm by 6cm. The slant length of the original pyramid is 36cm. Calculate
- (a) Vertical height of the original pyramid to 1 decimal place. (3mks)
- (b) The volume of the frustrum to the nearest whole number. (3mks)
- (c) The surface area of the original pyramid to the nearest whole number. (4mks)

**KIGUMO**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**  
**2½ HOURS**

**SECTION I**

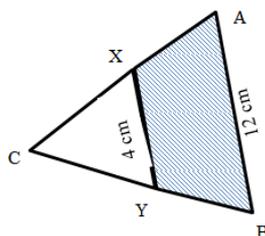
- Given that  $a = 2$ ,  $b = -1$  and  $c = 3$ , find the value of  $\frac{3a^2 - 2b^2c + 4b}{2ac + 2b^3 - 3c}$  (3 marks)
- The exterior angle of a regular polygon is equal to one-third of the interior angle. Calculate the number of sides of the polygon. (2 marks)
  - Give its name (1 mark)
- When coffee beans are dried to become mbuni the mass decreases in the ratio 5:13. Find the mass of green coffee which must be dried to give 650kg of mbuni. (3 marks)
- Find the value of  $x$  in the following equations (3 marks)  
 $(4)^{-2x} = \left(\frac{1}{64}\right)^{2x-4}$
- The straight line whose double intercept equation is  $\frac{x}{a} + \frac{y}{b} = 1$  passes through the points  $P(-4,9)$  and  $Q(4,-3)$ . Calculate the Equation of the line and write it in the form  $y=mx + c$  and hence determine the value of  $a$  and  $b$ . (4 marks)
- Solve the inequality (3 marks)  
 $4 - \frac{3}{2}x \geq \frac{5}{3}x - 2\frac{1}{3}$
- In the figure below  $O$  is the centre of the circle diameter  $AB$   $\angle APX = 90^\circ$ ,  $AX = 4$  cm and  $PX = 10$  cm Calculate the radius of the semi-circle. (3 marks)



- A tourist visited Kenya with 2,500 U.S. dollars and changed the U.S. dollars into Kenya shillings at a local bank in Kenya when the exchange rates at the time were as follows.

	Buying	Selling
1 U.S. dollar	Sh. 78.45	Sh. 78.55
1 Sterling Pound	Sh. 120.25	Sh. 120.45

    - How much did he get in Kenya shillings. (2 mks)
    - While in Kenya, he used sh. 80,000 and after his stay he converted the remaining amount into Sterling Pounds. Calculate to 2 decimal places the Sterling Pounds that he got. (2 mks)
- A solid block in the shape of a cylinder has a height of 14cm and weighs 22kgs. If it is made of material of density  $5g/cm^3$ , find the radius of the cylinder. Take  $\pi = \frac{22}{7}$  (4 mks)
- Factorize completely the Expression (2 mks)  
 $45a^2 - 20b^2$
- The position vectors of  $A$  and  $B$  are given as  $2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$  and  $2\mathbf{i} - \mathbf{j} + 2\mathbf{k}$  respectively. Find to 2 decimal places, the length of vector  $AB$  (3 mks)
- Given that  $\cos(x + 20)^\circ = \sin(2x + 34)^\circ$  and  $x$  is an acute angle, Find  $\tan(x - 4)^\circ$  (3 mks)
- Solve the equation (3 mks)  
 $\frac{x-2}{3} - \frac{3-x}{4} = \frac{x-2}{2}$
- In the figure below, lines  $AB$  and  $XY$  are parallel.  $XY = 4$ cm and  $AB = 12$  cm.

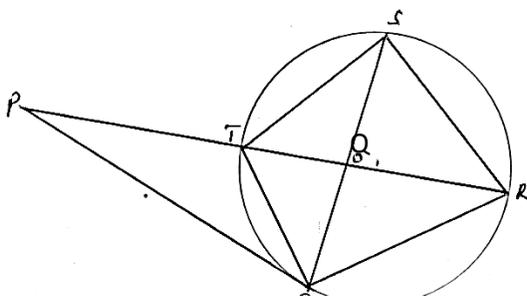


If the area of the shaded region is  $36cm^2$ , find the area of triangle  $CXY$ . (3 mks)

15. The marked price of a car in a dealer's shop was Kshs. 450,000. Wekesa bought the car at 7% discount. The dealer still made a profit of 13%. Calculate the amount of money the dealer had paid for the car to 1 decimal place. (3 mks)
16. The gradient of a curve at any point is given by  $2x - 1$ . Given that the curve passes through point (1,5). Find the equation of the curve. (3 mks)

**SECTION II**

17. A closed cylinder tank of diameter 7 meters has a total surface area of  $110\text{m}^2$ . The tank which is initially one-third full of water is filled by a pump which pumps water at the rate of 2.5 litres per second.
- a) Taking  $\pi = \frac{22}{7}$ , determine
- The height of the tank (2 mks)
  - The volume of water required to fill the tank in litres. (3 mks)
  - The time in hours and minutes, to the nearest minutes it takes to fill the tank. (2 mks).
- b) Starting with the full tank a school uses water from this tank at the rate of 2400 litres per day. Find how many complete days it takes to use all the water from the tank assuming that no more water is added. (3 mks)
18. The diagram alongside shows a circle centre O. PQ is a tangent to the circle at Q and PTOR is a straight line. QRST is a cyclic Quadrilateral in which angle RTS =  $35^\circ$  and RT and QS are diameters. Giving reasons for your answers. Find the size of



- Acute angle BOS (2 mks)
  - Angle RQS (2 mks)
  - Angle PQR (2 mks)
  - Angle QPT (2 mks)
  - Angle PQT (2 mks)
19. Use a ruler and compasses only for all constructions in this question.
- Construct triangle ABC in which  $BC = 6.5\text{ cm}$  and angle  $ABC = 45^\circ$  and angle  $ACB = 60^\circ$ . (3 mks)
  - Measure AB and AC (2 mks)
  - Construct a circle that touches BC at B and passes through A. (4 mks)
  - Measure the radius of this circle (1 mk)
20. a) Determine the values of x where the curve  $y = x^2 - 2x - 3$  cuts the x - axis. (2 mks)
- b) Using the mid-ordinate rule with four ordinates, estimate the area enclosed by the curve  $y = x^2 - 2x - 3$  and the x-axis. (3 mks)
- c) Calculate the same area using integration method. (3 mks)
- d) Taking the area obtained by integration to be the exact area of the region. Calculate the percentage error made when the mid-ordinate rule is used. (2 mks)
21. A bus left Kisumu for Nairobi at an average speed of 60 km/hr. After  $1\frac{1}{2}$  hours another car left Kisumu for Nairobi along the same route at an average speed of 100 km/hr. If the distance between Kisumu and Nairobi is 500 km, determine
- The distance of the bus from Nairobi when the car took off. (2 mks)
  - The distance the car travelled to catch up with the bus. (4 mks)
- b. Immediately the car caught up with the bus, the car stopped for 25 minutes. Find the new average speed of which the car travelled in order to reach Nairobi at the same time as the bus (to the nearest whole number). (4 mks)
22. Two variables X and V are known to satisfy the relation  $V = KX^n$  where K and n are constants. The table below shows data collected from the experienced.
- |   |      |      |      |      |       |        |
|---|------|------|------|------|-------|--------|
| X | 3.01 | 3.98 | 5.01 | 6.02 | 7.08  | 8.94   |
| V | 10.5 | 101  | 989  | 9600 | 95000 | 854000 |
- Write down the function  $V = KX^n$  in Linear form and make a suitable table of values correct to one decimal place. (3 mks)
  - Draw a suitable graph to represent the relation  $V = KX^n$  (3 mks)
  - Use your graph to determine the values of K and n. (4 mks)
23. The distance s meters from a fixed point O, covered by a particle after t seconds is given by the equation  $s = t^3 - 6t^2 + 9t + 5$

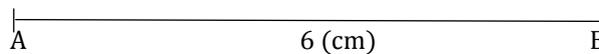
- a. Calculate the gradient to the curve at  $t = 0.5$  seconds (2 mks)
- b. Determine the values of  $s$  at the maximum and minimum turning points of the curve. (4 mks)
- c. On the space provided, sketch the curve of  $s = t^3 - 6t^2 + 9t + s$  (2 mks)
- d. The acceleration of the particle when  $t = 2$ . (2 mks)
24. A triangle has vertices of  $A(1,2)$ ,  $B(-2,4)$  and  $C(3,5)$ .
- a. Plot the triangle on the grid provided (1 mk)
- b. Triangle  $ABC$  is mapped onto triangle  $A^1 B^1 C^1$  by a transformation given by  $M = \begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix}$ . State the coordinates of triangle  $A^1 B^1 C^1$  on the same grid. Plot triangle  $A^1 B^1 C^1$ . (3 mks)
- c. Triangle  $A'' B'' C''$  is the image of triangle  $A^1 B^1 C^1$  under a reflection on the line  $y=0$ . Plot the triangle  $A'' B'' C''$  and state its coordinates. (3 mks)
- d. Triangle  $A'' B'' C''$  is further rotated through  $-90^\circ$  about  $(0,0)$  to obtain triangle  $A''' B''' C'''$ . Plot a triangle  $A''' B''' C'''$  and state its coordinate. (3 mks)

**KIGUMO**  
**121/2**  
**MATHEMATICS**  
**PAPER 2**  
**2½ HOURS**

**SECTION I**

1. Without using tables or a calculator, evaluate (4 mks)  

$$\sqrt{\frac{2187}{512} \cdot \frac{32}{27}}$$
2. Simplify  $\frac{\sqrt{11}}{\sqrt{3} + \sqrt{11}}$  (3 mks)
3. a) Expand  $(x + y)^7$  upto the power of  $y^5$ . (2 mks)  
 b) Use the expansion (a) above to estimate  $(1 + 0.2)^7$  (2 mks)
4. State the amplitude and calculate the period in the equation below. (3 mks)  
 $Y = 1.5 \sin 2.5x + 10^\circ$
5. Below is a line AB; on the upperside AB construct the locus of an angle such that  $\angle APB$  is  $90^\circ$ . (2 mks)  
 Measure maximum perpendicular height from the line AB to P.



6. Find the value of x given that (3 mks)  
 $\text{Log}(x - 1) + 2 = \text{Log}(3x + 2) + \text{Log} 25$ .
7. The verticals of a triangle A(0,0); B(2,1) and C(3,4) are transformed by a negative quarter turn; Calculate it's image  $A^1B^1C^1$  and state it's coordinates. (3 mks)
8. Find all the integers satisfying the inequalities (3 mks)  
 $5 - 2x < x - 2 \leq 7$
9. In a right angled triangle the two short sides are  $(x + 2)$  cm and  $(x + 5)$  cm. The hypotenuse is  $(x + 10)$  cm. Calculate the value of x to 2 decimal places. (4 mks)
10. Solve the equation (3 mks)  
 $\text{Cos}(2x + 10^\circ) = 0.4226 \quad 0 \leq x \leq 180^\circ$
11. A circle whose equation is  $(x - 1)^2 + (y - k)^2 = 10$  passes through the point (2,5). Find the coordinates of the two possible centres of the circle. (3 mks)
12. The matrix  $\begin{pmatrix} 3 & 6 \\ 1 & 5 \end{pmatrix}$  transforms a triangle whose area is  $13 \text{ cm}^2$ . Calculate the area of the image of the triangle. (2 mks)
13. Vector  $OA = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$  and  $OB = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$  point. C divides line AB externally in the ratio of 3:-1; Calculate the coordinates of C. (3 mks)
14. Five men working eight hours can dig a piece of land in six days; how many more men can dig the same piece of land in three days while working five hours in a day? (3 mks)
15. If  $A = \begin{pmatrix} 2 & 2 \\ 1 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 3 & 2 \\ 2 & 2 \end{pmatrix}$  (4 mks)  
 Find  $A^{-1} B^{-1}$
16. Make K the subject of the formula (3 mks)

$$X = \frac{1}{\sqrt{\frac{-2}{-}}}$$

**SECTION II (Answer only five questions in the paces provided)**

17. a) A bank offers an interest rate of 13.6% per annum on semi-annually basis. Mr. Waititu borrowed Kshs. 230,000.00 for three years; calculate what Waititu paid after the three years to the nearest shilling. (4 mks)  
 b) Mr. Waititu used the money to buy an acre of land into one eighth plot of an acre after three years and sold each plot at one hundred and twenty thousands shillings. Calculate the money he got after selling all the plots. (3 mks)  
 c) The surveying cost was sixteen thousands per plot; calculate the percentage profit he earned to what he paid the bank. (3 mks)

18. a) Complete the table below for the function of  $y = 2x^2 - 3x + 1$   $-3 \leq x \leq 4$

X	-3	-2	-1	0	1	2	3	4
$\geq X^2$	18		2		2		18	
$-3x + 1$		7			-2		-8	
y				0			10	21

(2 mks)

b) Draw the graph of  $y = 2x^2 - 3x + 1$   $-3 \leq x \leq 4$  on the grid provided below; (scale 2:1 on x - axis and 1:5 on y axis)

(3 mks)

c) Use the graph to solve  $2x^2 - 3x + 1 = 0$

(2 mks)

d) Use the graph solve the equation  $2x^2 - 3x + 1 = -5x + 2$

(3 mks)

19. a) Using a pair of compasses only and a ruler, construct a triangle ABC such that  $AB = 6.5$  cm  $\angle CAB = 45^\circ$  and  $\angle CBA = 60^\circ$ , measure BC

(3 mks)

b) Construct the locus of P such that  $\angle APB \leq 60^\circ$ , measure BP through C.

(3 mks)

c) i) Construct the Locus of P such that  $AP \leq 2$  cm.

(1 mk)

ii) Shade the area that satisfies b and c (i) above

(3 mks)

20. The probability of passing KCPE on depends performance in the school mock examination. If the candidate passes in mock, the probability of passing KCPE is  $\frac{4}{5}$ . if the candidate fails in mocks, the probability of passing KCPE is  $\frac{3}{5}$ . If the candidate passes KCPE, the probability of getting employed is  $\frac{1}{3}$ , the probability of passing mock is  $\frac{2}{3}$ .

a) Draw a well labelled tree diagram to represent the above information.

(2 mks)

b) Use your tree diagram in (a) above to find the probability that she

i. Passes KCPE exams

(2 mks)

ii. Gets employed

(2 mks)

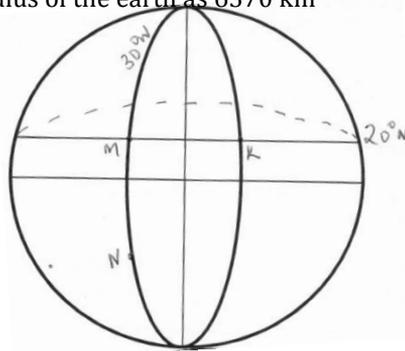
iii. Passes KCPE and doesn't get employed

(2 mks)

iv. Passes mock and gets employed

(2 mks)

21. a) The figure below shows two points M( $20^\circ N, 30^\circ W$ ), K( $20^\circ N, X^\circ E$ ) and N which is on the southern side of M and  $5^\circ$  South of equator. Take the radius of the earth as 6370 km



i) The distance from M to K is 6,200 km. Find longitude x to 2 d.p

(3 mks)

ii) Calculate distance from N to K through a line of longitude then a latitude to two decimal places.

(4mks)

b) An aeroplane started travelling from N at 08.30 hrs and took the route as in a (ii) above. Find the time the aeroplane arrived at K if its speed was 500 km/hr; give the answer to the nearest minute.

(3 mks)

22. An institute offers two courses; technical and nursing. The number of technical students must be at maximum twice the number of students taking nursing. The nursing students should be at least thirty. The technical student pays fifteen thousands while a nursing student pays twenty thousands as fees; The total number of students should be at most one hundred and total amount of fees collected should not exceed two million shillings. If the number of technical students is x and the number of nursing students y; The school makes a profit of six thousands from a nursing student and four thousands from a technical student.

a) Form all the inequalities satisfying the above information.

(4 mks)

b) On the grid provided below and using a scale of 1 cm to represent 20 on each axis, represent the above information.

(4 mks)

c) From the graph, find the number of technical and nursing students to be enrolled for the institution to have maximum profit and state the maximum profit.

(2 mks)

23. The table below shows income tax rates

Monthly income in Kenya shilling (Kshs)	Tax rate in percentage (%) in each shilling
Upto 9680	10
9681 - 18800	15
18801 - 27920	20
27921 - 37040	25
37041 and above	30

In a certain month Mr. Waihenya paid a net tax of 9500 ksh. after being relieved a members personal relief of 1160 ksh. Per month.

- a) Calculate Mr. Waihenya's monthly earnings. (7 mks)
- b) Mr. Waihenya was entitled to the following allowances.
  - i. House allowance which is 30% of basic salary.
  - ii. Travelling allowance; 12% of basic salary. Calculate his basic salary. (3 mks)

24. The table below shows the marks scored in a mathematics test which was out of 50 marks.

Marks	0-9	10-19	20-29	30-39	40-49
Number of students	2	14	24	12	8

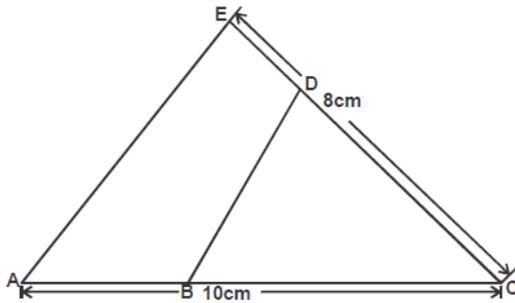
- a) Draw a cumulative frequency curve on the grid provided 2 units rep 10 in both axis. (5 mks)
- b) Use the curve drawn to determine
  - i. The median score (1 mk)
  - ii. The pass mark if 60% students passed. (2 mks)
  - iii. The semi-quartile range (2 mks)

**KAGEMA MATHIOYA**  
**121/1**  
**MATHEMATICS**  
**Paper 1**  
**July 2017**  
**Time: 2½ Hours**  
**FORM 4 END OF TERM 2 EXAM**

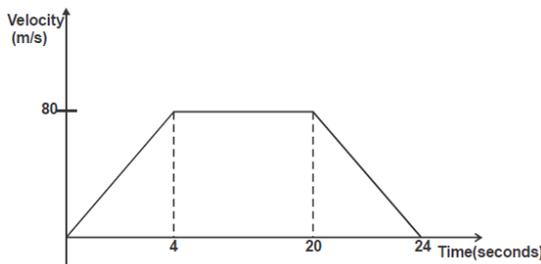
**SECTION I: (50 MARKS)**

Attempt all the questions in the spaces provided.

- Evaluate without tables or calculator.  
 $-12 \div (-3) \times 4 - (-20)$  (3 marks)  
 $-6 \times 6 \div 3 + -6$
- The gradient of a line L through points A(2x, 4) and B(-1, x) is  $\frac{1}{7}$ . Find the value of x and hence the equation of the line perpendicular to L through point B in the form  $y = mx + c$ . (4 marks)
- An article was bought at Ksh.2250 then later sold for Ksh.2550. Calculate:  
 a) the percentage profit (1 mark)  
 b) the price at which it should be sold to make a 20% profit. (2 marks)
- In the triangle below, point B divides line AC in the ratio 2 : 3 while point D divides EC in the ratio 1 : 4. Given that CE = 8cm, AC = 10cm and angle ACE = 30, find the area of the quadrilateral ABDE. (4 marks)



- Mr. Chelule was three times as old as his son four years ago. In three years' time, their total age will be 66 years. How old is the father now? (3 marks)
- The size of an interior angle of a regular polygon is  $3x$  while its corresponding exterior angle is  $(x - 20)^\circ$ . Find the number of sides of the polygon. (3 marks)
- The figure below represents a velocity time graph of a car. Calculate the deceleration of the car. (2 marks)



- Find the greatest number which when divided by 179 and 234 leaves a remainder of 3 in each case. (3 marks)
- From the roof of a house, the angle of elevation of the top of a tree is  $40^\circ$  and the angle of depression of the bottom of the tree from the top of the house is  $25^\circ$ . If the house is 12m tall, calculate the height of the tree. (3 marks)
- Calculate the acute angle that the line given by the equation  $2x - 3y - 6 = 0$  makes with the x-axis. (3 marks)
- A Kenyan bank buys and sells foreign currencies as shown in the table below.

	<u>Buying (Ksh)</u>	<u>Selling (Ksh)</u>
1 Euro	84.15	84.26
1 Sterling pound	118.35	121.47

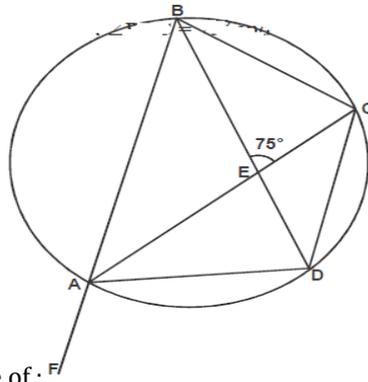
A tourist came to Kenya from London with 5000 Euros which he converted to Kenya shillings at the bank. While in Kenya, he spent a total of Ksh.289000 then converted the balance into Sterling pounds at the same bank. Calculate the amount in Sterling pounds that he received correct to 4 significant figures. (4 marks)

- Simplify :  $\frac{(m + 2n)^2 + (2m - n)^2}{m^2 + n^2}$  (3 marks)

13. Find the value of  $x$  in the following : (3 marks)  
 $25^{x-1} + 5^{2x} = 130$
14. Solve the inequality  $-3x + 2 < x + 6 \leq 17 - 2x$  and write down the integral values that satisfy the inequality. (3 marks)
15. A plane leaves town P to town Q on a bearing of  $130^\circ$  and a distance of 350km. It then flies 500km on a bearing of  $060^\circ$  to town R. Find by scale drawing the distance between town R and town P using a scale of 1cm: 100km. (3 marks)
16. A photograph is reduced in the ratio 3 : 5 for a newspaper and further reduced in the ratio 4 : 5 for a text book. Find the ratio of the photograph size to the text book size.

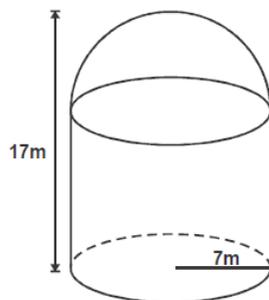
**SECTION II: ANSWER FIVE QUESTIONS**

17. a) Three people Amina, Bundi and Chari formed a business partnership. Amina invested sh.80, 000 for 2 years, Bundi sh.50,000 for 3 years and Chari invested his money for 4 years. They agreed that the profits should be shared in proportion to the amount invested and the time for which it was invested. How much did Chari invest if Amina's share of profit of sh.129000 was sh.48000? (5 marks)
- b) A lady buys a car for sh.40, 000 paying sh.16000 and the remainder in instalments of sh.8000 paid at the end of each of the first three quarters together with a final payment at the end of the fourth quarter to clear the debt. Interest at 3% per quarter, reckoned on the amount owing at the beginning of each quarter is added at the end of each quarter. Calculate the amount of the three quarters and also the final payment to clear the debt. (5 marks)
18. In the figure below,  $\angle CAD = 50^\circ$ ,  $\angle BEC = 75^\circ$  and  $\angle BDC = 25^\circ$ . BAF is a straight line.



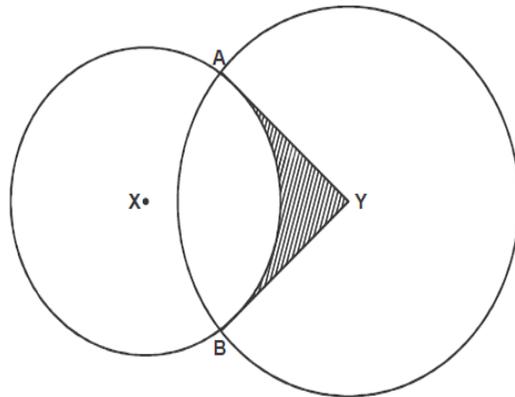
State giving reasons, the size of :  $\angle$

- a)  $\angle ABC$   
 b)  $\angle DEC$   
 c)  $\angle ABD$   
 d)  $\angle DAF$
19. A garden measures 10m long and 8m wide. A path of uniform width is made all round the garden. The total area of the garden and the path is  $168m^2$ .
- a) Find the width of the path. (4 marks)
- b) The path is to be covered with square concrete slabs. Each corner of the path is covered with a slab whose side is equal to the width of the path. The rest of the path is covered with slabs of side 50cm. The cost of making each corner slab is sh.600 while the cost of making each smaller slab is sh.50. Calculate :
- i) the number of the smaller slabs used (3 marks)  
 ii) the total cost of the slabs used to cover the whole path. (3 marks)
20. The figure below shows a solid which is a hemisphere on a cylinder. The base radius of the cylinder is 7m and the height of the solid is 17m.



- a) By taking  $\pi = \frac{22}{7}$  find
- i) the volume of the solid (4 marks)  
 ii) the total surface area of the solid (4 marks)
- b) Given that the density of the material of which the solid is made is  $800kg/m^3$ , calculate the mass of the material used. (2 marks)

21. A truck left town X at 11.15a.m and travelled towards town Y at an average speed of 60km/hr. Car left town X at 1.45p.m on the same day and travelled along the same road at an average speed of 100km/hr. The distance between the two towns is 500km.
- Calculate the time of the day when the car overtook the truck. (5 marks)
  - Both vehicles continued towards town Y at their original speeds. Find how long the car had to wait at town Y before the truck arrived. (5 marks)
22. a) Using a ruler and a pair of compasses only, construct a rhombus PQRS such that  $PQ = 6\text{cm}$  and  $\angle PQR = 135^\circ$ . (3 marks)
- Drop a perpendicular from R to meet PQ extended at N. Measure QN. (2 marks)
  - Bisect  $\angle PQR$  and  $\angle SPQ$  and let the two bisectors meet at M. Measure MP. (3 marks)
  - Hence determine the area of triangle PQM. (2 marks)
23. Triangle ABC has vertices  $A(1,2)$ ,  $B(2,3)$  and  $C(4,1)$  while triangle  $A^1B^1C^1$  has vertices  $A^1(1,-2)$ ,  $B^1(2,-3)$  and  $C^1(4,-1)$
- Draw the two triangles on the cartesian plane.
  - Describe fully a single transformation that maps triangle ABC onto  $A^1B^1C^1$ .
  - On the same axes, draw triangle  $A^{11}B^{11}C^{11}$  the image of ABC under a reflection on the line  $y = x$  and write down the coordinates of triangle  $A^{11}B^{11}C^{11}$ .
  - Draw triangle  $A^{111}B^{111}C^{111}$  such that it can be mapped onto triangle ABC by a negative quarter turn about the origin and write down its coordinates.
  - Find the matrix of transformation that maps triangle ABC onto triangle  $A^{111}B^{111}C^{111}$ .
24. Two circles of radius 3.5cm and 4.2cm and centres X and Y respectively intersect at point A and B.



Given that the centres of the two circles are 6cm apart. Find :

- angle AXB
- angle AYB
- the area of the quadrilateral XAYB correct to 3 decimal places.
- the area of the shaded part.

**KAGEMA MATHIOYA**

**121/2**

**MATHEMATICS**

Paper 2

July 2017

**Time: 2½ Hours**

**FORM 4 END OF TERM 2 EXAM**

**SECTION I : (50 MARKS)**

1. Use logarithm tables to evaluate: (4 marks)

$$\sqrt[3]{\frac{45.3 \times 0.00697}{0.534}}$$

2. Evaluate by rationalizing the denominator and leaving your answer in surd form. (3 marks)

$$\frac{\sqrt{8}}{1 + \cos 45^\circ}$$

3. Make n the subject of the formula. (3 marks)

$$M = 4\sqrt[4]{\frac{ax^2n}{w-n}}$$

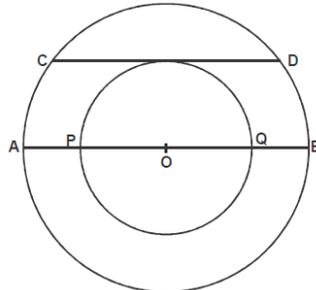
4. The first, third and the seventh terms of an increasing arithmetic progression are three consecutive terms of a G.P. If the first term of the AP is 10. Find the common difference of the AP. (3 marks)

5. Factorise completely

$$45 - 5x^2$$

6. a) Find the expansion in ascending powers of X of  $(1 - \frac{x}{7})^7$   
 b) Hence evaluate  $(0.99)^7$  to four significant figures. (2 marks)

7. The figure below shows two concentric circles with diameters AB = 10cm and PQ = 5cm. Find the length of CD which is a tangent to the inner circle and also a chord of the larger circle. (3 marks)



8. A body is moving in a straight line such that its velocity Vm/s after t seconds is given by  $v = 5t^2 - \frac{1}{2}t + 3$ . Find the distance travelled during the third second. (4 marks)

9. Calculate the standard deviation of the data: (3 marks)

34, 61, 49, 57, 53, 37, 59

10. If  $x = 44$  and  $y = 20.1$  calculate the greatest possible percentage error in  $x - y$ . Give your answer to 1 decimal place. (3 marks)

11. Find the radius and centre of a circle whose equation is  $x^2 + y^2 + 3x + 2 = 0$ . (3 marks)

12. Fill in the table below and use mid-ordinate rule to find the area bounded by the circle  $y = x^2 - 1$  from  $x = -7$  to  $x = -1$  using 6 strips. (3 marks)

x	-7	-6.5	-6	-5.5	-5	-4.5	-4	-3.5	-3	-2.5	-2	-1.5	-1
y	48		35		24		15		8		3		0

13. Solve the equation  $2 \cos (3t + 60^\circ) = -0.5$  for  $0^\circ \leq t \leq 180^\circ$  (3 marks)

14. Find without using log tables or calculators the value of x which satisfy the equation  $\log_3(x^2 - 9) = 2 \log_3 3 + 1$  (3 marks)

15. A quantity V is partly constants and partly varies as u. If  $u = 1$  when  $v = 12$  and  $u = 3$  when  $v = 22$ . Find the value of v when  $u = 5$ . (3 marks)

16. A man deposits sh.50,000 in an investment account which pays 12% interest p.a compounded semi-annually. Find the amount in the account after 3 years. (3 marks)

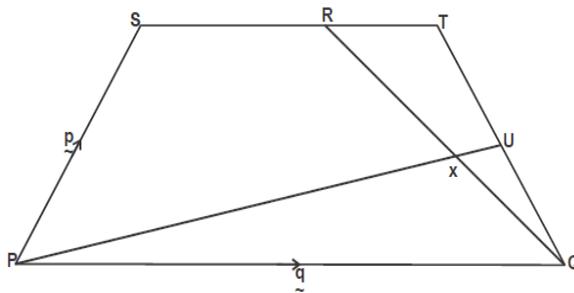
**SECTION B**

17. A bus travelling from Nakuru to Mandera averages at a speed of 70km/hr and on the return journey, the bus averages 20km/hr slower and takes 4 hours longer than on the journey from Nakuru to Mandera.
- Find the distance between Nakuru and Mandera. (4 marks)
  - Diesel consumption is 0.32 litres per kilometre on the journey from Nakuru to Mandera. However, this rate increases by 25% on the return journey. Calculate the amount of diesel the bus consumes for the trip. (3 marks)
  - If diesel costs sh.65 per litre and the bus makes 3 round trips in a week, determine the total cost of diesel required to run the bus for 5 months. (3 marks)
18. Kimutai earns K£12,000p.a and is housed by the company at a nominal rate of Ksh.2000 per month. 15% of his basic salary is added to his income for the purposes of taxation. He gets a family relief of K£1320p.a and is entitled to a relief of 10% of his insurance of K£800p.a.

<u>Income K£ p.a</u>	<u>Rate per K£</u>
1 - 2100	10%
2101 - 4200	15%
4201 - 6300	25%
6301 - 8400	35%
Over 8400	45%

- Calculate the taxable income. (2 marks)
- Calculate his PAYE (5 marks)
- Kimutai other deductions includes W.C.P.S sh.600p.m, NHIF sh.500p.m. Calculate his net monthly salary. (3 marks)

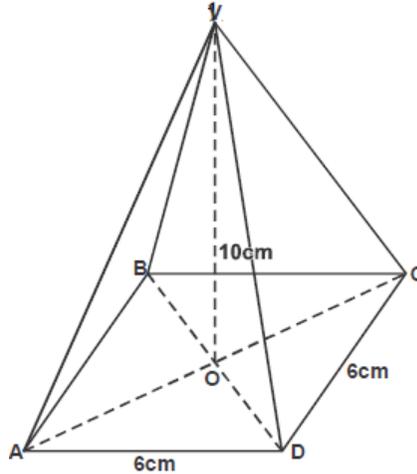
19. In the trapezium below,  $\overrightarrow{PQ} = 3 \overrightarrow{ST}$ . T divides SR in the ratio 4 : 1 and U is the midpoint of QT. PU and QR intersect at X. PX



Given that  $PQ = q$  and  $PS = p$ .

- Express QR in terms of p and q
  - Express PX in terms of p, q and h.
  - Express PX in terms of p, q and k.
  - Hence obtain the values of h and k. (3 marks)
  - Determine the ratio in which X divides QR. (1 mark)
20. The probability of a candidate passing her secondary examination is  $\frac{4}{5}$ . If she passes her examination the probability of her joining the university is  $\frac{2}{3}$ . If she fails her examination the probability of her joining the university is  $\frac{1}{4}$ . If she joins the university the probability of her getting a job is  $\frac{6}{7}$  and if she doesn't join the university the probability of her getting a job is  $\frac{2}{9}$ . Using a tree diagram, find :
- the probability that she fails her examination. (3 marks)
  - find the probability that she got a job after failing her secondary examination. (2 marks)
  - the probability that she joins the university. (2 marks)
  - the probability that she did not get a job. (3 marks)
21. A particle in a straight line is such that its displacement s metres from a given point is  $s = t^3 - 6t^2 + 2t + 3$  where t is time in seconds. Find :
- The displacement of the particle at  $t = 3$ . (2 marks)
  - The velocity of the particle where  $t = 4$ . (2 marks)
  - The value of t where the particle is momentarily at rest. (3 marks)
  - The acceleration of the particle when  $t = 4$  (3 marks)
22. The manager of a cinema wishes to divide the seats available into two classes A and B. He has the following constraints.
- There are not more than 120 seats available
  - There must be at least twice as many B class seats as there are A class seats
  - Class A seats are priced at sh.30 each and class B at sh.20 each and at least sh.2000 should be collected at each show to meet the expenses.
- Write inequalities from the constraints listed above. (3 marks)

- b) On the grid provided plot the inequalities . (4 marks)
- c) Find the number of seats of each kind which will give the maximum profit and calculate this maximum profit. (3 marks)
23. The positions of airport P and Q are  $(60^\circ\text{N}, 45^\circ\text{W})$  and  $(60^\circ\text{N}, K^\circ\text{E})$  respectively. It takes a plane 5 hours to travel due East from P to Q at an average speed of 600 knots. Taking  $R = 6370\text{km}$  and  $\pi = \frac{22}{7}$ .
- a) Calculate the value of k. (3 marks)
- b) The local time at P is 10.45a.m. What is the local time at Q when the plane reaches there. (4 marks)
- c) Find the distance PQ measured along a circle of latitude to the nearest km. (3 marks)
24. The figure below is a square based pyramid ABCDV with  $AD = DC = 6\text{cm}$  and height  $V = 10\text{cm}$ .



- a) State the projection of VA on the base ABCD. (1 mark)
- b) Find:
- i) the length of VA (3 marks)
- ii) the angle between VA and ABCD (2 marks)
- iii) the angle between the planes VDC and ABCD (2 marks)
- iv) volume of the pyramid (2 marks)

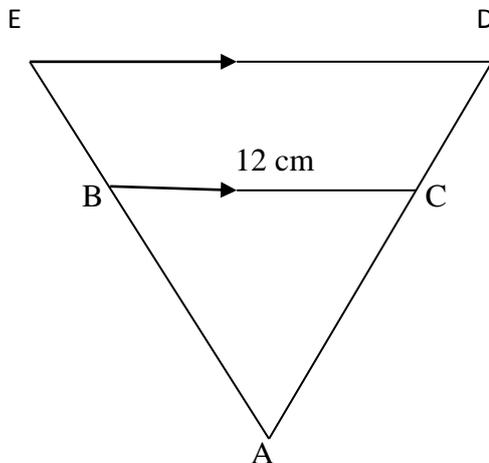
**MURUKA/ KANDARA**  
**FORM 4**  
**121/1**  
**MATHEMATICS**  
**PAPER 2½HRS**

**SECTION 1 (50MKS)**

*Answer all questions in this section.*

- Without using a calculator, evaluate (3marks)  

$$\frac{-2(5+3)-9 \div 3+5}{-3 \times 5 + -2 \times 4}$$
- Solve for X in the equation (3marks)  
 $\log_8(x+6) - \log_8(x-3) = -$
- Given that  $\frac{8}{4-2\sqrt{3}} = a + b\sqrt{3}$  and that a and b are rational numbers, find the values of a and b (3marks)
- The length and breadth of a rectangular paper were measured to the nearest centimeter and found to be 18 cm and 12 cm respectively. Find the percentage error in it area. (4marks)
- Solve for x in th equation (3marks)  
 $2 \cos 3x = \frac{\sqrt{3}}{2}$  in the range  $0^\circ \leq x \leq 360^\circ$
- Using reciprocal tables, evaluate (3marks)  
 $\frac{5}{0.02456} - \frac{2}{34.89}$
- Find the value of x in  $49^{x+1} + 7^{2x} = 350$  (3marks)
- Find the equation of a line passing through the point (3,5) but perpendicular to the line.  $2y+x=3$  (3marks)
- In the figure below the area of a triangle ABC = 100 cm<sup>2</sup> and that of quadrilateral BCDE = 224 cm<sup>2</sup>. Given that side BC = 12cm, calculate the length of side DE. (4marks)



- Express  $0.\overline{27}$  as a fraction. (2marks)
- The size of an interior angle of a regular polygon is  $3x^\circ$ , while its exterior angle is  $(x-20)^\circ$ . Find the number of sides of the polygon. (3marks)
- It takes 30 workers 6 days working 8 hours a day to harvest maize in a farm. How many days would 50 workers working 6 hours a day take to harvest the maize? (2marks)
- The angle of elevation of the top of a cliff from a point P is  $45^\circ$ . From a point which is 10m from P towards the foot of the cliff, the angle of elevation is  $48^\circ$ . Calculate the height of the cliff. (4marks)
- Find the difference between the GCD and LCM of 12, 18 and 36. (3marks)
- In what ratio should sugar costing sh.46 per kg and Ksh. 74 per kg be mixed to produce a sugar blend costing sh. 72 after making a profit of 20%. (4mks)
- Find the centre and radius of a circle whose equation is  $3x^2 + 3y^2 + 18x - 24y - 72 = 0$  (3mks)

**SECTION 2 (50MKS)**

Answer any Five questions in this section.

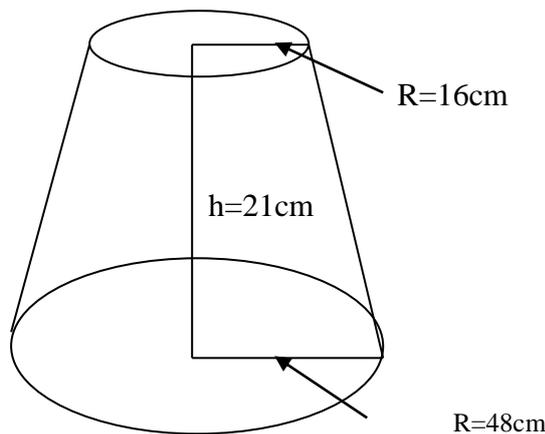
17. A passenger train travelling at 25km/hr is moving in the same direction as a truck travelling at 30 km/hr. The railway line runs parallel to the road and the truck takes 1½ minutes to overtake the train completely.
- Given that the truck is 5 metres long determine the length of the train in metres. (5mks)
  - The truck and the train continue moving parallel to each other at the original speeds. Calculate the distance between them, 4 minutes after the truck overtake the train. (2mks)
  - The truck stopped 45 minutes after overtaking the train. How long did the train take to catch up with the truck. (3mks)

18. The marks scored by 50 students in a mathematics examination are as follows:

60	54	40	67	53	73	37	55	62	43
44	69	39	32	45	58	48	67	39	51
46	59	40	52	61	48	23	60	59	47
65	58	74	47	40	59	68	51	50	50
71	21	26	36	38	70	46	40	51	26

- Prepare a frequency distribution table using a class interval of 10 starting with 21-30 (4marks)
- State the modal frequency (1mark)
- Calculate the mean mark (5marks)

19. The figure below represents a fraction of a solid cone of base radius 48 cm and top radius of 16 cm. The height of the frustum is 21 cm. (Take  $\pi = \dots$ )



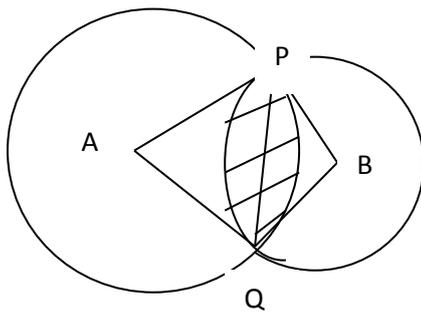
Calculate:

- The height of the solid cone. (2marks)
  - The volume of the solid frustum (3marks)
  - The total surface area of the frustum (5marks)
20. Complete the table below for the function  $Y=2x^2+4x-3$  for values of  $x$  in the range  $-4 \leq x \leq 2$  (2marks)

x	-4	-3	-2	-1	0	1	2
$2x^2$	32			2	0	2	
$4x$					0		8
-3	-3	-3	-3	-3	-3	-3	-3
y					-3	3	13

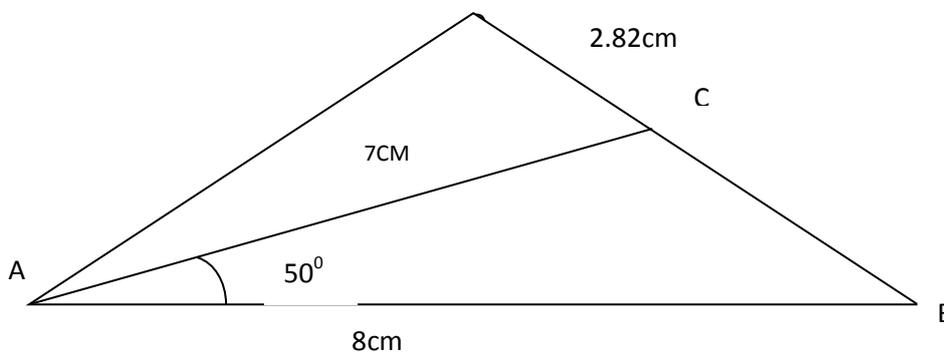
- On the grid below, draw the graph of the function  $y=2x^2+4x-3$  for  $-4 \leq x \leq 2$ . Use the graph to estimate the roots of the equations. (4mks)
  - $2x^2+4x-3=0$  (1mk)
  - $2x^2+x-5=0$  (3mks)

21. The figure below shows 2 circles of radii 10.5cm and 8.4cm and with centres A and B respectively. The common chord PQ=9cm.



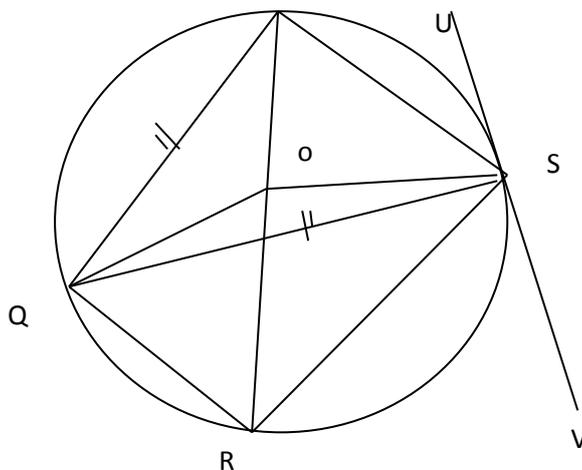
- a) Calculate angle PAQ (2marks)
- b) Calculate angle PBQ (2marks)
- c) Calculate the area of the shaded part (6marks)

22. The figure below (not drawn to scale), AB=8cm AC=6cm AD=7cm CD=2.82cm and angle CAB=50°



- a) Calculate to 2 decimal places The length BC (2mks)
- b) The size of angle ABC (3mks)
- c) The size of angle CAD (3mks)
- d) The area of triangle ACD (2mks)

23. In the figure below, PR is a diameter of the circle centre O. Points P,Q,R and S are on the circumference of the circle. Angle PRQ=72° QS=QP and line USV is a tangent to the Circle.



Giving reasons ,calculate the size of:

- a)  $\angle QPR$  (2mks)
- b)  $\angle PQS$  (2mks)
- c)  $\angle OQS$  (2mks)
- d)  $\angle RTS$  (2mks)
- e)  $\angle RSV$  (2mks)

24. The equation of a curve is  $y=2x^2+3x^2$

a) find

i) The x-intercept of the curve.

(2mks)

ii) The y-intercept of the curve.

(1mk)

b) i) Determine the stationery points of the curve

(3mks)

ii) For each point in (b) (i) above, determine whether it is a maximum or a minimum

(2mks)

c) Sketch the curve

(2mks)

**MURUKA /KANDARA**  
**FORM 4**  
**121/2**  
**MATHEMATICS**  
**PAPER2**  
**2½HRS**

**SECTION 1 (50MKS)**

**Answer all questions in this section**

- 1) Without using tables or calculators, evaluate (3marks)

$$\sqrt{\frac{15.3 \times 0.18}{0.34 \times 1.6}}$$

- 3) Use logarithms to evaluate (4mark)

$$\sqrt{\frac{(0.6873)^2 \times 438.7}{396.8}}$$

- 3) Solve the following equation by completing the square method (4marks)

$$2x^2 - 13x - 15 = 0$$

- 4) Make n the subject of the formula (4marks)

$$M = \sqrt[3]{\frac{ax^2 + n}{w - n}}$$

- 5) The position vectors of A and B are  $\begin{pmatrix} 3 \\ -1 \\ -4 \end{pmatrix}$  and  $\begin{pmatrix} 8 \\ -6 \\ 6 \end{pmatrix}$  respectively; A point m divides AB in the ratio 2:3. Find the position vectors of m (2marks)

- 6) A boy takes 10 hours to cultivate an orchard. However with the help of his sisters it takes them 6 hours only. How long would it take his sister working alone. (3mks)

- 7) Simplify the expression  $\frac{9x^2 - 4y^2}{12x^2 + xy - 6y^2}$  (3mks)

- 8) A box contains 10 bolts. It is found that 4 of them are standard. If two bolts are taken from the box at random, what is the probability that both are substandard? (2mks)

- 9) A point P(-2,5) is mapped onto P' (1,9) by a translation T<sub>1</sub>, if P' is mapped onto P'' by a translation T<sub>2</sub>  $\begin{pmatrix} - \\ - \end{pmatrix}$  given by find the coordinates of P'' and hence a single transformation Which maps P' to P'' (2mks)

- 10) The table below shows the masses in kg of some goods kept at a factory ware-house

masses	60-79	80-99	100-119	120-139	140-159	160-179
frequency	2	6	10	12	6	4

Calculate the median mass (4marks)

- 11) Find the inverse of the matrix  $\begin{bmatrix} 3 & 1 \\ 2 & -1 \end{bmatrix}$  (1mark)

Hence find the co-ordinates of the point of intersection of the line 3x+y=4 and 2x-y=1 (3marks)

- 12) A Kenyan bank buys and sells foreign currencies as shown below.

	Buying (Ksh)	Selling (Ksh)
1 Euro	84.15	84.26
50 Japanese Yen	65.37	65.45

A Japanese travelling from France arrives in Kenya with 4000 Euros, He converts all the 4000 Euros into Kenya shilling at the bank. While in the Kenya he spends a total of Ksh. 280,000 and then converts the remaining Ksh. to Japanese Yen at the bank. Calculate the amount in Japanese Yen that he receives. (Leave your answer to the nearest Yen) (4marks)

- 13) Find the equation of the tangent to the curve  $y = 1 + 2x + 3x^3$  at point (1, 4) (3marks)

- 14) Find the area of triangle PQR such that the area of its image is 12cm<sup>2</sup> after a transformation given by the matrix  $\begin{bmatrix} 2 & 1 \\ 4 & 4 \end{bmatrix}$  (3marks)

- 15) Two pipes A and B can fill a tank in 3 hrs and 4 hrs respectively. Pipe C can empty the full tank in 6 hours. Starting with an empty tank, how long would it take to fill the tank with all pipes running? (3mks)
- 16) T varies directly as the square of D and inversely as H. If T=2 when D =12 and H=6, find T when D=18 and H=1.5. (2mks)

**SECTION 2 (50MKS)**

Answer only FIVE questions from this section

- 17) The table below shows tax rates in a certain year.

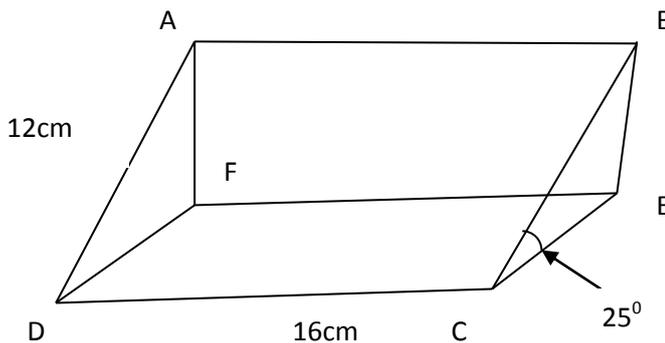
Monthly income (Ksh)	Tax rate %
1-9860	10
9861-18980	15
18981-28100	20
28101-37220	35
37221 and over	40

Moraa’s basic salary was sh. 20,600 and she was entitled to the following allowances per month

Medical allowance- sh. 2880  
 Transport allowance- sh 1040  
 Entertainment allowance-sh. 4000  
 She was also entitled to a tax relief of sh. 1056  
 Calculate

- a) Moraa’s taxable income (3mks)  
 b) Moraa’s net tax (5mks)  
 c) Moraa’s net salary per annum in pounds given that she repay’s a SACCO loan at Kshs 2000 per month, sh 450 union dues and sh 320 NHIF (2mks)

- 18) The area of a sloping ground is 16m wide and 12m long and slopes at 25° to the horizontal.



Find

- a) The length BD (2mks)  
 b) The length CE (2mks)  
 c) The angle between the line AB and ED (3mks)  
 d) The angle between the line BD and plane DCEF (3mks)
- 19) On the grid provided plot the points A(1,5) B(3,1) C(4,4) and D(3,3). Join these points to form quadrilateral ABCD (2mks)
- b) The points A’(2,10) B’(6,2) C’(8,8) and D’(6,6) are the images of A, B, C and D under a certain enlargement on the same grid draw the image A’B’C’D’. (2mks)
- c) Use the construction method to locate the centre of enlargement and state its coordinates (2mks)  
 d) What is the scale factor of this enlargement? (2mks)  
 e) Determine the matrix of this enlargement. (2mks)

- 20a) Complete the table below for the function  $Y=2\sin (2x+60)$  for  $0 \leq x < 360$  (3mks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
2x + 60	60	120			300	360	420	480	540			720	780
2sin x	0	1.00	1.73	2			0	-1	-1.73	-2	-1.73		
2sin (2x+60)					-1.73	0	1.73	1.73	0.00			0.00	1.73

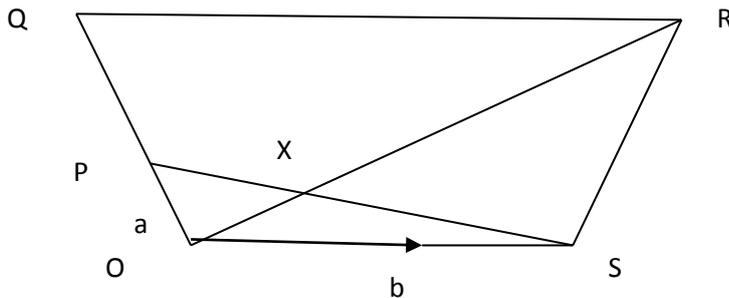
- b) Using the grid provided draw the graph of  $y=2\sin x$  and  $y=2\sin (2x+60)$  on the same axes for  $0 \leq x \leq 360$  (4mks)

- c) Use your graph to find  
 i) The period and amplitude of  $y=2\sin (2x+60)$  (2mks)  
 ii) The value of x for which

$$2\sin x = 2\sin(2x+60)$$

(1mk)

- 21) The displacement  $S$ , metres of a particle moving along a straight line after  $t$  seconds is given by  $S=2t^3-3t^2+t$
- Find its initial acceleration (3mks)
  - Find its velocity and acceleration when  $t=1$  (3mks)
  - Find the maximum speed attained (2mks)
  - Find the velocity attained in the fourth second (2mks)
- 22) Three towns are situated in such a way that town Q is 120 km on a bearing of  $030^\circ$  from P. town R is 210 km on a bearing of  $110^\circ$  from P.
- Draw a sketch diagram showing the positions of the three town (2mks)
  - Calculate to the nearest whole number the distance from town Q to R (3mks)
  - Find the bearing of R from Q to the nearest whole number (5mks)
- 23) In the diagram below  $\underline{OP}=\underline{a}$  and  $\underline{OS}=\underline{b}$   $\underline{SX}=\underline{hSP}$   $\underline{OQ}=3\underline{a}$  and  $\underline{QR}=2\underline{b}$



Express

- $\underline{SP}$  in terms of  $\underline{a}$  and  $\underline{b}$  (1mk)
  - $\underline{OR}$  in terms of  $\underline{a}$  and  $\underline{b}$  (1mk)
- b) i) Show that  $\underline{OX} = h\underline{a} + (1-h)\underline{b}$  (3mks)
- ii) Given that  $\underline{OX} = k\underline{QR}$ , find the value of  $h$  and  $k$  (5mks)
- 24) A bus left Nairobi at 7.00 am and travelled towards Nakuru at an average speed of 80km/h. at 8.00am a car left Nakuru towards Nairobi at an average speed of 120 km/hr. if the distance between Nakuru and Nairobi is 400 km calculate
- The time the bus arrived in Nakuru (2mks)
  - The time of the day the two vehicles met (4mks)
  - The distance from Nairobi where the two vehicles met (2mks)
  - The distance of the bus from Nakuru when the car arrived in Nairobi (2mks)

**GITUAMBA / LAIKIPIA**  
**Kenya Certificate of Secondary Education**  
**121/1**  
**Mathematics**  
**Paper 1**  
**2 ½ hours**

**SECTION A (50MARKS)**

1. Evaluate Leaving your answer in fraction form (3 mks)

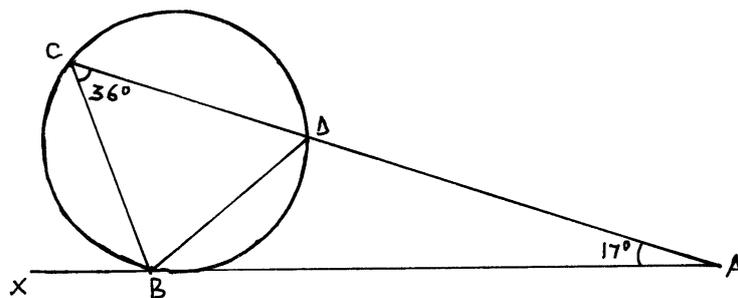
$$\frac{3}{5} \text{ of } 30 + 5\frac{5}{6} \div \frac{7}{12} - 2\frac{2}{3} \times 1\frac{1}{2}$$

$$5\frac{5}{8} \times 1\frac{7}{9} - \frac{5}{9} \text{ of } 4\frac{4}{5} + \frac{14}{5} \div \frac{7}{10}$$

2. Mr. Omondi leftshs. 116,580 in his bank account to be shared between his wife, daughter and son in the ratio 1:2:3. His wife decided to divide her share equally between her daughter and son. Determine how much the son finally got. (3 mks)
3. Use logarithms in all your steps to work out. (4mks)

$$\sqrt[87.56]{6.258}$$

4. Sankale walks for 2 ½ hours in the morning at xkm/hr and for ½ x hours in the afternoon at 6km/hr. This makes 38 ½ km altogether. How far did she walk in the morning. (3mks)
5. Given that  $\text{Cos}\theta = \frac{15}{17}$  and  $270^\circ \leq \theta \leq 360^\circ$ . Find without using tables the values of sine  $\theta$  and tangent  $\theta$ . (3mks)
6. On the figure below ABX is a tangent, Angle CAB=17° and Angle ACB = 36°. Calculate angle CBX and angle DBC. (3mks)



7. What is the sum of the roots of the equation. (3mks)

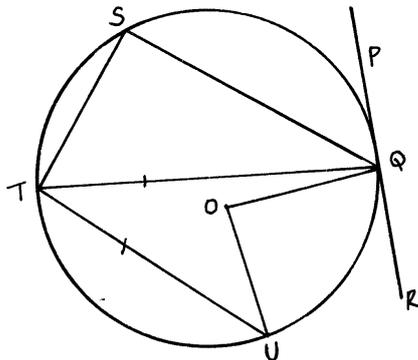
$$\frac{\quad}{\quad} + 3 = 4$$

8. Sonko is a real estate agent who is entitled to a commission on all properties bought through him. During a certain month he sold 2 mansions at sh. 2.54 million each, 4 flats at sh. 582,000 each and 5 bungalows at sh. 354,000 each. If he was paid a total commission of sh. 458,900. Calculate the percentage rate of commission he was paid. (4mks)
9. It takes 20 men 10 days to lay 300 metres of pipes. Find how many days it would take 15 men to lay 270 metres of pipes working at the same rate. (3mks)
10. A cylindrical tank of diameter 1.4m and height 1.2m is one-quarter full of water. This water is transferred to an empty rectangular container measuring 1.2m long and 70cm wide. Calculate the height of the water in the container in centimeters. (3mks)
11. Give the integral values of x which satisfies the following inequalities. (4mks)
- $$4 < 3x - 2 ; 15 - 2x > 4.$$
12. The average mark scored by the first 27 students in a mathematics test is 52. The average mark scored by the remaining 37 is 58. Calculate the mean mark for the whole class. (4mks)
13. Nyambura bought 3 skirts and 2 sweaters at a total cost sh. 1575. If he had bought 2 shirts and 3 sweaters he would have spent sh. 225 more. Find the cost of 5 skirts and 2 sweaters. (4mks)
14. The straight line whose equation is  $2y = 3x + 6$  meets the x-axis and the y-axis at P and Q respectively. Write down the coordinates of P and Q. (3mks)
15. Nairobi and Eldoret are 351 km apart. A bus leaves Nairobi towards Eldoret at an average speed of 66km/h. At the same time a car leaves Eldoret traveling at an average speed of 104km/hr towards Nairobi. Along the way the car stopped for 10 minutes to repair a puncture, then resumed the journey traveling at the same average speed. How far from Nairobi did they meet. (4mks)
16. A number P is divided by 12,15 and 18. In each case the remainder is 5. Find the smallest value of P. (3mks)

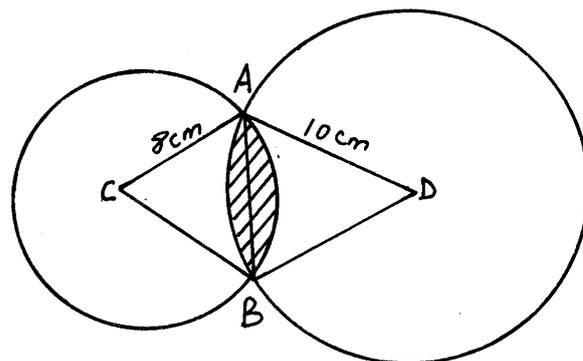
**Section II ( 50 Marks)**

**Answer ANY FIVE questions**

17. In the figure below, O is the centre of the circle. PQR is a tangent to the circle at Q, Angle PQS =  $28^\circ$ , angle UTQ =  $54^\circ$  and  $UT = TQ$ . Giving reasons, determine the size of

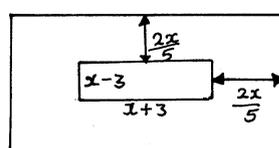


- a) Angle STQ (2 mks)  
 b) Angle TQU (2 mks)  
 c) Angle TQS (2 mks)  
 d) Reflex angle UOQ (2 mks)  
 e) Angle TQR (2 mks)
18. The figure below shows two circles, centres 'C' and 'D' of radii 8cm and 10cm respectively. The two circles subtend by angles of  $\theta$  and  $\beta$  respectively at their centres and intersect at A and B as shown.



- a) Given that the area of triangle ACB =  $30.07\text{cm}^2$  and that of triangle ADB =  $43.30\text{cm}^2$ . Calculate the size of the  
 (i) angle marked  $\theta$  (2 mks)  
 (ii) angle marked  $\beta$  (2 mks)
- b) Calculate to two decimal places the area of  
 (i) Sectors ACB (2 mks)  
 (ii) Sector ADB (2 mks)  
 (iii) The shaded region (2 mks)
19. a) Two ships Q and R are sailing towards port P. At 1144 hours ship Q is exactly 120km on a bearing of  $030^\circ$  from P and ship R is 50km on a bearing of  $300^\circ$  from P. At this instant, ship R develops engine trouble and cannot continue with the journey. Ship Q receives the distress signal from ship R and has to change course and steam straight towards ship R at 50km/h. Without using a scale drawing, calculate the time of day ship Q reaches ship R. (5 mks)
- b) A particle moves along a straight line OA such that t seconds after it is at 'O'; its velocity is  $v\text{m/s}$  where  $v=qt - 2t^2$  and q is a constant. At the point P,  $t = 4$  and the particle is momentarily at rest. Calculate;  
 (i) The value of q (1 mk)  
 (ii) The distance OP (2 mks)  
 (iii) The acceleration when  $t = 1\frac{1}{2}$  seconds. (2 mks)

20. The figure below represents the floor of a dancing hall with a carpeted margin all around of  $\frac{2x}{5}$  m wide leaving a dancing space of  $(x-3)\text{m}$  by  $(x+3)\text{m}$



- a) If the total area of the entire room is  $315\text{m}^2$ , calculate the value of  $x$  (4 mks)
- b) Hence calculate the area of the carpeted margin. (2 mks)
- c) If the carpet cost shs. 750 per  $\text{m}^2$ . Calculate the total cost of the sealed margin. (2 mks)
21. a) The points  $A^I B^I C^I$  are the images of  $A(4,1)$   $B(0,2)$  and  $C(-2,4)$  respectively under a transformation represented by matrix  $M = \begin{pmatrix} 1 & 1 \\ 2 & 3 \end{pmatrix}$ . Write down the co-ordinates of  $A^I B^I C^I$  (3 mks)
- b)  $A^{II} B^{II} C^{II}$  are the images of  $A^I B^I C^I$  under another transformation whose matrix is  $N = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$ . Write down the co-ordinates of  $A^{II} B^{II} C^{II}$ . (3 mks)
- c) Transformation  $M$  followed by  $N$  can be replaced by a single transformation  $P$ . Determine the matrix for  $P$ . (2 mks)
- d) Hence determine the inverse of matrix  $P$ . (2 mks)
22. Draw triangle  $PQR$  with vertices  $P(2,3)$   $Q(1,2)$  and  $R(4,1)$  and triangle  $P^{II} Q^{II} R^{II}$  with vertices  $P^{II}(-2,3)$   $Q^{II}(-1,2)$   $R^{II}(-4,1)$  on the same axes. (2 mks)
- (i) Describe fully a single transformation which maps triangle  $PQR$  onto triangle  $P^{II} Q^{II} R^{II}$ . (2 mks)
- (ii) On the same plane, draw triangle  $P^I Q^I R^I$  the image of triangle  $PQR$ , under reflection in line  $y = -x$  (2 mks)
- (iii) Describe fully a single transformation which maps triangle  $P^I Q^I R^I$  onto  $P^{II} Q^{II} R^{II}$  (2 mks)
- (iv) Draw triangle  $P^{III} Q^{III} R^{III}$  such that it can be mapped onto triangle  $PQR$  by a positive quarter turn about the origin  $(0,0)$  (2 mks)
23. a) Draw a graph of  $y = 8 - 10x - 3x^2$  for  $-5 \leq x \leq 3$  (5 mks)
- b) On the same axes, draw the line  $y = 2x + 1$  and hence find;
- (i) The roots of  $8 - 10x - 3x^2 = 2x + 1$  (2 mks)
- (ii) A quadratic equation with roots in b(i) above. (1 mk)
- c) By including a suitable straight line, use your graph to solve  $3x^2 + 12x - 11 = 0$  (2 mks)
24. Using a ruler and a pair of compasses only. Construct a parallelogram  $ABCD$  such that  $AB = 8\text{cm}$  diagonal  $AC = 12\text{cm}$  and angle  $BAC = 22.5^\circ$  (4 mks)
- a) Measure (i) The diagonal  $BD$  (1 mk)
- (ii) The angle  $ABC$  (1 mk)
- b) Draw the circumcircle of triangle  $ABC$  (2 mks)
- c) Calculate the area of the circle drawn. (2 mks)

**GITUAMBA / LAIKIPIA**  
**121/2**  
**Mathematics**  
**Paper 2**  
**July/August-2017.**  
**Time: 2 ½ hours**

- Evaluate without using Mathematical tables or a calculator. (3mks)  

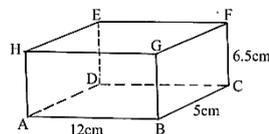
$$2 \log 5 - \frac{1}{2} \log 6 + 2 \log 40$$
- Solve for x given that the following is a singular matrix (2mks)  

$$\begin{pmatrix} 1 & 2 \\ x & x-3 \end{pmatrix}$$
- Make d the subject of the formula. (3mks)  

$$a^2 = \sqrt{\frac{1+d^2}{b^2} - \frac{b}{3}}$$
- Simplify  $\frac{3}{\sqrt{7-2}} + \frac{1}{\sqrt{7}}$  leaving your answer in the form  $a + b\sqrt{c}$ , where a, b and c are rational numbers. (3mks)
- Calculate the percentage error in the volume of a cone whose radius is 9.0cm and slant length 15.0cm. (3mks)
- A quantity A is partly constant and partly varies inversely as a quantity B. Given that A = -10 when B= 2.5 and A = 10 when B = 1.25, find the value of A when B = 1.5. (4mks)
- The table below shows corresponding values of x and y for a certain curve.

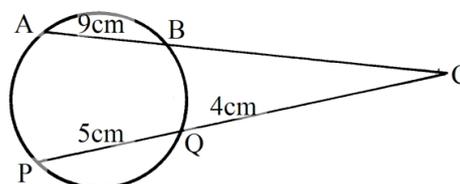
y	1.0	1.2	1.4	1.6	1.8	2.0	2.2
x	6.5	6.2	5.2	4.3	4.0	2.6	2.4

- Using 3 strips and mid-ordinate rule, estimate the area between the curve x axis, the line x = 1 and x = 2.2. (2mks)
- 14 people can build 10 huts in 30 days. Find the number of people working at the same rate that will build 18 similar huts in 27 days. (3mks)
  - The coordinates of two airports M and N are (60°N, 35°W) and (60°N, 15°E) respectively. Calculate; (1mk)  
 (i) The longitude difference.  
 (ii) the shortest time an aeroplane whose speed is 250 knots will take to fly from M to N along a circle of latitude. (2mks)
  - (a) Expand  $(x - 0.2)^5$  in ascending powers of x. (2mks)  
 (b) Use your expansion up to the fourth term to evaluate  $9.8^5$ . (2mks)
  - The figure below is a cuboid ABCDEFGH. AB = 12cm, BC = 5cm and CF = 6.5cm.



- State the projection of AF on the plane ABCD. (1mk)
  - Calculate the angle between AF and the plane ABCD correct to 2 decimal places. (3mks)
- Show that  $\frac{\sin x(\cos x + 1)}{\cos x} = \sin x + \tan x$ . (3mks)
  - The mid-point of AB is (1, -1.5, 2) and position vector of a point A is  $-i + j$ . Find the magnitude of  $\vec{AB}$  where O is the origin. (3mks)
  - Draw a line of best fit for the graph of y against x using the values in the table below. Hence determine the equation connecting y and x.
 

x	0.4	1.0	1.4	2.0	2.5
y	0.5	1.0	1.2	1.5	2.0
  - A coffee dealer mixes two brands of coffee, x and y to obtain 40kg of the mixture worth Ksh. 2,600. If brand x is valued at Ksh. 70 per kg and brand y is valued at Ksh. 55 per kg. Calculate the ratio in its simplest form in which brands x and y are mixed. (4mks)
  - The figure below shows a circle centre O. AB and PQ are chords intersecting externally at a point C. AB = 9cm, PQ = 5cm and QC = 4cm. Find the length of BC. (3mks)



**SECTION II (50 MARKS)**

**Answer only five questions in this section**

17. An examination involves a written and a practical test. The probability that a candidate passes the written test is  $\frac{1}{4}$ . If a candidate passes a written test then the probability of passing the practical test is  $\frac{1}{2}$  – otherwise it would be  $\frac{1}{3}$ .

- (a) Illustrate this information on a tree diagram (2mks)
- (b) Determine the probability that a candidate is awarded (2mks)
- (c) (i) credit for passing both tests (2mks)
- (ii) pass for passing the written test (2mks)
- (iii) retake for passing the test (2mks)
- (iv) Fail for not passing the test (2mks)

18. The relationship between the variables  $x$  and  $y$  is believed to be  $y = a/x + bx$ . Where  $a$  and  $b$  are constants. The table below shows corresponding values of  $x$  and  $y$

$x$	1	2	3	4	5
$y$	5.00	7.00	9.67	12.50	15.40

- (a) Write the relationship in the form of  $y = mx + c$  (1mk)
  - (b) By drawing a suitable straight line graph estimate the values of  $a$  and  $b$  (7mks)
  - (c) Find the value of  $y$  when  $x = 1000$  (2mks)
19. The vertices of triangle ABC are  $a(3,1)$  B  $(0,2)$  and  $c(2,-1)$
- (a) A'B'C' is the image of ABC under reflection on the line  $y = x$ . Draw A'B'C' on the grid provided hence state the co-ordinates of its vertices (3mks)
  - (b) A''B''C'' is the image of A'B'C' under positive quarter turn about the origin. Draw triangle A''B''C'' and state the co-ordinates of its vertices. (3mks)
  - (c) A'''B'''C''' is the image of triangle ABC under shear matrix,  $y$  axis invariant and linear scale factor 3. Write down the shear matrix hence find the co-ordinates of the vertices of triangle A'''B'''C''' (1mk)
20. Two points P and Q are found on the earth's surface the position of P is  $(52^\circ S, 66^\circ W)$  and Q  $(52^\circ S, 144^\circ E)$ . Taking earth's radius as 6370km,
- (a) Find the difference in longitude between the two points P and Q (1mk)
  - (b) (i) calculate the shortest distance between points P and q along (i) the latitude in km (1mk)
  - (ii) The longitude in Km (4mks)
  - (d) A plane travelling at 800km/hr leaves point P At 10.00am and sails through south pole to point q. Find the local time the plane arrives at point Q to the nearest minute. (4mks)
21. A company has two types of machines A and B for juice production. Type A machine can produce 800 litres per day while type B machine can produce 1600 litres per day. Type A machine needs four operators and type B needs seven operators. At least 800 litres must be produced daily and the total number of operators should not exceed 41. There should be two or more machine of each type.  
Letting  $x$  be the number of machines of type A and  $y$  for type B.
- (a) Form all inequalities in  $x$  and  $y$  to represent the above information (4mks)
  - (b) On the grid provided below, draw the inequalities and shade the unwanted region (4mks)
  - (c) Use the graph I (b) above to determine the least number of operators required for the maximum possible production. (2mk)
22. Using a ruler and a compass only, construct a triangle ABC such that  $AB = 6.8$  cm,  $BC = 5.6$  cm and angle  $ABC = 37 \frac{1}{2}^\circ$  (3mks)
- (b) Locate the:
    - (i) Locus P such that angle  $APB =$  angle  $ACB$  (3mks)
    - (ii) Locus Q such that Q is equidistant to points A and B (2mks)
    - (iii) Locus R such that R is equidistant to lines AB and AC (2mks)
23. The distance  $S$  meters from a fixed point O, covered by a particle after  $t$  seconds B given by the equation  $S = t^3 - 6t^2 + 9t + s$
- (a) Calculate the gradient of the curve at  $t = 0.5$  seconds (3mks)
  - (b) Determine the values of  $S$  at the turning points of the curve (3mks)
  - (c) Sketch the curve in the space provided. (4mks)
24. The table below shows the distribution of marks obtained by 50 students
- |                |       |       |       |       |       |       |       |
|----------------|-------|-------|-------|-------|-------|-------|-------|
| Marks          | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 |
| No of students | 3     | 9     | 13    | 15    | 5     | 4     | 1     |
- (a) Calculate the mean using a suitable assumed mean (3mks)
  - (b) calculate the variance (3mks)
  - (c) calculate standard deviation (1mk)
  - (d) If 30 students were to pass, calculate the pass mark ( give your answer to nearest whole mark) (3mks)

**WESTLANDS GRAPHICS**  
**FORM FOUR END OF TERM TWO EXAM - 2017**  
**121/1**  
**MATHEMATICS**  
 Paper 1  
**July 2017**  
 Time 2½ hours

**SECTION 1 (50 MARKS)**

**Answer all the questions in this section in the spaces provided.**

1. Given that 
$$\frac{\frac{3}{5} \text{ of } 60 - 2\frac{2}{3} \times 1\frac{1}{2}}{5\frac{5}{8} \times 1\frac{7}{9} - \frac{5}{4} \text{ of } 4\frac{4}{5} + 2\frac{4}{5} \div \frac{7}{10}} = M^M$$

Find the value of M. (3 marks)

2. Find the integral values of  $x$  which satisfy the following in equalities. (3 marks)

$$3(2 - x) < 4x - 9 < x + 11$$

3. Use the prime factors of 7056 and 74,088 to evaluate. (3 marks)

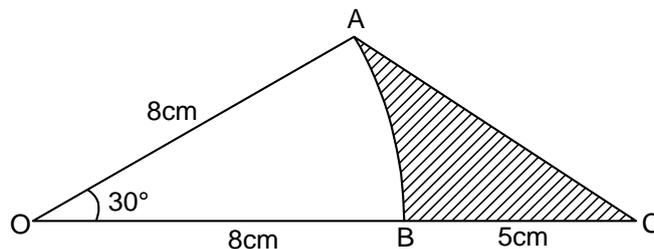
$$\frac{\sqrt{7056}}{\sqrt[3]{74,088}}$$

4. Evaluate using logarithms (3 marks)

$$\sqrt{\frac{\text{Tan}60^\circ}{76.8 \times 0.7034}}$$

5. Two beakers of exactly similar shape can hold 250ml and 2000ml of liquid respectively. If the surface area of the larger beaker is  $100\text{cm}^2$ , calculate the surface area of the smaller one. (4 marks)

6. In the figure below AB is an arc centre O. Given that angle  $\text{AOC} = 30^\circ$ ,  $\text{OA} = \text{OB} = 8\text{cm}$  and  $\text{BC} = 5\text{cm}$ , calculate the shaded area to 2dp. (Take  $\pi = 3.142$ ) (3 marks)



7. A cylindrical solid of length 20cm and radius 6cm is melted to form 12 similar conical solids of height 8cm. Determine the radius of each conical solid. (3 marks)

8. During a certain party, goats and chicken were slaughtered. The number of heads for both goats and chicken was 45. The total number of legs was 100. Determine the exact number of goats and chicken slaughtered. (3 marks)

9. Simplify: (3 marks)

$$\frac{3z^2 - 12}{3 - (1 + z)}$$

10. Find the equation of the image of the line  $y = 3x + 5$  under reflection in the line  $x = y$ . (3 marks)

11. The interior angle of a regular polygon is 9 times the exterior angle. How many sides does the polygon have? (3 marks)

12. The proceeds of a certain harambee was distributed among three schools P, Q and R. P received  $\frac{1}{3}$  of the total amount realized. Q received  $\frac{1}{3}$  of the remainder while R received  $\frac{4}{5}$  of what Q received. If the difference of what remained at Q's share was shs 25,000 determine how much the harambee realized. (4 marks)

13. Solve for  $x$  in the equation. (3 marks)

$$4^{1+x} + 3 \times 2^x = 1$$

14. A greengrocer buys 200kg of fruit at shs 40 per kg. He sells 20% of it at shs 70 per kg and 80% of the remainder at shs 50 per kg. If the rest becomes unsaleable, find the gain or loss as a percentage of the cost price. (3 marks)

15. Given that  $x = 4$  is a root of  $x^2 + kx - 20 = 0$ , find the value of  $k$  and the other root. (3 marks)

16. The position vector of P is  $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$  and vector PQ is  $\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ . Determine the coordinates of Q. (3 marks)

**SECTION B : 50 marks**

**Answer any FIVE questions in this section**

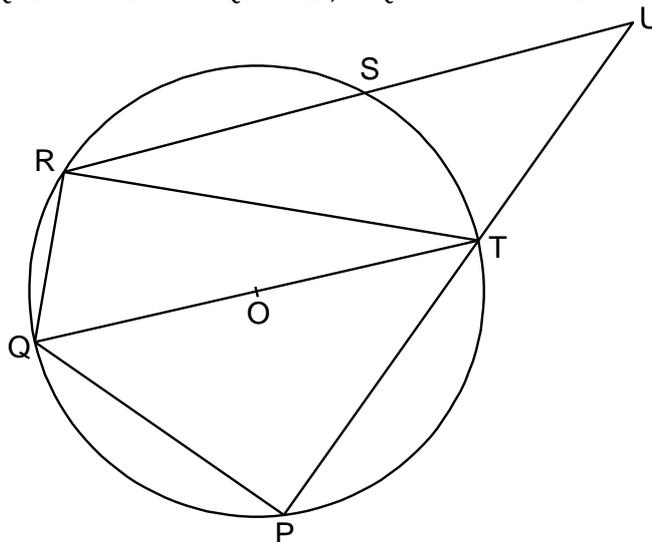
17. Two businessmen Achaki and Markazi contributed Ksh 128,000 and Ksh 112,000 respectively to start a business. They agreed to share the profits as follows:

- 30% shared equally
- 30% shared in the ratio of contributors.
- 40% retained for running business.

Their profit for a certain year was Ksh 86,400.

Calculate

- a) The amount shared equally. (3 marks)
  - b) The total amount received by each partner. (5 marks)
  - c) The amount retained for running the business. (2 marks)
18. a) A straight line  $L_1 : 9y - 6x = -6$  meets the x-axis at R. Determine the coordinates of R. (2 marks)
- b) A second Line  $L_2$  is perpendicular to  $L_1$  at R. Find the equation of  $L_2$  in the form  $ax + by = c$ ; where  $a, b$  and  $c$  are constants. (3 marks)
- c) A third line  $L_3$  passes through  $(-4, 3)$  and is parallel to  $L_1$ . Find
- i) The equation of  $L_3$  in the form  $ax + by = c$ ; where  $a, b$  and  $c$  are constants. (2 marks)
  - ii) The coordinates of point S at which  $L_3$  intersects  $L_2$ . (3 marks)
19. In Kangemi, a tailor bought a number of suits at a cost of sh 57, 600 from a wholesaler. Had he bought the same number of suits from a supermarket it would have cost him sh 480 less per unit. This would have enabled him to buy four extra suits for the same amount of money.
- a) Find the number of suits the tailor bought. (8 marks)
  - b) The tailor later sold each suit for shs 720 more than he paid for it. Determine the percentage profits he made. (2 marks)
20. The figure below, QOT is a diameter  $\angle QTP=42^\circ, \angle TQR=74^\circ$  and  $\angle SRT=39^\circ$ . RSU and PTU are secants.



Determine giving reasons

- a)  $\angle RST$  (2 marks)
- b)  $\angle SUT$  (2 marks)
- c) Obtuse angle ROT (2 marks)
- d)  $\angle PST$  (2 marks)
- e)  $\angle QPS$  (2 marks)

21. The table below shows marks obtained by 100 candidates of St. Marks Secondary school, in a Mathematics examination.

Marks	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94
Frequency	6	14	24	14	x	10	6	4

- a) Determine the value of  $x$  (2 marks)
  - b) State the modal class (1 mark)
  - c) Calculate the median mark. (3 marks)
  - d) Calculate the mean mark. (4 marks)
22. A(3, 7), B(5, 5), C(3, 1) and D(1, 5)
- a) On the grid provided below, plot ABCD on a Cartesian plane. (2 marks)

- b)  $A^1B^1C^1D^1$  is the image of ABCD under a translation vector  $T = \begin{pmatrix} -6 \\ -9 \end{pmatrix}$ . Plot  $A^1B^1C^1D^1$  and state its coordinates. (2 marks)
- c) Plot  $A^{11}B^{11}C^{11}D^{11}$  the image of  $A^1B^1C^1D^1$  after a rotation about  $(-1, 0)$  through a positive quarter turn. State its coordinates. (3 marks)
- d)  $A^{111}B^{111}C^{111}D^{111}$  is the image of  $A^{11}B^{11}C^{11}D^{11}$  after a reflection in the line  $y = x + 2$ . Plot  $A^1B^1C^1D^1$  and state its coordinates. (3 marks)
- 23.** Wambua is standing at a point P 160m south of a hill H on a level ground. From point P he observes the angle of elevation of the top of the hill to be  $67^\circ$ .
- a) Calculate the height of the hill. (3 marks)
- b) After walking 420m due east to the point Q, Wambua proceeds to point R due east of Q where the angle of elevation of the top of the hill is  $35^\circ$ . Calculate the angle of elevation of the top of the hill from Q. (3 marks)
- c) Calculate the distance from P and R. (4 marks)
- 24.** Four points B, C, Q and D lie on the same plane. Point B is 42km due southwest of Q. Point C is 50km on a bearing of  $S60^\circ E$  from Q. Point D is equidistant from B, Q and C.
- a) Using the scale: 1cm represents 10km construct a diagram showing the positions of B, C, Q and D. (5 marks)
- b) Determine the
- i) Distance between B and C. (1 mark)
- ii) Bearing of D from B. (2 marks)
- c) Find the distance and bearing of D from C. (2 marks)

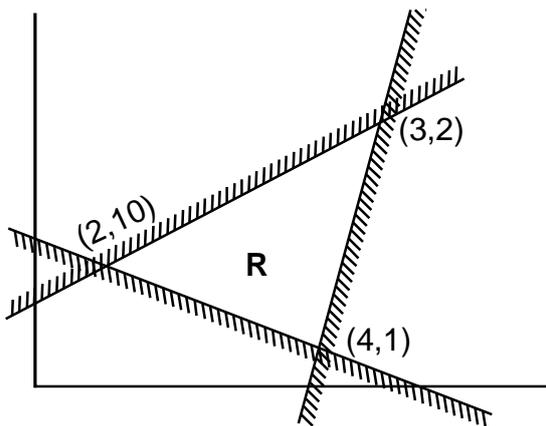
**WESTLANDS GRAPHICS**  
**FORM FOUR END OF TERM TWO EXAM - 2017**  
**121/2**  
**MATHEMATICS**  
 Paper 2  
 July 2017

**SECTION 1 (50 MARKS)**

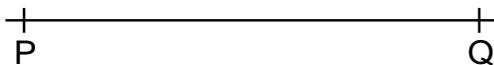
**Answer all the questions in this section in the spaces provided.**

1. Simply without using tables and calculators. (4 marks)  

$$\frac{2(\log 2.5 + \log 40)}{3 \log 0.05 + 2 \log 2 - \log 0.5}$$
2. Express  $\frac{\sqrt{2} - 4\sqrt{3}}{\sqrt{2} + \sqrt{3}}$  in the form of  $a + b\sqrt{c}$  where a, b and c are real numbers. (3 marks)
3. Two matrices A and B are such that  $A = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ . Given that the determinant of AB=4, find the value of k. (3 marks)
4. Find the term independent of x in the expansion of  $\left(3x - \frac{1}{2x}\right)^6$  (3 marks)
5. Find the distance of the point of intersection of line  $5x + y = 19$  and  $-x + 3y = 9$  from the point (11, -2) (4 marks)
6. The sum of the first three terms of a geometric progression is 27 and the first term is 36. Determine the common ratio and the value of the fourth term. (3 marks)
7. Write down the inequalities that satisfy the region R. (3 marks)



- 8.a) The line PQ below is 6cm long. On one side of the line, draw the locus of T such that the area of the triangle PTQ = 12cm<sup>2</sup>. (2 marks)



- b) Determine the two points on the locus obtained in part (a) above such that angle PRQ = 70° and label them as T<sub>1</sub> and T<sub>2</sub>. (2 marks)
9. A town B is 420 on a bearing of 160° from A town C is 280km on a bearing of 30° from town B. Find by calculation, the bearing of town A from town C. (4 marks)
10. A man invests a certain sum of money at 8% p.a. compounded quarterly. Find the number of years it takes for the amount to be 3.08 times the original value? (3 marks)
11. Under an enlargement of scale factor -2, the image of A(2, 4) is A<sup>1</sup>(-1, -2). Under the same enlargement the image of D(x, y) is D<sup>1</sup>(3, -2). Find the co-ordinate of object D. (3 marks)
12. The equation of a circle is given by  $3x^2 + 3y^2 + 3x + 42y + 30 = 0$ . Determine the co-ordinates of the centre and the radius of the circle. (3 marks)
13. The probability of a team loosing a game is  $\frac{1}{4}$ . The team plays the game until it wins. Determine the probability that the team wins in the fifth round. (3 marks)
14. Make M the subject of the formula.  $A = \frac{d \sqrt{f-M}}{2\pi M}$  (3 marks)
15. The fraction  $\frac{5}{3}$  is truncated as 1.666 to four significant figures. Find the percentage error in the truncation. (3 marks)
16. The gradient of the tangent to the curve  $y = ax^3 + bx$  at the point (1, 1) is -5. Calculate the values of a and b. (4 marks)

**SECTION II (50 marks)**

17. Income tax rates of a certain year were given as shown in the table below.

Taxable income K£ p.a	Rate (Ksh/£)
1 - 3600	0
3601 - 7200	2
7201 - 10,800	3
10,801 - 14,400	5
14,401 - 18,000	7
18001 and above	9

In that year, Musa's PAYE was Ksh 4,530, he was a civil servant with a free house and entitled to a monthly tax relief of Ksh 545. Calculate his monthly income in Ksh. (10 marks)

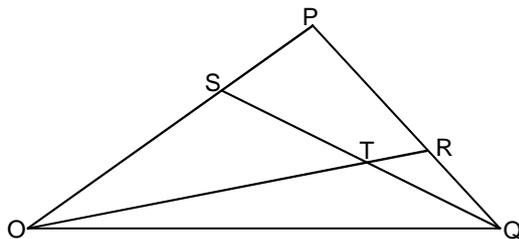
18. During installation of electricity bulbs in street lighting, a dealer is required to supply two types of bulbs A and B. The total number of bulbs should not be more than 400. He must supply more of A than B and type A should not be more than 300 and type B should not be less than 80.

- a) Write down in terms of  $x$  and  $y$  all the inequalities representing the above information. (3 marks)
- b) On the grid provided draw all the inequalities and shade the unwanted region. (4 marks)
- c) If type A cost Kshs 450 per piece and B Ksh 350 per piece and that the higher the cost the higher the profit.
  - i) Use your graph to determine the number in each type of bulb that he should supply to maximize the profit. (1 mark)
  - ii) Calculate the maximum cost of lighting the streets. (2 marks)

19. The cost  $c$ , of producing  $n$  items varies partly as  $n$  and partly as the inverse of  $n$ . To produce two items it costs Ksh 135 and to produce three items it costs Ksh 140. Find;

- a) The constants of proportionality and hence the equation connect  $c$  and  $n$ . (5 marks)
- b) The cost of producing 10 items. (2 marks)
- c) The number of items produced at a cost of Ksh 756 (3 marks)

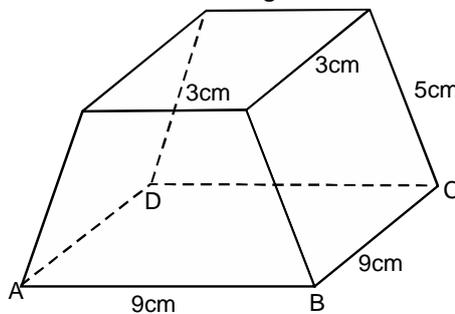
20.



In the figure above  $OPQ$  is a triangle in which  $OS = \frac{1}{4}OP$  and  $PR : RQ = 2 : 1$ . Lines  $OR$  and  $SQ$  meet at  $T$ .

- a) Given that  $OP = p$  and  $OQ = q$  express the following vectors in terms of  $p$  and  $q$ 
  - i)  $PQ$  (1 mark)
  - ii)  $OR$  (2 marks)
  - iii)  $SQ$  (2 marks)
- b) Its further given that  $ST = mSQ$  and  $OT = nQR$ . Determine the values of  $m$  and  $n$ . (4 marks)
- c) Find the ratio of  $ST : TQ$  (1 mark)

21. The diagram below shows a frustrum of a square based pyramid. The base  $ABCD$  is a square of sides 9cm. The top  $A^1B^1C^1D^1$  is a square of sides 3cm and each slant edges of the frustrum is 5cm.



Determine the

- i) Altitude of the frustrum (3 marks)
- ii) Angle between  $AC^1$  and the base  $ABCD$  (2 marks)
- iii) Calculate the volume of the frustrum (5 marks)

22. Fill in the table below for the functions  $y = \sin (2x + 10)^\circ$  and  $y = 2\cos x$ . (2 marks)

x	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
$\sin (2x + 10)$													
$2 \cos x$													

Using a scale of 1cm to represent  $30^\circ$  on the horizontal axis and 2cm to represent one unit on the vertical axis, draw the graphs of  $y = \sin (2x + 10)$  and  $y = 2\cos x$ . (4 marks)

Use your graph to solve the equations.

i)  $\sin (2x + 10) = 0$  (2 marks)

ii)  $\sin (2x + 10) - 2\cos x = 0$  (2 marks)

23. A globe representing the earth has a radius of 35cm. Point A ( $0^\circ, 10^\circ\text{W}$ ), B( $0^\circ, 35^\circ\text{E}$ ), P( $60^\circ\text{N}, 110^\circ\text{E}$ ) and Q( $60^\circ\text{N}, 120^\circ\text{W}$ ) are marked on globe.

a) Find the length of arc AB leaving your answer in terms of  $T_1$ . (3 marks)

b) If O is the center of latitude  $60^\circ\text{N}$ , find the area of the minor sector OPR. (4 marks)

c) If the local time at Q is 10.30 am on Monday, determine the local time and day at P. (3 marks)

24. The equation of a curve is  $y = 2x^2 - 4x + 6$

a) Determine the co-ordinates of the turning point of the curve. (2 marks)

b) Giving evidence, determine which type of H turning point is given in (a) above. (2 marks)

c) The curve passes through the point D (2, 6). Leaving your answer in the form  $y = mx + c$ , find the equation of

i) The gradient to the curve at D. (3 marks)

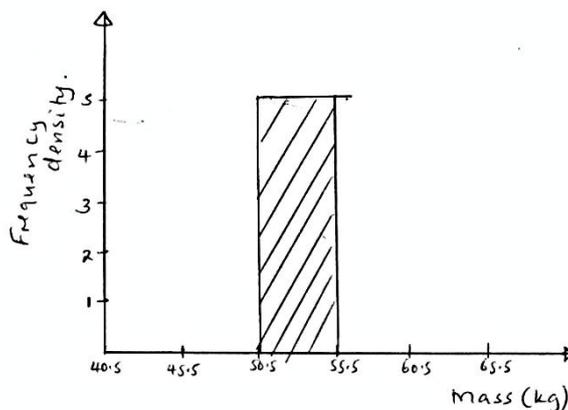
ii) The normal to the curve at D. (3 marks)

**MURANGA SOUTH B**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**  
**SECTION I (50 Marks)**

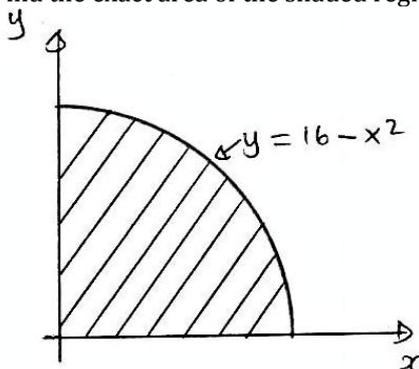
Answer all questions in this section in the spaces provided.

1. Evaluate  $\frac{-8 \div 2 + 12 \times 9 - 4 \times 6}{56 \div 7 \times 2}$  (3 marks)
2. (a) Express 10500 in terms of its prime factors. (2 marks)  
 (b) Determine the smallest positive number P such that 10500P is perfect cube. (2 marks)
3. Solve the equation  $\sin(3x + 30^\circ) = \frac{\sqrt{3}}{2}$  for  $0^\circ \leq \theta \leq 90^\circ$  (4 marks)
4. Find the range of x if  $2 \leq 3 - x < 5$  (2 marks)
5. Two towns A and B are 220 km apart. A bus left town A at 11: 00 a.m. and travelled towards B at 60 km/hr. At 11: 30 a.m., a matatu left town B for town A and travelled at 80 km/hr. Find the time of the day when the two vehicles met. (4 marks)
6. The size of an interior angle of a regular polygon is  $3x^\circ$  while its corresponding exterior angle is  $(x - 20)^\circ$ . Find the number of sides of the polygon. (3 marks)
7. Given that  $x = -2$ , find the values of y and z for the simultaneous equations. (3 marks)  
 $x + y - z = -1$   
 $x - 2y + z = -7$
8. A square whose vertices are P (1, 1), Q (2, 1) R (2, 2) and S (1, 2) is given an enlargement with centre (0, 0). Find the images of the vertices if the scale factor is 3. (3 marks)
9. The following data was obtained from the mass of a certain animal. Complete the table and the histogram below. (3 marks)

Mass (kg)	41 - 50	51 - 55	56 - 65
Frequency	20		40



10. The position vectors of A and B are  $\tilde{a} = 2i - 3j + 4k$  and  $\tilde{b} = -2i - j + 3k$  respectively. Find to 2 decimal places the length of vector AB. (3 marks)
11. Find the radius and the coordinate of the centre whose equation is  $\frac{1}{2}x^2 + \frac{1}{2}y^2 - 3x + 4y + 6\frac{3}{8} = 0$  (3 marks)
12. Find the exact area of the shaded region. (3 marks)

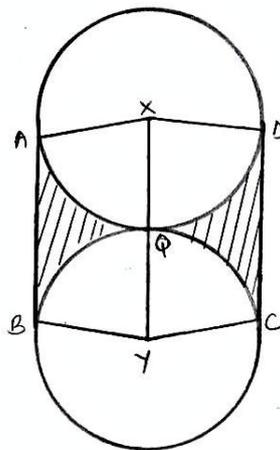


13. Determine the value of  $x$  for which the matrix below is singular  $\begin{pmatrix} x & 4 \\ 1 & x-3 \end{pmatrix}$  (3 marks)
14. Find the values of  $\theta$  in the equation  $2 \sin^2 \theta - 5 \cos \theta + 1 = 0$  for  $0^\circ \leq \theta \leq 360^\circ$  (3 marks)
15. Three business partners Kamau, Njoroge and Mwangi are to share Sh. 12 000 in the ratio 5: 6:  $x$ . If Kamau received Sh. 4 000, determine the value of  $x$ . (3 marks)
16. Factorise  $2x^2y^2 - 5xy - 12$  (3 marks)

**SECTION II (50 Marks)**

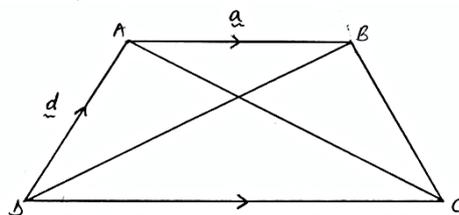
**Answer ANY FIVE questions in the spaces provided.**

17. Two aeroplanes P and Q leave an airport at the same time. P flies on a bearing of  $240^\circ$  at 900km/h while Q flies due east at 750 km/h.
- a) Using a scale of 1 cm to represent 100 km, make a scale drawing to show the positions of the aeroplanes after 40 minutes. (4 marks)
- b) Use the scale drawing to find the distance between the two areoplanes after 40 minutes. (2 marks)
- c) Determine the bearings of;
- i. P from Q (2 marks)
- ii. Q from P (2 marks)
18. The figure below shows two circles each of radius 7 cm with centres at X and Y. the circles touch each other at point Q.



Given that  $\angle AXD = \angle BYC = 120^\circ$  and lines AB, XQY and DC are parallel, calculate the area of;

- a) The minor sector XAQD. (Take  $\pi = \frac{22}{7}$ ) (3 marks)
- b) The trapezium XABY (4 marks)
- c) The shaded region. (3 marks)
19. Given  $y$  is inversely proportional to  $x^n$  and  $k$  as the constant of proportionality;
- a) (i) Write down a formula connecting  $y, x, n$  and  $k$ . (1 mark)
- (ii) If  $x = 2$  when  $y = 12$  and  $x = 4$  when  $y = 3$  write down two expressions for  $k$  in terms of  $n$ , hence, find the value of  $n$  and  $k$ . (7 marks)
- b) Using the value of  $n$  obtained in (a) (ii) above, find  $y$  when  $x = 5\frac{1}{3}$  (2 marks)
20. In the figure below, ABCD is a trapezium. AB is parallel to DC diagonals AC and DB intersect at X and  $DC = 2 AB$ .  $AB = \tilde{a}$   $DA = \tilde{d}$ ,  $AX = k AC$  and  $DX = h DB$ , where  $h$  and  $k$  are constants.



- a) Find in terms of  $\tilde{a}$  and  $\tilde{d}$ ;
- i. BC (2 marks)
- ii. AX (2 marks)
- iii. DX (1 mark)
- b) Determine the values of  $h$  and  $k$ . (5 marks)
21. (a) Complete the table given below for the equation  $y = 5 + 3x - 2x^2$  by filling in the blank spaces. (3 marks)

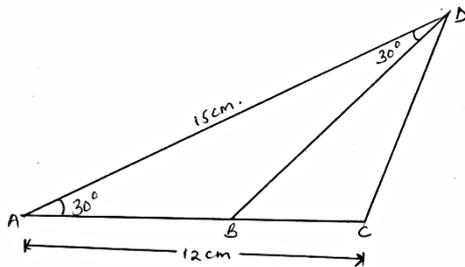
X	-2	-1.5	-1	-0.5		0.5	1	1.5	2	2.5	3	3.5
Y	-9			3		6	6	5			-4	

(b) Use the values from the table above to draw the graph of  $y = 5 + 3x - 2x^2$  (4 marks)

(c) Use your graph to determine the ranges of values of  $x$  which satisfy the equation (3 marks)

$$5 + 3x - 2x^2 \leq -2$$

22. In the figure below,  $AC = 12$  cm,  $AD = 15$  cm and  $B$  is a point on  $AC$ ,  $\angle BAD = \angle ADB = 30^\circ$



Calculate to 2 d.p.

a) The length of  $CD$ . (3 marks)

b) The length of  $AB$ . (3 marks)

c) The area of the triangle  $BCD$ . (2 marks)

d) The size of  $\angle BDC$  (2 marks)

23. The product of the first three terms of a geometric progression is 64. If the first term is  $a$  and the common ratio is  $r$

a) Express  $r$  in terms of  $a$ . (3 marks)

b) Given that the sum of the three terms is 14;

i. Find the values of  $a$  and  $r$  and hence write down two possible sequences each up to 4<sup>th</sup> term. (5 marks)

ii. Find the product of the 50<sup>th</sup> term of the two sequences. (2 marks)

24. Two towns  $A$  and  $B$  are 80 km apart. Juma started cycling from town  $A$  to town  $B$  at 10.00 a.m. at an average speed of 40 km/h. Mutuku started his journey from town  $B$  to  $A$  at 10.30 a.m. and travelled by car at an average speed of 60 km/h.

a) Calculate;

i. The distance from town  $A$  when Juma and Mutuku met. (5 marks)

ii. The time of the day when the two met. (2 marks)

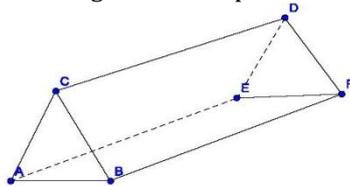
b) Kamau started cycling from town  $A$  to town  $B$  at 10.21 a.m. He met Mutuku at the same time as Juma did. Determine Kamau's average speed. (3 marks)

**MURANGA SOUTH B**  
**121/2**  
**MATHEMATICS**  
**PAPER 2**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**  
**SECTION I (50 Marks)**

1. Make P the subject of the formula. (3 marks)

$$t = \frac{2R}{n} \sqrt{\frac{L - P}{3k}}$$

2. Without using a calculator or Mathematical tables express  $\frac{\sin 30^\circ}{2 + \tan 60^\circ}$  in surd form and simplify leaving your answer in the form  $a + b\sqrt{c}$  where a, b and c are rational numbers. (3 marks)
3. The radius of a spherical ball is measured as 6cm to the nearest cm. Determine, to 2 decimal places, the percentage error in calculating the surface area of the ball. (4 marks)
4. The equation of a circle is given by  $x^2 + 8x + y^2 - 2y - 1 = 0$ . Determine the radius and centre of the circle. (3 marks)
5. The matrix  $p = \begin{pmatrix} q + 2 & q \\ -3 & q - 2 \end{pmatrix}$  is a singular matrix. Find two possible;
- a) Values of q. (2 marks)
- b) The matrices for p. (1 mark)
6. The gradient function of a curve is given by  $\frac{dy}{dx} = 3x - 6$ .  
 Determine
- a) The equation of the curve given that it passes through the point (0, 7). (2 marks)
- b) The coordinates of the turning point of the curve. (1 mark)
7. Two towns R and S are 3 000 nautical miles apart. Both towns are situated on the equator such that S is to the East of R.  
 Calculate:
- a) The longitude difference between towns S and R. (1 mark)
- b) The local time at R if the local time at S is 1:15 a.m. (2 marks)
8. The volume of a cylinder is given by  $V = \pi r^2 h$ . Find the percentage change in V if r increases by 8% and h decreases by 12%. (4 marks)
9. The figure below shows a triangular prism ABCDEF. If given that AB = 12 cm, AE = 20 cm AC = ED = BC = FD = 10cm, calculate the angle between plane ADB and the base. (3 marks)



10. Solve  $\log_2(x + 7) - \log_2(x - 7) = 3$  (3 marks)
11. Use the trapezium rule to find the area bounded by the curve  $y = \frac{1}{1+x}$ ,  $x = 0$  and  $x = 5$ . Use strips of unit length. (3 marks)
12. Use logarithms tables to evaluate; (4 marks)
- $$\sqrt[4]{\frac{3.45 + 2.62}{786 \times 0.7}}$$
13. Construct  $\Delta ABC$  with AB = 8cm, BC = 6cm and AC 7cm. On the same diagram construct the locus L of points 3cm from the midpoint of AB. (3 marks)
14. (a) Expand and simplify the binomial expression  $(2 - x)^6$  up to the term in  $x^2$ . (1 mark)
- (b) Use your expansion up to term the term in  $x^2$  to estimate  $(1.99)^6$  (2 marks)
15. A plane figure of area 50 cm<sup>2</sup> is transformed by the matrix  $\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$  and then followed by the matrix  $\begin{pmatrix} 3 & -1 \\ 0 & 4 \end{pmatrix}$ . Find the area of the final image. (2marks)
16. In a chemistry experiment, a boy mixed some acid solution of 45% concentration with an acid solution of 25% concentration. In what proportion should the two acids be mixed in order to get 100 cm<sup>3</sup> concentration? (3 marks)

**SECTION II (50 Marks)**

**(Answer any Five questions in this section)**

17. Wambui planned to spend sh 16 800 to buy a number of bags of maize. When she went to the market she discovered that the price of maize had increased by sh 200 per bag. She could now afford to buy two bags less than she had planned to buy with the same amount of money.
- a) Determine the number of bags she had planned to buy. (6 marks)
- b) She later sold the maize at sh 1 750 per bag. Find the percent profit she made. (4 marks)
18. The gradient function of a curve is given by the expression  $2x + 1$ . If the curve passes the points  $(-4, 6)$ ;
- a) Find;
- i. The equation of the curve. (3 marks)
- ii. The values of  $x$  at which the curve cuts the line  $y = 0$ . (3 marks)
- b) Determine the area enclosed by the curve and the  $x$  axis. (4 marks)
19. The 2<sup>nd</sup> and 5<sup>th</sup> terms of an arithmetic progression are 8 and 17 respectively. The 2<sup>nd</sup>, 10<sup>th</sup> and 42<sup>nd</sup> terms of the A.P. form the first three terms of a geometric progression. Find
- a) The 1<sup>st</sup> term and the common difference. (3 marks)
- b) The first three terms of the G.P and the 10<sup>th</sup> term of the G.P. (4 marks)
- c) The sum of the first 10 terms of the G.P. (3 marks)
20. In a science class  $\frac{2}{3}$  of the class are boys and the rest girls. 80% of the boys and 90% of the girls are right handed and the rest are left handed. The probability that a right handed student will break a test tube in any session is  $\frac{1}{10}$  and the corresponding for the left handed student is  $\frac{3}{10}$ , their probability being independent of the student's sex.
- a) Draw a probability tree diagram to represent the above information. (2 marks)
- b) Find the probability that;
- i. A student chosen from the class is left handed. (2 marks)
- ii. A test tube is broken by a left handed student. (2 marks)
- iii. A test tube is broken by a right handed student. (2 marks)
- iv. A test tube is not broken in any session. (2 marks)
21. Complete the table below for the functions  $y = 3 \sin 3\theta$  and  $y = 2 \cos(\theta + 40^\circ)$ . (2 marks)

$\theta^\circ$	$0^\circ$	$10^\circ$	$20^\circ$	$30^\circ$	$40^\circ$	$50^\circ$	$60^\circ$	$70^\circ$	$80^\circ$	$90^\circ$
$3 \sin 3\theta$	0	1.50		3.00			0.00			
$2 \cos(\theta + 40^\circ)$	1.53	1.29			0.35			-0.69		

- a) On the grid provided, draw the graphs of  $y = \sin 3\theta$  and  $y = \cos(\theta + 40^\circ)$  on the same axis. (4 marks)
- b) From the graph, find the roots of the equation;
- i.  $\frac{3}{4} \sin 3\theta = \frac{1}{2} \cos(\theta + 40^\circ)$  (2 marks)
- ii.  $2 \cos(\theta + 40^\circ) = 0$  in the range  $0 \leq \theta \leq 90^\circ$  (2 marks)
22. Mr. Patrick pays sh. 2, 652 per month as income tax in his gross income. He receives sh. 2400 medical allowance and sh. 5 800 as house allowance in addition to his basic salary. He is entitled to a personal relief of sh. 10 800 p.a. Use the tax table below to answer the questions below.

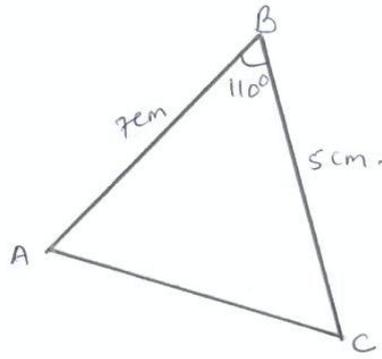
Income £ p. a.	Rate sh./£
1 - 4 000	2
4 0001 - 7 500	3
7501 - 12 000	4
Over 12 000	6

- a) Find his monthly basic salary. (to the nearest shilling). (8 marks)
- b) His net income per month if all other deductions total shs. 3849. (2 marks)
23. Two variable quantities  $R$  and  $t$  are connected by the equation  $R = kt^n$  where  $k$  and  $n$  are constants. The table below gives the values of  $R$  and  $t$ .

R	1.82	2.14	2.51	2.95	3.47	4.17	4.79	5.62	7.59
t	1.58	2.0	2.51	3.16	3.98	5.01	6.31	7.94	12.0

- a) Find a linear equation which connects  $R$  and  $t$ . (2 marks)
- b) On the graph provided, draw a suitable straight line graph to represent the relation in part (a) above. (4 marks)
- c) Hence estimate to one decimal place, the values of  $k$  and  $n$ . (4 marks)

24. Triangle ABC is such that  $AB = 7$  cm,  $BC = 5$  cm and angle  $ABC = 110^\circ$ .



Calculate to 2 decimal places;

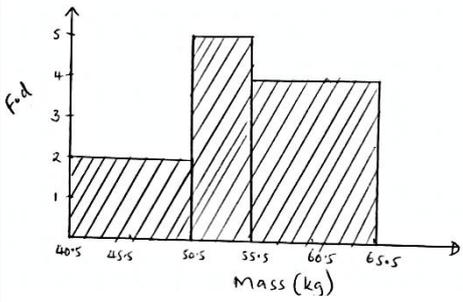
- i. The area of the triangle ABC.
- ii. The perimeter of triangle ABC.
- iii. The size of angle ACB.

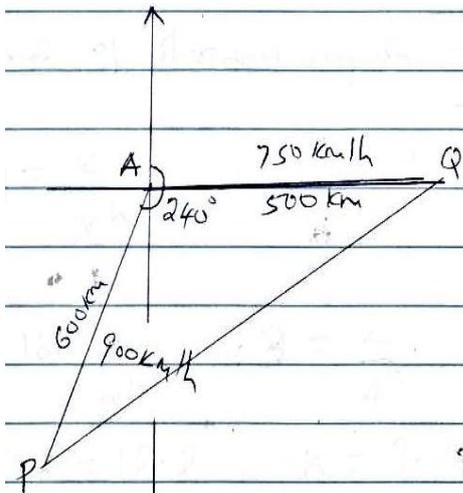
(2 marks)

(4 marks)

(4 marks)

**MURANGA SOUTH B**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**  
**SECTION I (50 Marks)**

<p>1.</p>	<p>Numerator:  <math>-8 \div 2 + 12 \times 9 - 4 \times 6</math>  <math>-4 + 108 - 24</math>  <math>= 88</math>                      Denominator:  <math>56 \div 7 \times 2</math>  <math>8 \times 2</math>  <math>= 16</math>  <math>\frac{88}{16} = 5</math></p>	<p>9</p>	<table border="1" style="width: 100%;"> <thead> <tr> <th>Mass (kg)</th> <th>Frequency</th> <th>Frequency distribution</th> </tr> </thead> <tbody> <tr> <td>41 – 50</td> <td>20</td> <td>2</td> </tr> <tr> <td>51 – 55</td> <td>25</td> <td>5</td> </tr> <tr> <td>56 – 65</td> <td>40</td> <td>4</td> </tr> </tbody> </table> 	Mass (kg)	Frequency	Frequency distribution	41 – 50	20	2	51 – 55	25	5	56 – 65	40	4			
Mass (kg)	Frequency	Frequency distribution																
41 – 50	20	2																
51 – 55	25	5																
56 – 65	40	4																
<p>2.</p>	<p>a. <math>10500 = 2^2 \times 3 \times 5^2 \times 7</math>                      b. <math>10500P = 2^3 \times 3^3 \times 5^3 \times 7^3</math>  <math>P = \frac{2^3 \times 3^3 \times 5^3 \times 7^3}{2^2 \times 3 \times 5^2 \times 7}</math>  <math>P = 2 \times 3^2 \times 5 \times 7^2</math></p>																	
<p>3.</p>	<p><math>\sin(3x + 30^\circ) = \frac{\sqrt{3}}{2}</math>  <math>3x + 30^\circ = 60^\circ, 120^\circ \dots</math>  <math>3x = 30^\circ, 90^\circ</math>  <math>x = 10^\circ, 30^\circ</math></p>	<p>10</p>	<p><math> AB  = \sqrt{(-4)^2 + (-4)^2 + (-1)^2}</math>  <math>= \sqrt{16 + 16 + 1} = \sqrt{33}</math> Type equation here.  <math>= 5.745</math> units</p>															
<p>4.</p>	<p><math>2 \leq 3 - x</math>  <math>x \leq 3 - 2</math>  <math>x \leq 1</math>   <math>3 - x &lt; 5</math>  <math>-x &lt; 2</math>  <math>x &gt; -2</math>      <math>-2 &lt; x \leq 1</math></p>	<p>11</p>	<p><math>x^2 + y^2 - 6x + 8y + \frac{51}{4} = 0</math>  <math>x^2 - 6x + 9 + y^2 + 8y + 16 = -\frac{51}{4} + 16 + 9</math>  <math>(x - 3)^2 + (y + 4)^2 = \frac{49}{4} = \left(\frac{7}{2}\right)^2</math>                      Radius = 3.5  <math>C(3, -4)</math></p>															
<p>5.</p>	<p>Distance between A and B                      before meeting = <math>(220 - 30)</math> km  <math>= 190</math> km                      Relative Speed =  <math>80 + 60 = 140</math> km/h                      Time taken to meet  <math>= \frac{190}{140} = 1 \text{ hr } 21 \text{ min}</math>                      They met at 12:51 p.m.</p>	<p>12</p>	<p><math>y = 0</math>    <math>x = 4</math>  <math>x = 0</math>    <math>y = 16</math>  <math>A = \int_0^4 (16 - x^2) dx</math>  <math>= 16x - \frac{x^3}{3} + c \Big _0^4</math>  <math>= 64 - \frac{64}{3} = \frac{128}{3} = 42 \frac{2}{3}</math> units</p>															
<p>6.</p>	<p><math>\angle \text{ext.} + \angle \text{int} = 180^\circ</math>  <math>3x + x - 20^\circ = 180^\circ</math>  <math>4x = 200^\circ</math>  <math>x = 50^\circ</math>                      No of sides of the polygon,  <math>n = \frac{360^\circ}{\angle \text{ext}} = \frac{360^\circ}{30^\circ}</math>    <math>n = 12</math> sides</p>	<p>13</p>	<p><math>\det = x(x - 3) - 4 = 0</math>  <math>x^2 - 3x - 4 = 0</math>    <math>\left. \begin{matrix} p = -4 \\ s = -3 \end{matrix} \right\} -4, 1</math>  <math>x^2 - 4x + x - 4 = 0</math>  <math>(x - 4)(x + 1) = 0</math>  <math>x = 4</math> or <math>-1</math></p>															
<p>7.</p>	<p><math>y - z = 1</math>  <math>-2y + z = -5</math>  <math>-y = -4</math>  <math>y = 4</math>  <math>4 - z = 1</math>    <math>\therefore z = 3</math></p>	<p>14</p>	<p><math>2(1 - \cos^2 \theta) - 5 \cos \theta + 1 = 0</math>  <math>2 - 2\cos^2 \theta - 5 \cos \theta + 1 = 0</math>  <math>2\cos^2 \theta + 5 \cos \theta - 3 = 0</math>                      Let <math>\cos \theta</math> be <math>t</math>  <math>\therefore 2t^2 + 5t - 3 = 0</math>    <math>\left. \begin{matrix} p = -6 \\ s = -5 \end{matrix} \right\} 6, -1</math>  <math>(t + 3)(2t - 1) = 0</math>  <math>t = -3</math> or <math>0.5</math>  <math>\cos \theta = 0.5</math>  <math>\theta = 60^\circ</math></p>															
<p>8.</p>	<table border="1" style="width: 100%;"> <thead> <tr> <th>Object</th> <th>Enlargement scale factor (3)</th> <th>Image</th> </tr> </thead> <tbody> <tr> <td>P(1, 1)</td> <td></td> <td>P'(3, 3)</td> </tr> <tr> <td>Q(2, 1)</td> <td></td> <td>Q'(6, 3)</td> </tr> <tr> <td>R(2, 2)</td> <td></td> <td>R'(6, 6)</td> </tr> <tr> <td>S(1, 2)</td> <td></td> <td>S'(3, 6)</td> </tr> </tbody> </table>	Object	Enlargement scale factor (3)	Image	P(1, 1)		P'(3, 3)	Q(2, 1)		Q'(6, 3)	R(2, 2)		R'(6, 6)	S(1, 2)		S'(3, 6)		
Object	Enlargement scale factor (3)	Image																
P(1, 1)		P'(3, 3)																
Q(2, 1)		Q'(6, 3)																
R(2, 2)		R'(6, 6)																
S(1, 2)		S'(3, 6)																

<p>15. Kamau's share =  <math>\left(\frac{5}{11+x}\right) \times 12\,000 = 4\,000</math>  <math>60\,000 = 44\,000 + 4000x</math>  <math>4000x = 16\,000</math>  <math>x = 4</math></p>	<p>19 a) (i) <math>y = \frac{k}{x^n}</math>  (ii) <math>12 = \frac{k}{2^n}, 3 = \frac{k}{4^n}</math>  <math>k = 12 \times 2^n, k = 3 \times 4^n</math>  <math>12 \times 2^n = 3 \times 4^n</math>  <math>\frac{12}{3} = \frac{4^n}{2^n} = \frac{2^{2n}}{2^n}</math>  <math>\frac{2^{2n}}{2^n} = 2^2</math>  <math>2^n = 2^2 \quad n = 2</math>  <math>k = 12 \times 4 = 48</math>  b) <math>y = \frac{48}{\left(\frac{16}{3}\right)^2} = \frac{48 \times 9}{16 \times 16}</math>  <math>= \frac{27}{16} = 1 \frac{11}{16}</math></p>
<p>16. <math>2x^2y^2 - 8xy + 3xy - 12</math>  <math>2xy(xy - 8) + 3(xy - 8)</math>  <math>(xy - 8)(2xy + 3)</math></p>	
<p><b>SECTION II</b></p>	
<p>17. a) Distance = speed x time  In 40 minutes  P covers <math>\frac{40}{60} \times 900</math>  <math>= 600 \text{ km}</math>  Q covers <math>\frac{40}{60} \times 750</math>  <math>= 500 \text{ km}</math></p>  <p>b) Distance between the two planes = <math>9.0 \pm 0.1 \text{ cm}</math>  <math>= 910 \pm 10 \text{ km}</math>  c) Bearing of;  i. P from Q is <math>233 \pm 1^\circ</math>  ii. Q from P is <math>52 \pm 1^\circ</math></p>	<p>20 a) (i) <math>\vec{BC} = \vec{BA} + \vec{AD} + \vec{DC}</math>  <math>= -\vec{a} + (-\vec{d}) + 2\vec{a}</math>  <math>= \vec{a} - \vec{d}</math>  (ii) <math>\vec{AX} = \vec{AD} + \vec{DX}</math>  <math>= -\vec{d} + h(\vec{a} + \vec{d})</math>  <math>= h\vec{a} - \vec{d} + h\vec{d}</math>  <math>= (h-1)\vec{d} + h\vec{a}</math>  (iii) <math>\vec{DX} = h(\vec{a} + \vec{d})</math>  <math>= h\vec{a} + h\vec{d}</math>  b) <math>\vec{AX} = k(\vec{AB} + \vec{BC})</math>  <math>= k(\vec{a} + \vec{a} - \vec{d})</math>  <math>= k(2\vec{a} - \vec{d})</math>  <math>= (h-1)\vec{d} = -k\vec{d}</math>  <math>\therefore -k = h-1</math>  also <math>h\vec{a} = k\vec{a}</math>  <math>\therefore k = h</math>  <math>\therefore -2h = -1</math>  <math>\Rightarrow h = \frac{1}{2}, k = \frac{1}{2}</math></p>
<p>18. a) Area of minor sector XAQD  <math>= \frac{120}{360} \times \frac{22}{7} \times 7 \times 7</math>  <math>= 51.35 \text{ cm}^2</math>  b) Area of trapezium XABY  <math>\perp ar</math> distance btn AB and XY  <math>= 7 \sin 60</math>  <math>= 6.062 \text{ cm}</math>  <math>AB = 14 - 14 \cos 60</math>  <math>= 7 \text{ cm}</math>  Area of trapezium  <math>= \frac{1}{2}(14 + 7) \times 6.062</math>  <math>= 63.65 \text{ cm}^2</math>  c) Area of shaded region  <math>= 127.3 - 102.7 = 24.6 \text{ cm}^2</math></p>	<p>22 a) <math>CD^2 = 15^2 + 12^2 - 2.15.12 \cos 30</math>  <math>= 225 + 144 - 360 \cos 30</math>  <math>= 57.23</math>  <math>CD = 7.57 \text{ cm}</math>  b) <math>\frac{AB}{\sin 30} = \frac{15}{\sin 120}</math>  <math>AB = \frac{15 \cdot \sin 30}{\sin 120}</math>  <math>AB = 8.66 \text{ cm}</math>  c) Area of <math>\Delta BCD</math>  <math>A = \sqrt{s(s-a)(s-b)(s-c)}</math>  <math>s = 0.5(8.66 + 3.34 + 7.57) = 9.785 \text{ cm}</math>  <math>A = \sqrt{9.785(6.445)(1.125)(2.215)}</math>  <math>= 12.54 \text{ cm}^2</math>  d) <math>3.34^2 = 7.57^2 + 8.66^2 - 2 \times 7.57 \times 8.66 \times \cos D</math>  <math>53.3 + 75.0 - 11.16</math>  <math>\cos D = \frac{131.11}{131.11} = 0.8934</math>  <math>\angle BDC = 26.7^\circ</math></p>

21. a) Table of the function  $y = 5 + 3x - 2x^2$

$x$	-2	-1.5	-1	-0.5	0	0.5	1.5	2	2.5	3	3.5
$y$	-9	-4	0	3	5	6	6	3	0	-4	-9

On the graph

23. a)  $a^3 r^3 = 64$

$$r = \sqrt[3]{\frac{64}{a^3}} = \frac{4}{a}$$

b)  $a + a \cdot \frac{4}{a} + a \cdot \frac{16}{a^2} = 14$

$$a + 4 + \frac{16}{a} = 14$$

$$a^2 + 4a + 16 = 14a$$

$$a^2 - 10a + 16 = 0$$

$$a^2 - 8a - 2a + 16 = 0$$

$$(a - 8)(a - 2) = 0$$

$$a = 8 \text{ or } 2$$

$$\text{When } a = 8 \quad r = \frac{1}{2}$$

$$a = 2 \quad r = 2$$

1<sup>st</sup> sequence is 8, 4, 2, 1

2<sup>nd</sup> sequence is 8, 16, 32, 64

c)  $T_{50} = 8 \times \left(\frac{1}{2}\right)^{49}$  ..... 1st sequence

$T_{50} = 8 \times (2)^{49}$  ..... 2nd sequence

$$\text{Product} = 8 \left(\frac{1}{2}\right)^{49} \times 8(2)^{49} = 64$$

24. a) (i) Distance between them by 10:30 a.m. =  $80 - (0.5 \times 40)$   
 $= 60 \text{ km}$

$$\text{Relative speed} = 40 + 60 = 100 \text{ km/h}$$

$$\text{Time taken to meet} = \frac{60}{100} = \frac{3}{5} \text{ hrs} = 36 \text{ mins}$$

$$\text{Distance} = 40 \times \frac{3}{5} = 24 \text{ km}$$

(ii) Time they met is 11:06 a.m.

b) Time taken by Kamau is

11:06

10:21

45 minutes

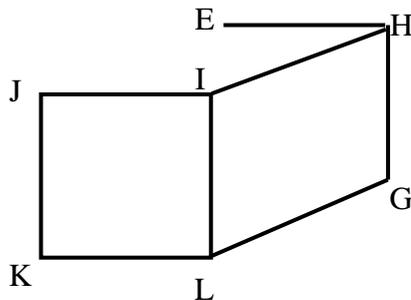
$$\text{Average speed by Kamau} = 33 \div \frac{3}{4}$$

$$= \frac{176}{3} = 58.7 \text{ km/h}$$

**KIRINYAGA  
SCHOOL BASED FORM 4 EXAM JULY-AUGUST 2017  
Kenya Certificate of Secondary Education (K.C.S.E)  
MATHEMATICS  
Paper 1  
July/August 2017  
Time: 2 ½ Hours**

**SECTION I (50 MARKS)**

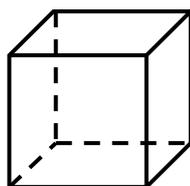
- (a) Evaluate  $94344 - 36425 \div 5$  (1 mk)  
(b) Write the total value of the digit in the thousands place of the result obtained in (a) above (1 mk)
- In a game park  $\frac{1}{5}$  of the animals are rhinos and  $\frac{3}{4}$  of them are zebras.  $\frac{2}{3}$  of the remaining animals are lions and the rest are warthogs. Find the fraction of warthogs in the game park. (3 mks)
- The volume of a cube is  $2744\text{cm}^3$ . Calculate the length of the diagonal of a face of the cube giving your answer in surd form. (3 mks)
- Use logarithms correct to four significant figures to evaluate: (3 mks)  
$$\sqrt[3]{\frac{24.36 \times 0.066547}{(1.48)^2}}$$
- A piece of copper wire is bent in the shape of an isosceles triangle. The vertical angle is  $40^\circ$  and the altitude of the triangle is 5cm. Find the length of the copper wire correct to 1 decimal place. (3 mks)
- An empty specimen bottle has a capacity of 300ml and a mass of 280g. Calculate the mass of the bottle when it is full of a liquid whose density is  $1.2\text{g/cm}^3$ . (3 mks)
- The figure below shows a sketch of a solid cuboid EFGHIJKL. Complete the sketch. (2 mks)



- Find the rate per annum at which a certain amount doubles after being invested for a period of 5 years compound semi-annually (3 mks)
- The sum of the interior angles of a regular polygon is 40 times the size of the exterior angle.  
(a) Find the number of sides of the polygon. (2 mks)  
(b) Name the polygon (1 mk)
- The data below shows the number of pupils in Nairutia Primary School

42	43	48	40	46	42	44	48	39	40	42
41	47	46	45	49	45	42	40	38	39	40
46	47	42	40	41	43	44	45	46	48	

- (a) Using a class size of 2 organize the data in a grouped frequency table. (2 mks)  
(b) Determine the mean of the data. (2 mks)
- Given that  $\vec{q} = 5\vec{t} - 3\vec{f}$  where  $\vec{t} = \begin{pmatrix} -2 \\ -3 \end{pmatrix}$  and  $\vec{f} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$  find:  
(a) the column vector  $\vec{q}$  (2 mks)  
(b) Given that  $T^{-1}(3,2)$  is the image of  $T(0,-2)$  under a translation, find the translation. (1 mk)
- Given that  $a = -5$ ,  $b = 3$  and  $c = -\frac{1}{3}$ , evaluate:  $\frac{5a^2 - 2b - 4c}{\frac{1}{3}(b^2 + 2a)}$  (3 mks)
- The figure below represents a skeleton cuboid on a square base of side  $x\text{cm}$  and is made from 36cm of copper wire.



Find the height of the box in terms of  $x$  and hence show that the volume,  $V$  of the cuboid is given by  $V = (9 - 2x) x^2$  (3 mks)

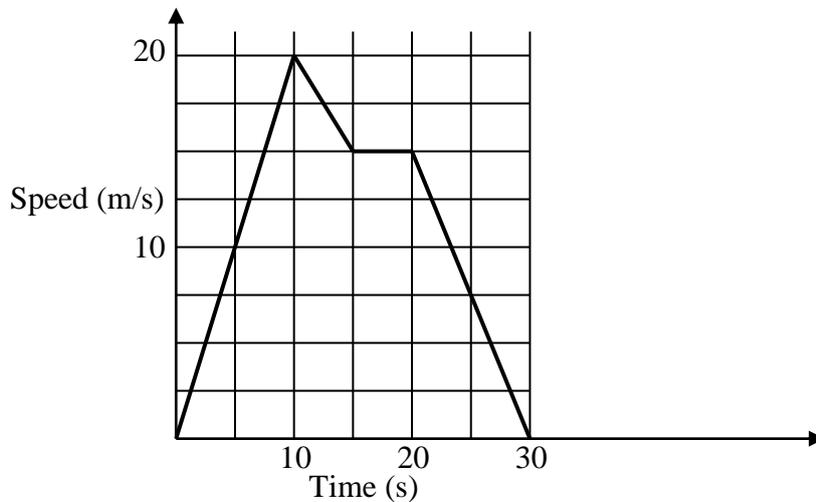
- (a) Find the inverse of the matrix  $\begin{bmatrix} 4 & 3 \\ 2 & -1 \end{bmatrix}$  (1 mk)

(b) Hence solve the simultaneous equations below. (3 mks)

$$3y + 4x = 8$$

$$2x - y = 9$$

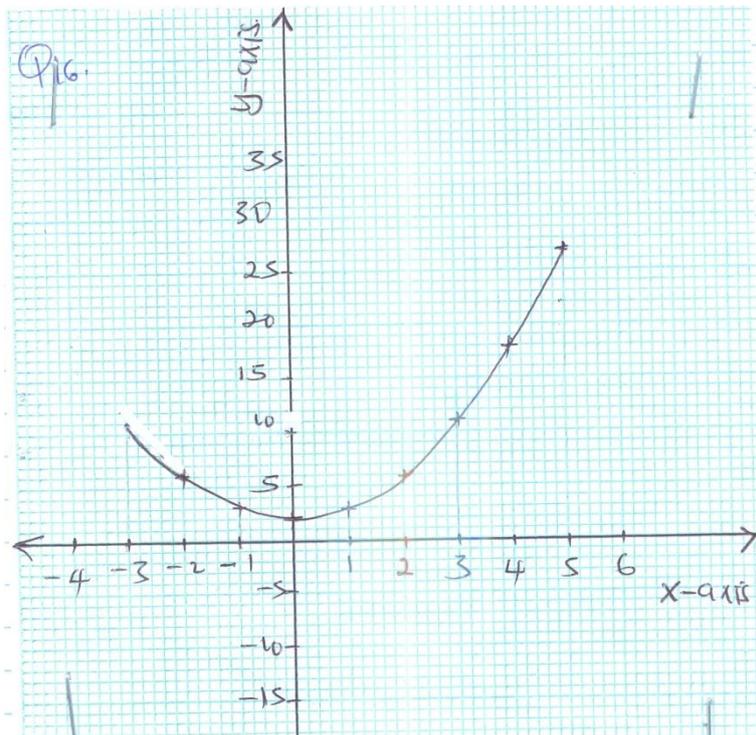
15. The figure below represents the speed-time graph of a tuktuk. Use it to answer the questions (a) and (b)



(a) Calculate the acceleration of the tuktuk. (2 mks)

(b) Find the total distance travelled for the whole journey (2 mks)

16. The figure below represents the curve of an equation. Use the trapezium rule with four strips to estimate the area bounded by the curve, the lines  $y = 0$ ,  $x = -3$  and  $x = 5$ . (3 mks)



**SECTION (50 MARKS)**

Answer any five questions in this section in the spaces provided.

17. In the year 2001 the price of a sofa set in a shop was KSh. 12,000

(a) Calculate the amount received from the sales of 240 sofa sets that year (2 mks)

(b) In the year 2002 the price of each sofa set increased by 25% while the number of sets sold decreased by 10%. (3 mks)

(i) Calculate the percentage increase in the amount received from the sales (3 mks)

(ii) If at the end of the year 2002, the price of each sofa set changed in the ratio 16:15. Calculate the price of each sofa set in the year 2003. (2 mks)

(c) The number of sofa sets sold in the year 2003 was  $p\%$  less than the number sold in the year 2002. Calculate the value of  $P$  given that the amount received from the sales in the year were equal. (3 mks)

18. (a) Find the inverse of the matrix (2 mks)

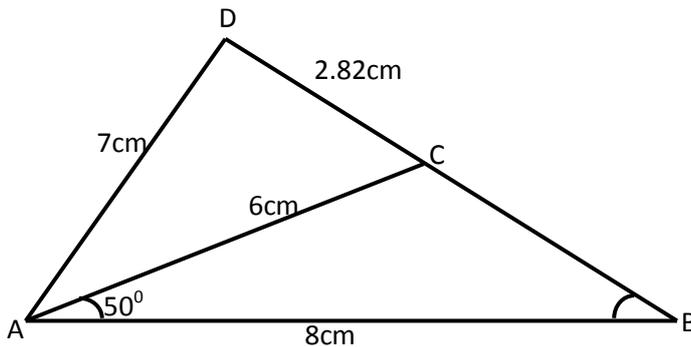
$$\begin{bmatrix} 2 & 5 \\ 4 & 3 \end{bmatrix}$$

- (b) A transport company has two types of vehicles for hire: Lorries and buses. The vehicles are hired per day. The cost of hiring two lorries and five buses is Sh. 156,000 and that of hiring 4 lorries and three buses is Sh. 137,000.
- (i) Form two equations to represent the above information. (2 mks)
- (ii) Use matrix method to determine the cost of hiring a lorry and that of hiring a bus. (3 mks)
- (c) Find the value of  $x$  given that  $\begin{bmatrix} 2x - 1 & 1 \\ x^2 & 1 \end{bmatrix}$  is a singular matrix (3 mks)

19. Without using a set square or a protractor construct.

- (a) Triangle ABC such that  $AB = 8\text{cm}$ ,  $BC = 6\text{cm}$  and  $\angle ABC = 30^\circ$ . (2 mks)
- (b) Measure the length AC (1 mk)
- (c) Draw a circle that touches sides AB, BC and AC (3 mks)
- (d) Measure the radius of the circle (1 mk)
- (e) Hence or otherwise calculate the area in the triangle but not in the circle. (3 mks)

20. In the figure below (not drawn to scale)  $AB = 8\text{cm}$ ,  $AC = 6\text{cm}$ ,  $AD = 7\text{cm}$ ,  $CD = 2.82\text{cm}$  and angle  $CAB = 50^\circ$ .



Calculate to 2 decimal places

- (a) the length BC (3 mks)
- (b) the size of angle ABC (2 mks)
- (c) the size of angle CAD (3 mks)
- (d) the area of triangle ACD (2 mks)

21. A line L passes through points  $(-2,3)$  and  $(-1,6)$  and is perpendicular to a line P at  $(-1,6)$

- (a) Find the equation of L. (2 mks)
- (b) Find the equation P in the form  $ax + by = c$  where  $a$ ,  $b$  and  $c$  are constants. (2 mks)
- (c) Given that another line Q is parallel to L and passes through point  $(1,2)$ , find the  $x$  and  $y$  - intercepts of Q (3 mks)
- (d) Find the point of intersection of lines P and Q (3 mks)

22. ABCD is a quadrilateral with vertices  $A(3,1)$ ,  $B(2,4)$ ,  $C(4,3)$   $D(5,1)$

- (a) Draw the image  $A^1B^1C^1D^1$  image of ABCD under transformation matrix  $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$  and write down the co-ordinates. (3 mks)
- (b) A transformation represented by  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  maps  $A^1B^1C^1D^1$  onto  $A^{11}B^{11}C^{11}D^{11}$  determine the coordinates of the image and draw  $A^{11}B^{11}C^{11}D^{11}$ . (3 mks)
- (c) Determine the single matrix transformation which maps ABCD onto  $A^{11}B^{11}C^{11}D^{11}$  and describe the transformation. (3 mks)

23. A carpenter constructed a closed wooden box with internal measurements 1.5m long 0.8m wide and 0.4m high. The wood used in constructing the box was 1.0cm thick and had a density of  $0.6\text{g}/\text{cm}^3$ .

- (a) Determine the:
- (i) volume in  $\text{cm}^3$  of the wood used in constructing the box. (3 mks)
- (ii) mass of the box in kg correct to 1 d.p (2 mks)
- (b) Identical cylindrical tins of diameter 10cm height 20cm with a mass of 120g each were packed in the box.

Calculate the:

- (i) maximum number of tins that were packed (3 mks)
- (ii) Total mass of the box with the tins (2 mks)

24. (a) (i) Find the co-ordinates of the stationary points of the curve  $y = x^3 - 3x + 2$  (4 mks)

(ii) For each stationary point determine its nature (2 mks)

(b) Determine the  $y$ -intercept (2 mks)

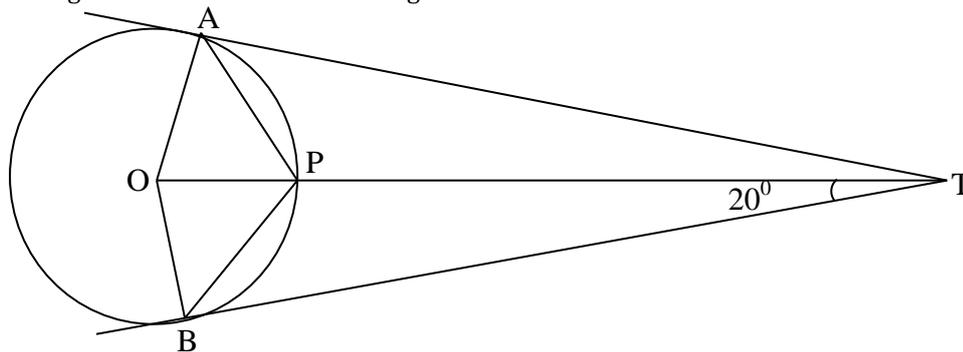
(c) In the space provided sketch the graph of the function  $y = x^3 - 3x + 2$  (2 mks)

**KIRINYAGA**  
**SCHOOL BASED FORM 4 EXAM JULY-AUGUST 2017**  
**MATHEMATICS**  
**Paper 2**  
**July/August 2017**  
**Time: 2 ½ Hours**

**SECTION A (50 MARKS)**

**ALL QUESTIONS IN THIS SECTION**

- If  $A = 2.3$ ,  $B = 8.7$  and  $C = 2.0$ . Find the percentage error in  $\frac{A+B}{C}$  (3 mks)
- Simplify  $\frac{2\sqrt{5}}{\sqrt{3-\sqrt{5}}}$  leaving the answer in the form  $a + b\sqrt{c}$ , where  $a$ ,  $b$  and  $c$  are rational numbers. (2 mks)
- Starting from seven minutes to noon the minutes hands of a clock moved so that the clock is showing 27 minutes to one.
  - Find the angle through which the minute hand moved. (2 mks)
  - Given that the minute hand is 6.37cm long. Find the length of the arc it describes in that time. (2 mks)
- In the figure below TA and TB are tangents to the circle centre O. Given that  $\angle ATB = 20^\circ$ . Find  $\angle PAT$ . (3 mks)



- In a school the form three students are 90. The ratio of boys to girls is 7:2. Find the number of girls required to join the existing class so that the ratio of boys to girls is 5:4. (3 mks)
- A wire 180cm long was used to make a model of a triangular-based prism. The cross-section has side of length 10cm each. Calculate the volume of the resulting prism. (4 mks)
- Find the value of  $x$  given that  $\text{Log}_2(x^2 - 2) - \text{Log}_2(\frac{1}{2}x + 5) - 1 = 0$  (3 mks)
- Write down the first four terms of the expression of  $(2 - \frac{1}{4}x)^9$  in ascending powers of  $x$  giving your answer in simplest forms. Hence find the value of  $(1.975)^8$  to the nearest 3 d.p. (3 mks)
- Determine the centre and the radius of the circle given by equation. (3 mks)  
 $x^2 + y^2 - 6x + 4y - 12 = 0$
- (a) Draw line  $MN = 7\text{cm}$  and show the locus of a point  $P$  which is such that  $\angle MPN = 90^\circ$ . (1 mk)  
 (b) On the locus of  $P$  in the diagram in (a) above, construct the locus of  $T$  which is such that it is equidistant from  $M$  and  $N$ . (2 mks)
- A box contains 3 red balls, 7 blue balls and 2 green balls. A ball is taken at random. What is the probability of it being neither red nor green. (2 mks)
- In an examination there are two papers each with total marks of 50. To pass the examination a candidate must score at least 20 marks on each paper and at least 50 marks on the two papers combined. If  $x$  and  $y$  represent marks on paper I and paper II respectively. Write down three inequalities representing the above information. (3 marks)
- The gradient of a curve at the point  $(x,y)$  is  $5x + \frac{3}{x^2}$  if it passes through  $(1,2)$ . Find its equation. (4 mks)
- A ship sails due North from latitude  $20^\circ\text{S}$  for a distance 1440nm. Find the latitude of the point it reaches. (3 mks)
- Find  $x$  if  $\text{Cos } x = \frac{\sqrt{3}}{2}$  for  $-180^\circ \leq x \leq 180^\circ$ . (3 mks)
- Given that  $\underline{x} = 3\underline{i} + 2\underline{j} - 4\underline{k}$ ,  $\underline{y} = 3\underline{i} + 5\underline{j} - 2\underline{k}$  and  $\underline{z} = -4\underline{i} + 3\underline{j} + 5\underline{k}$  and that  $\underline{p} = 4\underline{x} - 2\underline{y} + 3\underline{z}$ . Find the magnitude of  $\underline{p}$  to 4 S.F (4 mks)

**SECTION II (50 Marks)**

**Answer any Five Questions in this section**

- An amount of money was shared among five businessmen. Njoroge, Mwanzia, Ahamed, Wanyama and Kiprotich. Njoroge got  $\frac{3}{8}$  of the total while Mwanzia got  $\frac{2}{5}$  of the remainder. The remaining amount was shared equally among the other three of which each received KSh. 600.
  - How much was shared among the five. (3 mks)
  - Determine how much Mwanzia got. (2 mks)
  - Njoroge, Mwanzia and Kiprotich invested their money and earned a profit of KSh. 1200. A third of the profit was

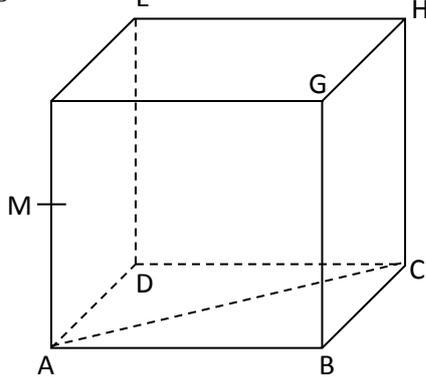
left to maintain the business and the rest was shared according to their investment. Calculate how much each got. (5 mks)

18. Three consecutive term of a geometric progression are  $3^{2x+1}$ ,  $9^x$  and 81 respectively.
- (a) Calculate the value of x. (3 mks)
  - (b) Find the common ratio. (1 mk)
  - (c) Calculate the sum of the first 4 terms of this series. (3 mks)
  - (d) Given that the fifth and the seventh terms of the G.P form the first two consecutive terms of an arithmetic sequence, calculate the sum of the fist 20 terms of the sequence. (3 mks)

19. The equation of a curve is given by  $y = 3 \cos x - 4 \sin x$ .

- (a) Complete the table below correct to 1 d.p. (2 mks)
- |   |   |    |    |    |     |     |     |     |     |     |     |     |     |
|---|---|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| x | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | 360 |
| y | 3 |    |    | -4 |     |     | -3  |     |     | 4   |     |     | 3   |
- (b) On the grid provided, draw the graph of  $y = 3 \cos x - 4 \sin x$  for  $0 \leq x \leq 360$  (4 mks)
  - (c) Use your graph to solve.  $3 \cos x = 4 \sin x - 1$  (2 mks)
  - (d) Find the range of values of x for which  $3 \cos x - 4 \sin x + 4 < 0$  (2 mks)

20. The figure below shows a cube of side 10cm. M is the midpoint of AF.



Find

- (i) length HM (2 mks)
  - (ii) the angle HM and ABCD. (4 mks)
  - (iii) angle between HM and MC (4 mks)
21. P varies directly as the square of Q and inversely as R.
- (a) (i) Given that  $P = 2$  when  $R = 5$  and  $Q = 4$ , find the equation connecting P Q and R. (2 mks)
  - (ii) If  $P = 4.5$  and  $R = 5$ . Find the positive value of Q. (3 mks)
  - (b) If Q increases by 5% and R decreases by 10%. Find the percentage change in P. (5 mks)
22. A particle moves such that its displacement S metres after t seconds from a fixed point is given by  $S = 3t^3 - 6t^2 + 4t + 5$ . Determine
- (a) The displacement of the particle at  $t = 2$ . (1 mk)
  - (b) The velocity of the particle when  $t = 3$ . (3 mks)
  - (c) The displacement of the particle when the particle was momentarily at rest. (3 mks)
  - (d) The acceleration of the particle when  $t = 1.5$  seconds. (3 mks)
23. A number of students were asked to cut 30cm length of binding wire without measuring. Later 100 pieces are collected and measured correct to the nearest 0.1cm and the data filled on the table below.
- |             |            |           |           |           |           |           |           |           |
|-------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Length (cm) | 28.0- 28.4 | 28.5-28.9 | 29.0-29.4 | 29.5-29.9 | 30.0-30.4 | 30.5-30.9 | 31.0-31.4 | 31.5-31.9 |
|             | 5          | 8         | 30        | x         | 10        | 20        | 10        | 4         |
- (a) Calculate the value of x (1 mk)
  - (b) State the model class (1 mk)
  - (c) Using 29.7 as working mean, calculate
    - (i) the mean. (4 mks)
    - (ii) the standard deviation. (4 mks)
24. Two quantities p and n are connected by the equation  $P = AK^n$ , where A and K are constant. The table below shows corresponding values of n and p.
- |   |     |      |      |      |       |
|---|-----|------|------|------|-------|
| n | 2   | 4    | 6    | 8    | 10    |
| P | 9.8 | 19.4 | 37.4 | 74.0 | 144.4 |
- (a) State the linear equation connecting p and n. (2 mks)
  - (b) On the grid provided, draw a suitable straight line. (6 mks)
  - (c) Use your graph to estimate the value of A and K. (2 mks)

**COMPLIANT PREPARATORY EXAMINATION 2017**

121/1

Mathematics (Alt. A)

Paper 1

Time 2 ½ Hours

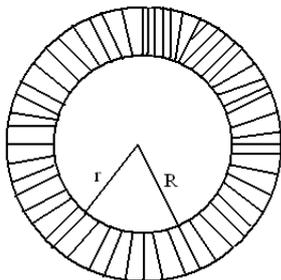
Section A (50 Marks)

Attempt all questions in this section

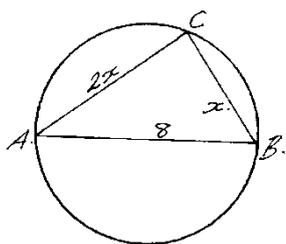
- Use logarithms tables to **evaluate**.  $\left(\frac{130.9}{27.68 \times 100.9}\right)^{\frac{2}{3}}$  (4mks)
- Five men working six hours a day take eight days to fill a trench. **How** long does it take three men working eight hours a day to complete the same trench? (2mks)
- A surveyor recorded the information about a tea farm in his field book as in the table below.

To A 180	Q 600 420 300 50 P	90 to C  90 to D
----------	-----------------------------------	------------------------

- Given that PQ = 650m, make a sketch of the field and hence find the area of the field in hectares. (3mks)
- Given that  $\sin E = \frac{5}{13}$ , where E is an obtuse angle.
    - Find  $\tan E$  in fraction form. (1mk)
    - Find the value of  $\frac{2 \tan E}{1 - \tan^2 E}$ , leaving your answer in fraction form. (2mks)
  - The figure shows two concentric circles such that the ratio of their radii is 1: 3. If the area of the shaded region is 78.4 square units, **calculate** the area of the larger circle. (3mks)



- From the window of a building a few metres from the ground an observer sees the top of a flag post at an angle of elevation of  $30^\circ$ . From the top of the flag post an eagle observes the foot of the building at the point where the window is through an angle of depression  $80^\circ$ . If the distance from the building to the flag post is 25m. Find the distance from the foot of the building to the window. (4mks)
- A line  $L_1$  that passes through  $(-1,2)$  has a gradient of  $-\frac{1}{2}$  in the. Find the equation of  $L_1$  in the form  $ax + by = c$ . (2mks)
  - If  $L_2$  is perpendicular to  $L_1$  at a another point  $(3, -3)$  find the gradient of  $L_2$  in the form  $Y = mX + C$  (2mks)
- Factorize completely the expression  $3x^2y^2 - 8xy - 51$  (3mks)
- In the figure below, AB is a diameter of the circle and  $AB = 8\text{cm}$ ,  $BC = x \text{ cm}$  and  $AC = 2x \text{ cm}$ . Calculate the length of AC to 2 significant figures (3mks)



- Find a number such that if  $\frac{1}{4}$  of it is added to  $4\frac{1}{3}$ , the result is the same as when  $\frac{1}{3}$  of it is subtracted from  $20\frac{2}{3}$ . (3mks)
- Find the range of x if  $x + 21 \geq 15 - 2x \geq x + 12$ . (3mks)

12. Solve for y in the equation  $8^{(2y-1)} \times 32^y = 16^{(y+1)}$ . (3mks)

13. A Kenyan tourist arrived in London with Ksh. 720,000 He exchanged them into Euros. During his stay he spends 3450 Euros before he proceeds to Germany. As he leaves he exchanges the remaining money into Germany DM. Given the exchange rates at the time.

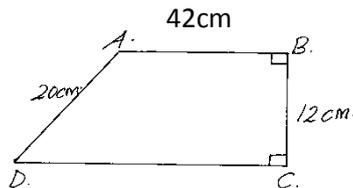
**Exchange Rates in Euros**

Foreign currency	Buying	Selling
1 ksh	0.0083	0.008333
1 German DM	2.5	2.55

Determine how much Germany DM he got (give your answer to 2d.p) (3mks)

14. In an experiment award scheme, a candidate gets two marks for each correct answer, losses one mark for each wrong answer and no mark if a question is unattempted. In a test with 20 questions a candidate scores 24 marks after leaving two questions unattempted. Find the number of correct answers. (3mks)

15. In the figure below (not drawn to scale) angle ABC = BCD = 90°.



Calculate

- (a) The length of DC (2mks)
  - (b) Area of the trapezium (1mk)
16. The interior angles of an octagon are  $70^\circ, 90^\circ, x^\circ, 1.5x^\circ, 130^\circ, 80^\circ, 1.75x^\circ$  and  $200^\circ$ . Find the value of the largest angle. (3mks)

**SECTION II (50 Marks)**

Answer any FIVE questions

17. The table below shows Kenya Tax Rates in a certain year.

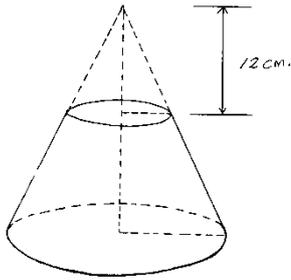
Income (k£ per annum)	(Sh. Per £)	Tax Rate
1 – 1800	2	
1801 – 3600	3	
3601 – 5400	5	
5401 – 7200	7	

A married man earns sh. 6600 per month and is housed by the employer. The man is given benefit amounting to K£1200p.a for a car, school fees and medical fee. He is allowed a relief of K£ 48 p.a. for insurance and claims K£ 120 family relief p.a. Calculate:

- (a) The man’s annual taxable income in K£ (4mks)
  - (b) The monthly tax paid by the man in KSh. (6mks)
18. A triangle has vertices **A**( 1,2), **B** ( 4,4) and **C** (6,2)
- a) Draw triangle **ABC** on the Cartesian plane (1mk)
  - b) Construct the image angle **A'B'C'** the image of triangle ABC under a rotation of 90° clockwise about the origin. (2mks)
  - c) Draw triangle **A''B''C''**, the image of triangle **A'B'C'** under reflection in line  $y=x$ , state the coordinates of **A''B''C''** (3mks)
  - d) Draw triangle **A'''B'''C'''** the image of triangle **A''B''C''** under a reflection in the line  $y=0$  and state the coordinates of its vertices (2mks)
  - e) Describe a single transformation that maps angle **A'''B'''C'''** onto angle **ABC**. (2mks)
19. Water flows through a cylindrical pipe of diameter 3.5cm at a speed of 45m/minute.
- a) Calculate the volume of water delivered by the pipe in one minute in litres. (3mks)
  - b) A cylindrical storage tank of height 4 metres is filled by water from this pipe at the same rate of flow. Water started flowing at 8.00a.m. and was filled up at 2.50p.m. Calculate the area of the cross-section of this tank. (4mks)
  - c) Water costs sh. 3.50 per thousand litres plus a fixed standing charge of sh.18.50. Calculate the cost of a family which consumes the capacity of this tank in one month. (3mks)
20. a) By taking integral values of **x**, from  $x = - 2$ , to  $x=6$  make table of values for the function  $y = 3x (4 - x)$  (2mks)
- (b) On the same axes and using the scale of 1cm to 1 unit on the x-axis and 1cm to 5 units on the y- axis draw graphs of  $y=3x(4 - x)$  and  $y=5( x - 2)$  (4mks)
  - (c) From your graph;
    - (i) Find the roots of the equations  $3x ( 4 - x) = 0$  (1mk)

- (ii) Write down the maximum value of  $y = 3x(4 - x)$  (1mk)
- (iii) Deduce the roots of the equation  $3x(4 - x) = 5(x - 2)$  (2mks)

21. Eldoret and Nairobi are 350km apart. Two buses A and B started from Nairobi at the same time traveling towards Eldoret. Bus B, traveling at an average speed of 12km/hr greater than that of A reaches Eldoret  $1\frac{1}{5}$  hours earlier.
- a) Find the average speed of A. (6mks)
  - b) How far was A from Nairobi when B was 20 minutes to reach Eldoret? (4mks)
22. A sector of angle  $108^\circ$  is cut from a circle of radius 20cm. It is folded and fixed to form a cone. Taking  $\pi$  as  $\frac{22}{7}$ , calculate:-
- a) The curved area of the cone. (2mks)
  - b) The base radius of the cone. (3mks)
  - c) The vertical height of the cone. (2mks)
  - d) If 12cm of the cone is chopped off to form a frustum as shown below



- Calculate the volume of the frustum formed. (3mks)
- of points **A** and **B** with respect to the origin **O** are **a** and **b** respectively. **P** is on **OA** such that **OA = 3OP**. **Q** divides **OB** externally in the ratio 5:-2. **PQ** intersect **AB** point **N**.
- a) Express the vectors **AB**, **AP**, **OQ** and **PQ** in terms of **a** and **b**. (3mks)
  - b) Express **AN** in two different ways. (5mks)
  - c) (i) In which ratio does **N** divide **AB** (1mk)
  - (ii) Express **PN** in terms of **PQ**. (1mk)
24. a) Using a ruler and compasses only, construct triangle **ABC** such that **AB = 4cm**, **BC = 5cm** and  $\angle ABC = 120^\circ$ . Measure **AC**. (3mks)
- b) On the same diagram, construct a circle which passes through the vertices of the triangle **ABC**. Measure the radius of the circle. (3mks)
  - c) Measure the shortest distance from the centre of the circle to the line **BC**. (2mks)
  - d) With **BC** as the base, calculate the area of the triangle **ABC**. (2mks)

**COMPLIANT PREPARATORY EXAMINATION 2017**

121/2

Mathematics (Alt. A)

Paper 2

Time 2 ½ Hours

Section A (50 Marks)

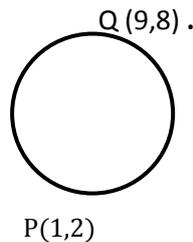
**Attempt all questions in this section**

1. Make A the subject of the formula. (3mks)

$$t = \frac{2m}{n} \sqrt{\frac{L - A}{3k}}$$

2. Solve for x, in the equation  $(\log_2 x)^2 + \log_2 8 = \log_2 x^4$  (3mks)

3. P and Q are the points on the ends of the diameter of the circle below.



- a) Write down in terms of x and y the equation of the circle in the form  $ax^2 + by^2 + x + y + c = 0$  (2mks)  
 b) Find the equation of the tangent at Q in the form  $ax + by + c = 0$ . (2mks)

4. The transformations **M** and **N** are represented by matrices  $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$  and  $\begin{pmatrix} 3 & 0 \\ 1 & 3 \end{pmatrix}$  respectively.

A point **R** has coordinates (3, -2). Find the coordinates of **MN(R)** (3mks)

5. Coffee at sh. 50 per kilogram is mixed with coffee of sh. 60 per kilogram in the ratio 2:3. What ratio should this mixture be mixed with coffee at sh. 40 to produce a coffee costing sh. 52 per kilogram. (3mks)

6. A fraction  $\frac{2}{7}$  is truncated to 3 decimal places. Find the percentage error in doing this. (3mks)

7. Expand  $(1 + 2x)^7$  up to  $x^3$ , hence use the expansion to estimate the value of  $(1.02)^7$  correct to four decimal places. (3mks)

8. Two ships leave a port in the directions which diverge from one another by  $44.4^\circ$ . After an hour the ships are 11km apart. If the faster ship is traveling at 14km/h, find the speed of the slower ship. (4mks)

9. A quantity **P** is partly constant and partly varies as the cube of **Q**. When **Q**=1, **P**=23 and when **Q**=2, **P**= 44. Find the value of **P** when **Q** = 5. (3mks)

10. The second term of a G.P is 6, and the fifth term is 48, find the common ratio and the 3<sup>rd</sup> term of the G.P. (3mks)

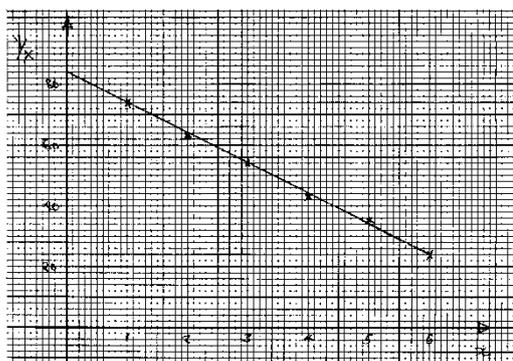
11. A lorry starts from rest and after t seconds, its speed in Vm/s is given by the following table

t	0	1	2	3	4	5	6
Vm/s	0	2.4	4.2	5.6	6.6	7.2	7.6

Use the trapezoidal rule to estimate the distance the lorry travels in the six seconds. (3mks)

12. If  $\mathbf{r} = 3\mathbf{i} - \mathbf{j} + \mathbf{k}$ ,  $\mathbf{t} = \mathbf{j} + 2\mathbf{k}$  and  $\mathbf{P} = \mathbf{r} + \mathbf{t}$  find  $|\mathbf{P}|$  to 4 s.f. (2mks)

13. The graph below shows the linear relation between two variables X and Y connected by the expression  $Y = pX^2 + qX$



Using the graph, estimate, to the nearest whole number, the value of

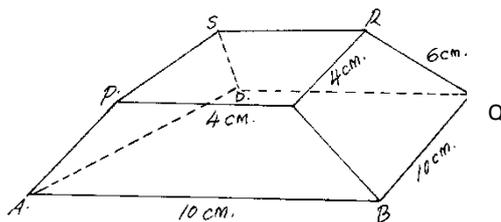
- (i) p (2mks)  
 (ii) q (1mk)

14. Water flows at 3m/s through a pipe of radius 3.5cm. How long does it take to fill a rectangular tank 9m long, 7m wide and 3m deep? (3mks)
15. Given  $V = \sqrt{5} + \sqrt{2}$  and  $U = \sqrt{2} - \sqrt{5}$ , Find the value of  $\frac{V^2 - U^2}{U^2}$  in the form  $a + b\sqrt{c}$ . (4mks)
16. Using a protractor and ruler only construct a rectangle ABCD of side 8cm by 3cm. On CD mark two points, P<sub>1</sub> and P<sub>2</sub>, such that angle AP<sub>1</sub>B = angle AP<sub>2</sub>B = 90°. Measure P<sub>1</sub>P<sub>2</sub>. (3mks)

**SECTION II (50 MARKS)**

**Answer any FIVE questions**

17. The cash price of a radio cassette is Ksh.27,000 it can also be bought using either of the two plans below :  
 PLAN A: A deposit of shillings 6,000 and 15 equal monthly installments  
 PLAN B: 20 equal monthly instalments of shillings 1680 each.
- (a) If the total payment in plan A is 20% more than the cash price. Find  
 (i) The amount of each instalment (2mks)  
 (ii) The annual rate of interest (3mks)
- (b) Find the annual rate of interest in PLAN B (3mks)
- (c) Which plan is cheaper and by how much (2mks)
18. The diagram below shows a frustum of a square based pyramid. The base ABCD is a square of side 10cm. The top PQRS is a square of side 4cm and each of the slant edges are 6cm



- a) Calculate the height of the pyramid. (4mks)
- b) A point X is  $\frac{1}{4}$  of the height of the pyramid from the base. Calculate the angle that line AX makes with the base. (2mks)
- c) Calculate the angle between planes PQRS and BCRQ. (4mks)
19. A jewelry room is guarded by three policemen X, Y, and Z. A thief on his way in has to pass X, Y and Z in that order. On his way out after stealing the jewellery has to pass Z, Y and X in that order. The probability of being caught on his way in by X is  $\frac{1}{3}$ , Y is  $\frac{1}{5}$  and Z is  $\frac{1}{4}$ . The probability of being caught on his way out by X is  $\frac{5}{6}$ , Y is  $\frac{2}{5}$  and Z is  $\frac{2}{3}$ . Find the probability that;
- a) The thief is caught by policeman Z. (4mks)
- b) The thief is caught by Y on his way out. (1mk)
- c) The jewelry is stolen and the thief escapes. (2mks)
- d) The thief stole the jewelry but is caught on his way out. (3mks)
20. a) **Complete** the table below for  $y = \cos(4x - 60^\circ)$  for  $0^\circ \leq x \leq 180^\circ$ . (2mks)

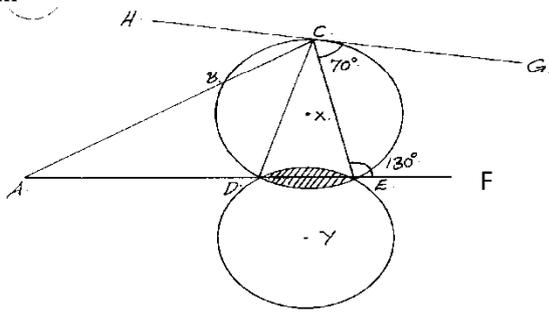
x	0	15	30	45	60	75	90	105	120	135	150	165	180
4x	0	60	120	180	240	300	360	420	480	540	600		
4x - 60°	-60		60		180	240	300		420	480	540		
y=cos(4x-60°)	0.5		0.5	-0.5	-1		0.5						

- b) Using the scale of 1cm to represent 15° on the x - axis and 4cm to represent 1 unit on the y- axis, draw the graph of  $y = \cos(4x - 60^\circ)$  for  $0^\circ \leq x \leq 180^\circ$ . (3mks)
- c) Use your graph to solve the equations.  
 (i)  $1 + \cos(4x - 60^\circ) = 1$  (1mk)  
 (ii)  $5 \cos(4x - 60^\circ) = 1$  (2mks)
- d) State the period and the phase angle of the graph. (2mks)
21. The masses of 50 loaves of bread were taken and recorded in the table below.

Mass (gms)	470- 479	480- 489	490 - 499	500 - 509	510 - 519	520 - 529	530- 539
No. of loaves	1	3	11	21	8	4	2

- a) Using an assumed mean of 504.5, calculate the mean mass. (4mks)
- b) i) Using the formula  $S^2 = C^2 \left[ \frac{\sum fd^2}{\sum f} - \left( \frac{\sum fd}{\sum f} \right)^2 \right]$  calculate the variance. (3mks)
- ii) Calculate the standard deviation. (2mks)
- iii) If 5 is added to each score and then divided by 3, write down the new standard deviation. (1mk)

22. The diagram below shows two intersecting circles with centers X and Y. HG is a tangent to the circle center X at C.  $\angle GCE = 70^\circ$  and  $\angle CEF = 130^\circ$ . Given that AF is a straight line and  $CB = 5\text{cm}$ ,  $BA = 4\text{cm}$ ,  $AE = 12\text{cm}$  and radius  $DY = 6\text{cm}$



- a) Determine;
- Angle DXE (2mks)
  - Length DE (2mks)
- b) Hence, calculate the area of the shaded region. (6mks)
23. A farmer has 50 acres of land. He has a capital Shs. 2,400 to grow carrots and potatoes as cash crops. The cost of growing carrots is Shs.40 per acre and that of growing potatoes is Shs.60 per acre. He estimates that the respective profits per acre are Shs.30 (on carrots) and Shs. 40 (on potatoes).  
By letting X and Y to represent carrots and potatoes respectively:-
- Form suitable inequalities to represent this information. (4mks)
  - By representing this information on a graph, determine on how many acres he should grow each crop for maximum profit. (4mks)
  - Find the maximum profit. (2mks)
24. Two towns P and Q, lie on the same parallel of latitude,  $61.5^\circ\text{N}$ . (Take radius of the earth,  $R = 6370\text{ km}$  and  $\pi = \frac{22}{7}$ )
- Find the shortest distance between the towns and the north pole in kilometers. (2mks)
  - If the longitudes of P and Q are  $42^\circ\text{W}$  and  $29^\circ\text{E}$  respectively, find the shortest distance between them in km. (3mks)
  - If R is another town due south of P and 960 km away from P, find the coordinates of R. (5mks)

## SUNSHINE SECONDARY SCHOOL

## MATHEMATICS

## Paper 1

121/1

Form 4

## SECTION I (50 Marks)

Answer all the questions in this section

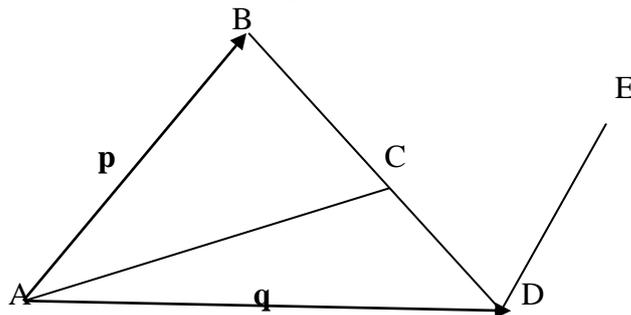
1. Without using a calculator, evaluate  $\frac{-8+(-5)\times(-8)-(-6)}{-3+(-8)\div 2\times 4}$  (2Marks)
2. (a) A rhombus has diagonals of 12 cm and 18cm. Calculate the area of the rhombus (2Marks)  
(b) Calculate the lengths of the rhombus correct to 2 decimal places. (2Marks)
3. Simplify  $\frac{27^{\frac{2}{3}}\div 2^4}{32^{\frac{-3}{5}}}$  (3Marks)
4. Simplify the expression  $\frac{a^4-b^4}{a^3-ab^2}$  (3Marks)
5. Mapesa travelled by train from Butere to Nairobi. The train left Butere on a Sunday at 23 50hours and travelled for 7 hours 15 minutes to reach Nakuru. After a 45 minutes stop in Nakuru, the train took 5 hours 40minutes to reach Nairobi. Find the time, in the 12 hour clock system and the Mapesa arrived in Nairobi. (2Marks)
6. Given the ratio a:b= 3:4, find the ratio (6a – b):(3a+3b) (3Marks)
7. A fuel dealer makes a profit of Ksh 520 for every 1 000 litres of petrol sold and Ksh480 for every 1 000 litres of diesel sold. In a certain month the dealer sold twice as much diesel as petrol. If the total fuel sold that month was 900 000 litres, find the dealer's profit for that month. (3Marks)
8. A liquid spray of mass 384 g is packed in a cylindrical container of internal radius 3.2 cm. Given that the density of the liquid is  $0.6g/cm^3$ , calculate to two decimal places the height of the liquid in the container. (3Marks)
9. A cylinder has a radius equal to its height and its volume is  $134.2cm^3$ . Determine  
(a) Its radius using mathematical table only (2Marks)  
(b) Its surface area assuming it is open at one end (2Marks)
10. Solve the equation:  $2 \cos 2\theta = 1$  for  $0^\circ \leq \theta \leq 360^\circ$ . (4Marks)
11. The equation of the line  $L_1$  is  $2y - 5x - 8 = 0$  and  $L_2$  passes through the points  $(-5,0)$  and is perpendicular to  $L_1$ . Find the equation of  $L_2$  leaving it in double intercept form. (3Marks)
12. Calculate the area of a triangle with sides 9 cm, 6 cm and 7 cm correct to 2 decimal places (3Marks)
13. A solid metal sphere of radius 4.2 cm was melted and the molten materials used to make a cube. Find to 3 significant figures the length of the side of the cube. (3Marks)
14. Two matrices A and B are such that  $A = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ . Given that the determinant of  $AB = 4$ , find the value of  $k$  (3Marks)
15. Given that  $\log_{10} 3 = 0.4771$ ,  $\log_{10} 5 = 0.6990$  and  $\log_{10} 2 = 0.3010$ , without using tables or calculators evaluate  $\log_{10} 0.243$  (3marks)
16. An angle of 1.8 radians at the centre of a circle subtends an arc of length 23.4cm.  
Find : (a) the radius of the circle (2Marks)  
(b) the area of the sector enclosed by the arc and the radii (2Marks)

## SECTION II (50 Marks)

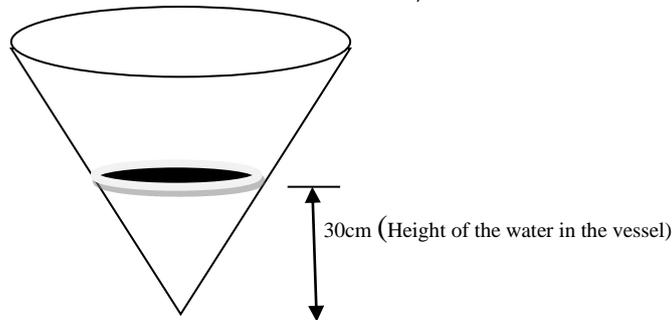
Answer any five questions in this section

17. (a) The ratio of Juma's and Akinyi's earnings was 5:3. Juma's earnings rose to Ksh 8 400 after an increase of 12%. Calculate the percentage increase in Akinyi's earnings given that the sum of their new earnings was Ksh 14 100. (6Marks)  
(c) Juma and Akinyi contributed all the new earnings to buy maize at Ksh 1 175 per bag. The maize was then sold at Ksh 1 762.50 per bag. The two shared all the money from the sales of the maize in the ratio of their contributions. Calculate the amount that Akinyi got. (4Marks)
18. Patrick at point A is 100 km East of Mellissa who is at point B. Patrick travels on a bearing of  $040^\circ$  at a speed of 30km/h and Mellissa starts off at the same time travelling on a bearing of  $320^\circ$  and a speed of 20km/h.  
(a) Draw an accurate scale diagram to show their current initial positions (4Marks)  
(b) Determine the distance and bearing of Mellissa from Patrick after two hours (3Marks)  
(c) After two hours, they decided to head straight for one another using their original speeds. How long will it take them to meet? (3Marks)
19. A group of people planned to contribute equally towards a water project which needed Ksh 2 000 000 to complete. However, 40 members of the group withdrew from the project. As a result, each of the remaining members was to contribute Ksh 2 500 more.  
(a) Find the original number of the members in the group (5Marks)  
(b) Forty-five percent of the value of the project was funded by Constituency Development Fund (CDF). Calculate the amount of contribution that would be made by each of the members of the group. (3Marks)

- (c) Members' contributions were in terms of labour provided and money contributed. If the ratio of the value of labour to the money contributed was 6:19, calculate the total amount of money contributed by the members. (2Marks)
20. A triangle ABC has vertices A (3, 4), B (1, 3) and C(2, 1).  
 (a) Draw triangle  $A'B'C'$  the image of triangle ABC under a rotation of  $+90^\circ$  about (0,0) (2Marks)  
 (b) Draw triangle  $A''B''C''$  the image of triangle  $A'B'C'$  under a reflection in the line  $y = x$  (2Marks)  
 (c) Draw triangle  $A'''B'''C'''$ , the image of  $A''B''C''$  under a rotation of  $-90^\circ$  about (0,0) (2Marks)  
 (d) Describe a single transformation that maps triangle ABC onto triangle  $A'''B'''C'''$  (2Marks)  
 (e) Write down the equations of the lines of symmetry of the quadrilateral  $BB''A''A'$  (2Marks)
21. In a KCPE examination the total marks obtained by 200 students is as shown in the following table.
- |      |        |         |         |         |         |         |         |         |         |
|------|--------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1-50 | 51-100 | 101-150 | 151-200 | 201-250 | 251-300 | 301-350 | 351-400 | 401-450 | 451-500 |
| 3    | 5      | 20      | 18      | 25      | 50      | 48      | 20      | 8       | 3       |
- (a) State the frequency of the modal class (1Marks)  
 (b) Modify the table to calculate the mean Mark (4Marks)  
 (c) Represent the information on a frequency polygon (5Marks)
22. In figure below  $AB=b$ ,  $AD=q$ ,  $DE=\frac{1}{2}AB$  and  $BC=\frac{2}{3}BD$



- (a) Find in terms of  $p$  and  $q$  the vectors  
 (i)  $BD$  (1Mark)  
 (ii)  $BC$  (1Mark)  
 (iii)  $CD$  (1Mark)  
 (iv)  $AC$  (2Marks)
- (b) Given that  $AC=kCE$ , where  $k$  is a scalar, find:  
 (i) The value of  $k$  (4Marks)  
 (ii) The ratio in which C divides AE (1Mark)
23. The diagram below represents a conical vessel which stands vertically. The vessel contains water to a depth of 30cm. The radius of the water surface in the vessel is 21cm. (Take  $\pi = \frac{22}{7}$ )



- (a) Calculate the volume of the water in the vessel in  $cm^3$  (2Marks)  
 (b) When a metal sphere is completely submerged in the water, the level of the water in the vessel rises by 6 cm. Calculate  
 (i) The radius of the new water surface in the vessel; (2Marks)  
 (ii) The volume of the metal sphere in  $cm^3$  (3Marks)  
 (iii) The radius of the sphere (3Marks)
24. The angle of elevation of the top of the spire from the foot of a building is  $60^\circ$ . The angle of depression of the top of the building from the top of the spire is  $47.7^\circ$ . Given that the height of the building is 15 metres, calculate to one decimal place  
 (a) The distance between the spire and the building (4Marks)  
 (b) The difference in height between the spire and the building (2marks)  
 (c) The height of the spire (2Marks)  
 (d) The angle of depression of the foot of the spire from the top of the building (2marks)

**SUNSHINE SECONDARY SCHOOL**  
**MATHEMATICS**  
**PAPER 2**  
**2017**

**TIME: 2 ½ HOURS**  
**SECTION I (50 MARKS)**

**Answer all the questions in the spaces provided.**

- In this question, show all the steps in your calculations, giving your answers at each stage. using logarithms, correct to 4 decimal places, evaluate: (4 marks)  

$$\sqrt[3]{\frac{36.72 \times (0.46)^2}{185.4}}$$
- Make  $s$  the subject of the formula (3 marks)  

$$\sqrt{p+r} + \sqrt{1-as^2}$$
- In the figure below R, T and S are points on a circle centre O. PQ is a tangent to the circle at T. POR is a straight line and  $\angle QPR = 20^\circ$ . Find the size of  $\angle RST$ . (2 marks)
- By correcting each number to one significant figure, approximate the value of  $788 \times 0.006$ . Hence calculate the percentage error arising from this approximation. (3 marks)
- The data below represents the ages in months at which 6 babies started walking: 9, 11, 12, 13, 11 and 10. Without using a calculator, find the exact value of the variances. (3 marks)
- Without using a calculator or mathematical table, simplify  $\frac{3\sqrt{2}-\sqrt{3}}{2\sqrt{3}-\sqrt{2}}$  (3 marks)
- The figure below is a sketch of the graph of the quadratic function  $y = k(x+1)(x-2)$ . Find the value of  $k$ . (3 marks)
- The table below is a part of tax table for monthly income for the year 2004.  

Monthly taxable income in (Kshs)	Tax rate percentage (%) in each shilling
Under Ksh 9681	10%
From Ksh 9681 but under 18801	15%
From Ksh 18801 but 27921	20%

In the tax year 2004, the tax of Kerubo's monthly income was Kshs 1916. Calculate Kerubo's monthly income. (3 marks)
- Given that  $qi \div \frac{1}{3}j + \frac{2}{3}k$  is a unit vector, find  $q$ . (2 marks)
- The points with coordinates (5,5) and (-3,1) are the ends of a diameter of a circle centre a. Determine:  
 (a) The coordinates of A (1 mark)  
 (b) The equation of the circle, expressing it in form  $x^2 + y^2 - ax + by + c = 0$  where a, b, and c are constants. (3 marks)
- Use binomial expression to evaluate: (4 marks)  

$$\left[2 + \frac{1}{\sqrt{2}}\right]^5 + \left[2 - \frac{1}{2}\right]^5$$
- Three quantities  $t$ ,  $x$  and  $y$  are such that  $t$  varies directly as  $x$  and inversely as the square root of  $y$ . Find the percentage change in  $t$  if  $x$  decreases by 4% when  $y$  increases by 44%. (4 marks)
- The figure below is drawn to scale. It represents a field in the shape of an equilateral triangle of side 80m. The owner wants to plant some flowers in the field. The flowers must be at most 60m from A and nearer to B than to C. If no flower is to be more than 40m from BC show by shading, the exact region where the flowers may be planted. (4 marks)
- Solve for  $y$  in the equation  $\log_{10}(y-4)$  (3 marks)
- Five people can build 3 huts in 21 days. Find the number of people, working at the same rate that will build 6 similar huts in 15 days. (2 marks)
- Find all the integral values of  $x$  which satisfy the inequality (3 marks)  
 $3(1+x) < 5x - 11 < x + 45$

**SECTION II (50 MARKS)**

**Answer any 5 questions only in this section**

- Halima deposited Ksh 109375 in a financial institution which paid simple interest at the rate of 8% p.a. At the end of 2 years, she withdrew all the money. She then invested the money in shares. The value of the shares depreciated at 4% p.a. during the first year of investment. In the next 3 years, the value of the shares appreciated at the rate of 6% every four months.  
 (a) Calculate the amount Halima invested in shares. (3 marks)  
 (b) Calculate the value of Halima's shares:  
 (i) At the end of the first year (2 marks)  
 (ii) at the end of the fourth year, to the nearest shilling (3 marks)  
 (c) Calculate Halima's gain from the share as a percentage. (2 marks)
- (a) (i) Construct a triangle ABC in which  $AB = 6$  cm,  $BC = 7$  cm and  $\angle ABC = 75^\circ$  (3 marks)

- Measure:
- (i) Length of AC (1 mark)
  - (ii) Angle ACB (1 mark)
- (b) The locus of P is such that  $BP = PC$ . Construct P. (1 mark)
- (c) Construct the locus of Q such that Q is on one side of BC, opposite A and angle  $BQC = 30^\circ$  (1 mark)
- (d) (i) Locus of P and locus of Q meet at X. Mark x. (1 mark)
- (ii) Construct locus R in which angle  $BRC = 120^\circ$  (1 mark)
- (iii) Show the locus s inside triangle ABC such that  $XS \geq SR$ . (1 mark)
19. Plot triangle ABC with vertices A (-6,5), B(-4,1) and C (3,2) in the grid provided. (1 mark)
- (a) Given that A (-6,5) is mapped into A' (-6,-4) by a shear with y-axis invariant
- (i) draw triangle A'B'C', the image of triangle ABC under the shear (2 marks)
  - (ii) Determine the matrix representing this shear (2 mark)
- (b) Triangle ABC is mapped on to A''B''C'' by a transformation defined by the matrix
- $$\begin{bmatrix} -1 & 0 \\ 1 & -1 \\ \frac{1}{2} & -1 \end{bmatrix}$$
- (i) Draw triangle A''B''C'' (3 marks)
  - (ii) Describe fully a single transformation that maps ABC onto A''B''C'' (2 marks)
20. (a) Two integers x and y are selected at random from the integers 1 to 8. If the same integer may be selected twice, find the probability that:
- (i)  $x - y = 2$  (3 marks)
  - (ii)  $x > y$  (3 marks)
- (b) A bag contains 3 black balls and 6 white ones. If two balls are drawn from the bag one at a time, find the probability of drawing a black ball and a white ball.
- (i) without replacement (2 marks)
  - (ii) with replacement (2 marks)
21. A trader deals in two types of rice; type A and type B. type A costs Ksh 400 per bag and type B costs Ksh 350 per bag.
- (a) The trader mixes 30 bags of type A with 50 bags of type B. If he sells the mixture at a profit of 20% calculate the selling price of one bag of the mixture. (4 marks)
- (b) The trader now mixes type A with type B in the ratio x:y respectively. If the cost of the mixture is Ksh 383.50 per bag, find the ratio x:y. (4 marks)
- (c) The trader mixes one bag of the mixture in part (a) with one bag of the mixture in part (b). Calculate the ratio of type A rice to type B rice in this mixture. (2 marks)
22. The product of the first three terms of geometric progression is 64. If the first term is a, and the common ratio is r.
- (a) Express r in terms of a (3 marks)
- (b) Given that the sum of the three terms is 14:
- (i) Find the value of a and r and hence write down two possible sequences each up to the 4<sup>th</sup> term. (5 marks)
  - (ii) Find the product of the 50<sup>th</sup> terms of two sequences. (2 marks)
23. Mwanjoki flying company operates a flying service. It has two types of aeroplanes. The smaller one uses 180 litres of fuel per hour while the bigger one uses 300 litres per hour. The fuel available per week is 10,000 litres. The company is allowed 80 flying hours per week while the smaller aeroplane must be flown for y hours per week.
- (a) Write down all the equations representing the above information. (3 marks)
- (b) On the grid provided, draw all the inequalities in (a) above by shading the unwanted regions. (4 marks)
- (c) The profits on the smaller aeroplane is Ksh 4000 per hour while that on the bigger one is Ksh 600 per hour. Use the graph drawn in (b) above to determine the maximum profit that the company made per week. (3 marks)
24. Given that y is inversely proportional to  $x^n$  and k as the constant of proportionality;
- (a) (i) Write down a formula connecting y, x, n and k. (1 mark)
- (ii) If  $x = 2$  when  $y = 12$  and  $x = 4$  when  $y = 3$ , write down two expressions for k in terms of n. Hence, find the value of n and k. (7 marks)
- (b) Using the value of n obtained in (a) (ii) above, find y when  $x = 5 \frac{1}{3}$ . (2 marks)

SUNSHINE SECONDARY SCHOOL 2017

kenya certificate of secondary education (k.c.s.e.)

121/1 MATHEMATICS

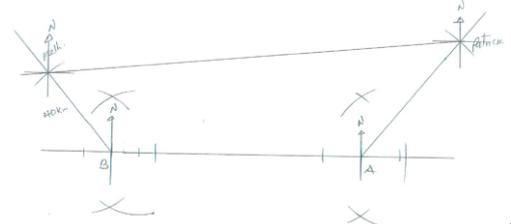
PAPER 1 MARKING SCHEME

1.	$\frac{-8+40+6}{-3-16}$ $\frac{38}{-19}$ $-2$
2.	(a) $\frac{1}{2} \times 12 \times 18$ $= 108\text{cm}^2$ (b) $L = \sqrt{\left(\frac{12}{2}\right)^2 + \left(\frac{18}{2}\right)^2}$ $= \sqrt{36 + 81}$ $= \sqrt{117}$ $= 10.82\text{cm}$
3.	$\frac{3^2 \div 2^4}{\frac{1}{2^3}}$ $\frac{9}{16} \times 8$ $\frac{9}{2} = 4\frac{1}{2}$
4.	$\frac{(a^2-b^2)(a^2+b^2)}{a(a^2-b^2)}$ $\frac{a^2+b^2}{a}$
5.	$\frac{2350}{715}$ $\frac{3105}{-2400}$ 0705 hrs $\frac{45}{0750}$ $\frac{540}{1330 \text{ hrs}}$ 1.30 pm Monday
6.	$a = \frac{3}{4}b$ $6(\frac{3}{4}b - b) : 3(\frac{3}{4}b) + 3b$ $-\frac{3}{2}b : \frac{21}{4}b$ $-6 : 21$ $-2 : 7$
7.	Let litres of petrol be x Let no. of litres of diesel be y $x + y = 900\ 000$ $x = 2y$ $3y = 300000$ $y = 600\ 000$ $\frac{520 \times 600000}{1000} = 312000$ $\frac{480 \times 300\ 000}{1000} = 456000$ Dealer's total profit = 456000
8.	$V = \frac{384}{0.6}$ $= 640\text{cm}^3$ Height = $\frac{640}{\frac{22}{7} \times 3.2 \times 3.2} = 19.89\text{cm}$
9.	(a) $\pi r^3 = 134.2$ $\frac{22}{7} r^3 = 134.2$ $r^3 = \frac{134.2 \times 7}{22}$ $r^3 = 42.7$ $r = 3.5\text{cm}$ (b) $r = 3.5, h = 3.5$ $\frac{22}{7} \times 3.5 \times 3.5 + 2 \times \frac{22}{7} \times 3.5 \times 3.5$ $38.5 + 77$ $115.5\text{cm}^2$

10.	$\cos 2\theta = 0.5$ $2\theta = 60^\circ$ $2\theta = 60^\circ, 300^\circ, 360^\circ, 660^\circ, 780^\circ$ $\theta = 30^\circ, 150^\circ, 180^\circ, 330^\circ$
11.	$M_1 = \frac{5}{2}$ $M_2 = -\frac{2}{5}$ $\frac{y-0}{x+5} = -\frac{2}{5}$ $5y = -2x - 10$ $\frac{2x}{-10} + \frac{5y}{-10} = \frac{-10}{-10}$ $\frac{x}{-5} + \frac{y}{-2} = 1$
12.	$S = \frac{9+6+7}{2} = 11$ $A = \sqrt{11(11-9)(11-7)}$ $= \sqrt{11 \times 2 \times 5 \times 4}$ $= \sqrt{440}$ $= 20.98\text{cm}^2$
13.	$\frac{4}{3} \times \frac{22}{7} \times 4.2^3$ $V = 310.46\text{cm}^3$ $L = \sqrt[3]{310.464} = 6.77\text{cm}$
14.	$AB = \begin{pmatrix} k+12 & 2k+16 \\ 9 & 14 \end{pmatrix}$ $14(k+12) - 9(2k+16) = 4$ $-4k = -20 \quad k = 5$
15.	$\log \frac{3^5}{2^3 \times 5^3}$ $\log 3^5 - (\log 2^3 + \log 5^3)$ $5\log 3 - (3\log 2 + 3\log 5)$ $5(0.4771) - (3\log 2 + 3\log 5)$ $5(0.4771) - 3(3(0.3010) + 3(0.6990))$ $2.3855 - (0.9030 + 2.097)$ $2.3855 - 3 = -0.6145$
16.	(a) $1.8^C = \left(\frac{324}{360\pi}\right)^D \times 2 \times \pi \times r = 23.4$ $r = \frac{23.4 \times 180}{324}$ (b) $\frac{324}{360\pi} \times \pi \times 13 \times 13$ $152.1\text{cm}^2$
17.	(a) Multiply the ratio by a constant Juma $5k : 3k$ Initial earnings = $8k$ New earnings = 14100 $\frac{14100-8k}{8k} = \frac{12}{100}$ $\frac{14100}{8k} - 1 = 0.12$ $\frac{14100}{8k} = 1.12$ $k = \frac{14100}{8 \times 1.12} = 1573.66$ Akinyi's initial earnings $3 \times 1573.66 = 4720.98$ Akinyi's new earnings $14100 - 4720.98 = 9379.02$ % increase $\frac{9379.02}{4720.98} \times 100\%$ $19.87\%$ (b) Ratio of their contribution

Juma : Akinyi  
 7868.30 : 4720.98  
 No. of bags =  $\frac{14100}{1175} = 12 \text{ bags}$   
 S.P =  $12 \times 1762.50$   

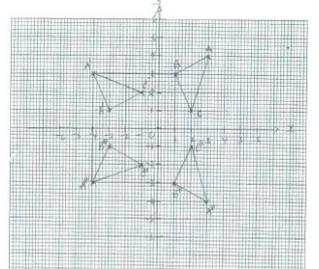
$$\begin{array}{r} 4720.98 \\ \underline{12589.28} \end{array}$$

18.  (b)

Distance  $16.4 \times 10 = 164\text{km} \pm 4\text{km}$   
 Bearing  $265^{\circ} \pm 1^{\circ}$   
 (c)  $T = \frac{D}{S} = \frac{164}{30+20}$   
 $R/S = 50$   
 $\frac{164}{50} = 3.28 \text{ hrs } 3 \text{ hrs } 17 \text{ mins}$

19. Let the initial no. of members be n  
 New no. of members = n - 40  
 $\frac{2000000}{n}, \frac{2000000}{n-40}$   
 $\frac{200000}{n} - \frac{2000000}{n-40} = 2500$   
 $\frac{n-40}{n^2-40n} - \frac{n}{32000} = 0$   
 $n = \frac{-(-40) \pm \sqrt{(-40)^2 - 4(-3200)}}{2}$   
 $n = \frac{40 \pm \sqrt{129600}}{2}$   
 $n = \frac{40 \pm 360}{2}$  n = 200 or -160  
 Original no. of members = 200  
 $\frac{55}{100} \times 2000000 = \text{Sh. } 1100000$   
 Member contribution =  $\frac{1100000}{200}$   
 = Sh. 5500  
 (c) Labour =  $\frac{6}{25} \times 1100000$   
 = Sh. 264000  
 Members contribution = 1100000  

$$\begin{array}{r} 264000 \\ \underline{836000} \end{array}$$

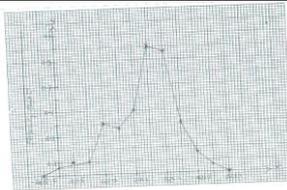
20. 

(d) Reflection in the line  $y = -x$   
 (e)  $y = 0$   
 $x = -1.5$

21. (a) State the frequency of the modal class  
 (b)

x	25.5	75.5	125.5	175.5	225.5	25.5	325.5	375.5	425.5	475.5
f	3	5	20	18	25	50	48	20	8	3
fx	76.5	377.5	2510	3159	5637.5	13775	15624	7510	3404	1426.5

$\Sigma = 200$   
 $\Sigma fx = 53500$   
 $\bar{x} = \frac{53500}{200} = 267.5$

(c) 

22. (a) (i)  $q - p$   
 (ii)  $\frac{2}{3}p + \frac{2}{3}q$  or  $\frac{2}{3}(p + q)$   
 (iii)  $\frac{1}{3}q - \frac{1}{3}p$  or  $\frac{1}{3}(q - p)$   
 (iv)  $\vec{AC} = \vec{AB} + \frac{2}{3}\vec{BD}$   
 $\frac{1}{3}p + \frac{2}{3}q$   
 (b) (i)  $CE = \frac{1}{3}q + \frac{1}{6}p$   
 $\frac{1}{3}p + \frac{2}{3}q = k(\frac{1}{3}q + \frac{1}{6}p)$   
 $\frac{1}{3}p + \frac{2}{3}q = \frac{1}{3}kq + \frac{1}{6}kp$   
 $\frac{1}{3} = \frac{1}{6}k$   
 $k = 2$   
 $\frac{2}{3} = \frac{1}{3}k$   
 $k = 2$   
 (ii) 2 : 1

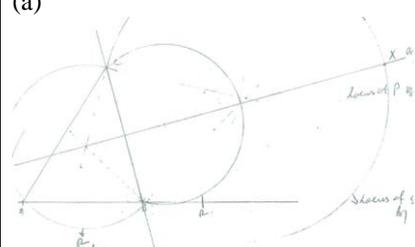
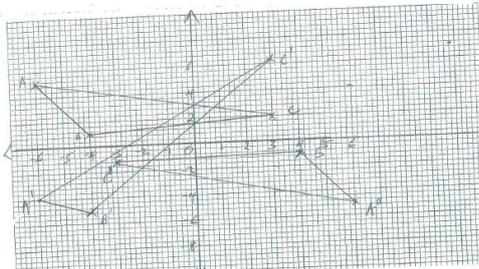
23. (a)  $\frac{1}{3} \times \frac{22}{7} \times 21^2 \times 30$   
 $13860\text{cm}^3$   
 (b)(i)  $\frac{36}{30} = \frac{R}{21}$   
 $R = \frac{36}{30} \times 21$   
 $= 25.5\text{cm}$   
 (ii)  $\frac{1}{3} \times \frac{22}{7} \times 25.5^2 \times 36$   
 $24523.71429$   
 $-13860$   
 $10663.71429\text{cm}^3$   
 (iii)  $\frac{4}{3} \times \frac{22}{7} \times r^3 = 10663.71429$   
 $r^3 = 10663.71429 \times \frac{3}{4} \times \frac{7}{2}$   
 $r^3 = 2544.75$   
 $r = \sqrt[3]{2544.75}$   
 $r = 13.65\text{cm}$

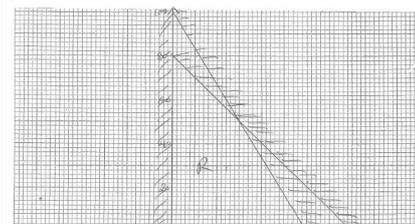
24. (a)  $\frac{15}{\sin 12.3^{\circ}} = \frac{\text{Hyp}}{\sin 137.7^{\circ}}$   
 $\text{Hyp} = \frac{15 \times 0.6730}{0.2130}$   
 $47.39\text{m}$   
 Distance btm  
 $\cos 60^{\circ} = \frac{\text{Adj}}{47.39}$   
 $\text{Adj} = 47.39 \cos 60$   
 $= 47.39 \times 0.5$   
 $= 23.70$   
 $\cong 23.7\text{m}$   
 (b) Height of spire =  $23.7 \tan = 41.04$   
 Difference =  $41.04 - 15$   
 $26.04$   
 $\cong 26.0\text{cm}$   
 (c)  $= \sqrt{47.39^2 - 23.7^2}$   
 $= 41.04$   
 $\cong 41.04 \text{ m}$   
 (d)  $\tan \theta = \frac{15}{23.7} = 0.6329$   
 $\theta = 32.33$   
 Angle of depression =  $32.3^{\circ}$

**SUNSHINE SECONDARY SCHOOL 2017**  
 kenya certificate of secondary education (k.c.s.e.)  
**121/2 MATHEMATICS**  
**PAPER 2 MARKING SCHEME**

No																					
1.	<table border="1"> <thead> <tr> <th>No.</th> <th>Log</th> </tr> </thead> <tbody> <tr> <td>36.72</td> <td>1.5649</td> </tr> <tr> <td><math>0.46^2 \rightarrow (\bar{1}.6628)</math></td> <td><u>1.3256</u></td> </tr> <tr> <td></td> <td>0.8905</td> </tr> <tr> <td>185.4</td> <td><u>2.2682</u></td> </tr> <tr> <td></td> <td><math>\bar{2}.6223 \times \frac{1}{3}</math></td> </tr> <tr> <td></td> <td><math>\frac{\bar{3}}{3} + \frac{1.6223}{3}</math></td> </tr> <tr> <td></td> <td><u>1.5408</u></td> </tr> <tr> <td></td> <td><math>3.474 \times 10^{-1}</math></td> </tr> <tr> <td></td> <td>= 0.3474</td> </tr> </tbody> </table>	No.	Log	36.72	1.5649	$0.46^2 \rightarrow (\bar{1}.6628)$	<u>1.3256</u>		0.8905	185.4	<u>2.2682</u>		$\bar{2}.6223 \times \frac{1}{3}$		$\frac{\bar{3}}{3} + \frac{1.6223}{3}$		<u>1.5408</u>		$3.474 \times 10^{-1}$		= 0.3474
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2.	$Ptr = 1 - as^2$ $\frac{as^2}{a} = \frac{1-p-r}{a}$ $s = \sqrt{\frac{1-p-r}{a}}$																				
3.	$\angle RST = \angle RTQ$ $\angle RTQ = 90 - 35^\circ = 55^\circ$ $\angle RST = 55^\circ$																				
4.	$800 \times 0.006 = 8 \times 0.006 \times 100 = 4.8$ $788 \times 0.006 = 4.728$ Absolute error = $4.8 - 4.728 = 0.072$ $\frac{0.072}{4.728} \times 100 = 1.5228$																				
5.	$Mean = \frac{9+11+12+13+11+10}{6} = \frac{66}{6} = 11$ $Deviation^2 (d^2) = (-2)^2 + 0^2 + 1^2 + 2^2 + (-1)^2 + 0^2$ $4 + 1 + 4 + 1 = 10$ $Variance = \frac{\sum d^2}{n} = \frac{10}{6} = \frac{5}{3} = 1\frac{2}{3}$																				
6.	$\frac{3\sqrt{2}-\sqrt{3}}{2\sqrt{3}-\sqrt{2}} \times \frac{2\sqrt{3}+\sqrt{2}}{2\sqrt{3}+\sqrt{2}}$ Numerator $6\sqrt{6} + 3\sqrt{4} - 2\sqrt{9} - \sqrt{6}$ $5\sqrt{6} + 6 - 6$ $= 5\sqrt{6}$ Denominator $(2\sqrt{3})^2 - (\sqrt{2})^2$ $12 - 2 = 10$ $= \frac{5\sqrt{6}}{10}$ $= \frac{\sqrt{6}}{2}$																				
7.	Substitute the co-ordinator (0,2) in the function. $2 = k(0+1)(0-2)$ $\frac{2}{-2} = \frac{-2}{-2}$ $k = -1$																				
8.	Tax = Sh. 19.60 $1 \text{ slab} = \frac{10}{100} \times 9681 = 968.1$ $Slab 2 = \frac{15}{100} \times x = 947.9$ $x = 6319.3333$ Income = $9681 + 6319.333$ = Sh. 16000																				
9.	Since this is a unit vector $\sqrt{q^2 + \left(\frac{1}{3}\right)^2 + \left(\frac{2}{3}\right)^2} = 1^2$																				

	$q^2 + \frac{1}{9} + \frac{4}{9} = 1$ $q^2 = \frac{9}{9} - \frac{5}{9} = \frac{4}{9}$ $q = \pm \sqrt{\frac{4}{9}}$ $q = \pm \frac{2}{3}$
10.	(a) Mid point $A = \left(\frac{5-3}{2}, \frac{5-1}{2}\right) = (1,2)$ (b) (a,b) is the centre $(x-a)^2 + (y-b)^2 = r^2$ $(x-1)^2 + (y-2)^2 = \sqrt{(1-5)^2 + (2-5)^2}$ $(x-1)^2 + (y-2)^2 = 25$
11.	$64 + 80 + 5 = 149$
12.	$t \times \frac{x}{\sqrt{y}}$ $t = \frac{kx}{\sqrt{y}} \dots \dots \dots (i)$ $t_1 = \frac{0.96x}{\sqrt{1.44y}}$ $\% \text{ change} = \frac{t_1 - t}{t} \times 100$ $\frac{\frac{0.96xk}{\sqrt{1.44y}} - \frac{kx}{\sqrt{y}}}{\frac{kx}{\sqrt{y}}} \times 100\%$ $= \frac{-0.24xk}{1.2\sqrt{y}} \times \frac{\sqrt{y}}{xk} \times 100$ $= \frac{-0.24}{1.2} \times 100\%$ $t \text{ decreases by } 20\% = -20\%$
13.	
14.	$\log_{10}(3y+2) - \log_{10}10 = \log_{10}(y-4)$ $\log_{10}\left(\frac{3y+2}{10}\right) = \log_{10}(y-4)$ $\frac{3y+2}{10} = y-4$ $3y+2 = 10y-40$ $-7y = -42$ $y = 6$
15.	Number of huts increase in the ratio 6:3 $\therefore$ Number of people increase in the ratio 6:3 Number of days decrease in the ratio 15:21 $\therefore$ Number of people increase in the ratio 21:15 $\frac{6}{3} \times \frac{21}{15} \times 5 = 14 \text{ people}$
16.	$3 + 3x < 5x - 11$ $5x - 11 < x + 45$ $\frac{-2x}{-2} < \frac{-14}{-2}$ $\frac{4}{4}x < \frac{56}{4}$ $7 < x < 14$ $x < 14$ Integral values 8, 9, 10, 11, 12, 13
17.	(a) $I = \frac{PRT}{100} = \frac{109375 \times 8 \times 2}{100} = 17500$ Amount = $109375 + 17500$ = KSh. 126875 (b) (i) $A = P \left(1 - \frac{r}{100}\right)^n$ $A = 126875 \left(1 - \frac{4}{100}\right)^1$

	$= \text{KSh. } 121,100$ (ii) $A = P \left(1 + \frac{r}{100}\right)^n$ $A = 121800 \left(1 + \frac{6}{100}\right)^9$ $= \text{KSh. } 205778.5372$ $= \text{KSh. } 205779$ (c) $\frac{205779 - 126875}{126875} \times 100\%$ $= 62.19\%$
18.	(a)  (i) $7.9\text{cm} \pm 0.1$ (ii) $48^0 \pm 0.1$
19.	 (a) (ii) $\begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} -4 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 3 & 0 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 6.5 \end{pmatrix}$ $\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix} \begin{pmatrix} -6 \\ 5 \end{pmatrix} = \begin{pmatrix} -6 \\ 4 \end{pmatrix}$ $k = 1\frac{1}{2}$ Matrix $\begin{pmatrix} 1 & 0 \\ 1\frac{1}{2} & 1 \end{pmatrix}$ (b) (ii) Half-turn about (0,0)
20.	(i) Favourable outcomes = 12 $\frac{12}{64} = \frac{3}{16}$ (ii) $\frac{28}{64} = \frac{7}{16}$ (b) (i) $\frac{3}{9}x^{\frac{6}{8}} + \frac{6}{9}x^{\frac{3}{8}}$ $\frac{18}{72} + \frac{18}{72} = \frac{1}{2}$ (ii) $\frac{3}{9}x^{\frac{6}{9}} + \frac{6}{9}x^{\frac{3}{9}}$ $\frac{18}{81} + \frac{18}{81} = \frac{36}{81} = \frac{4}{9}$
21.	(a) $\frac{30 \times 400 + 50 \times 350}{30 + 50} = \text{Sh. } 368.75$ per bag $368.75 \Rightarrow 100\%$ $? \Leftarrow 120\%$ $\Rightarrow \frac{120 \times 368.75}{100} = \text{Sh. } 442.50$ $\frac{400x + 350y}{x + y} = 383.50$ (b) $400x + 350y = 383.50x + 383.50y$ $\frac{16.5x}{16.5y} = \frac{33.5y}{16.5y} \quad \frac{x}{y} = \frac{33.5}{16.5}$ $\frac{x}{y} = 2\frac{1}{33}$ $\frac{x}{y} = \frac{67}{33} \quad 67:33$ (c) $3:5 \quad 67:33$

	$67 + 3 = 70$ $33 + 5 = 38$ Ratio A to B $70 : 38$ $35 : 19$
20.	(a) $a, ar, ar^2$ $a \times a \times ar^2 = a^3 r^3$ $\frac{a^3 r^3}{a^3} = \frac{64}{a^3}$ $\sqrt[3]{r^3} = \sqrt[3]{\frac{64}{a^3}}$ $r = \frac{4}{a}$ (b) (i) $a + ar + ar^2 = 14$ $a + a \times \frac{4}{a} + a \times \left(\frac{4}{a}\right)^2 = 14$ $a + 4 + \frac{16}{a} = 14$ $a^2 + 4a + 16 = 14a$ $a^2 - 10a + 16 = 0$ $a = x = \frac{10 \pm \sqrt{100 - 64}}{2}$ $a = 8$ $a_1 = 2$ $r = \frac{4}{8} = \frac{1}{2}$ $r_1 = \frac{4}{2} = 2$ Sequence 1: 8, 4, 2, 1 Sequence 2: 2, 4, 8, 16 $n^{\text{th}} \text{ term} = ar^{n-1}$ $50^{\text{th}} \text{ term} = 8 \left(\frac{1}{2}\right)^{49} = 1.421 \times 10^{-14}$ $50^{\text{th}} \text{ term} = 2 \times 2^{49} = 1.126 \times 10^{15}$ $1.421 \times 10^{-14} \times 1.126 \times 10^{15}$ $1.600046 \times 10^1$ $\cong 16$
23.	(a) $5x + 3y \leq 300$ $x + y \leq 80$ $x > 0, y > 0$ (b)  (c) $6000x + 4000y = ?$ Objective function $x = 30, y = 50$ Max profit = $50 \times 4000 + 30 \times 6000$ $= \text{Sh. } 380,000$
24.	(a) (i) $y = \frac{k}{x^n}$ (ii) $12 = \frac{k}{2^n} \quad k = n^2 \times 12$ $3 = \frac{k}{4^n} \quad k = 4^n \times 3$ Hence $k = 4^2 \times 3$ But $k = k$ $\therefore 2^n \times 12 = 4^n \times 3$ $2^n \div 2^n = \frac{1}{4}$ $2^{-n} = 2^{-2}$ $n = 2$ (b) $y = \frac{48}{\left(\frac{16}{3}\right)^2} \quad y = 1.6875$

## NAKA JOINT EVALUATION TEST.

121/1

MATHEMATICS

PAPER 1

TIME: 2 HOURS

Kenya Certificate of Secondary Education (K.C.S.E)

**SECTION I (50MARKS)**

- 1 Without using tables or calculators, evaluate.

$$\sqrt{\frac{0.38 \times 0.23 \times 2.7}{0.114 \times 0.0575}} \quad (3\text{marks})$$

- 2 Without using a calculator or tables, find the value of y given that
- $y = (a+b)(x-c)^2$
- and
- $a = 5$
- ,
- $b = 6$
- ,
- $x = -3$
- and
- $c = 2$
- . (3marks)

- 3 Solve the following inequalities and represent the solution on a single number line.

$$3 - 2x < 5$$

$$4 - 3x \geq -8.$$

(3marks)

- 4 Use the reciprocal, square and square-root tables to evaluate to 4 significant figures the expression.

$$\sqrt{\frac{1}{24.56} + 4.346^2} \quad (4\text{marks})$$

- 5 A Kenyan bank buys and sells foreign currencies at the exchange rates shown below.

	BUYING (KSHS)	SELLING (KSHS)
1Euro	147.56	148.00
1U.S Dollar	74.22	74.50

An American arrived in Kenya with 20,000 Euros. He converted all the Euros into Kenyan Shillings at the bank. He spent Kshs.2,510,200 while in Kenya and converted the remaining Kenya shillings into U.S Dollars at the bank. Find the amount in dollars that he received. (3marks)

- 6 Determine the quartile deviation of the following data 4,9,5,4,7,6,2,1,6,7,8,3. (3marks)

- 7 Translation Q is represented by the column vector
- $\begin{pmatrix} 6 \\ 3 \end{pmatrix}$
- and another translation R by the column vector
- $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$
- . A point

S is mapped onto a point T by Q and a point T is mapped into a point U by R.If point U is

(8, - 4),determine the co-ordinates of point S. (3marks)

- 8 Find the equation of the perpendicular line that passes through the mid - point X of C (- 7, 8) and D (3, - 8) (4marks)

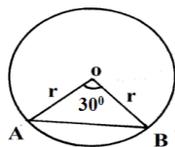
- 9 Mbom paid Kshs.160 for a blouse after getting a discount of 20%. The vendor made a profit of 30% on the sale of this blouse. What percentage profit would the vendor have made if no discount was allowed? (3marks)

- 10 The base of a triangle is 3cm longer than its height. Given that the area of the triangle is
- $35\text{cm}^2$
- , determine the height of the triangle. (3marks)

- 11 Solve for X in the equation. (2marks)

$$\frac{6x-4}{3} - \frac{2x-1}{2} = \frac{6-5x}{6}$$

- 12 The figure below shows a circle centre O. Chord AB subtends
- $30^\circ$
- at the centre. If the area of the minor segment is
- $5.25\text{cm}^2$
- , find the radius of the circle. (3marks)



- 13 A certain two - digit number is equivalent to five times the sum of the digits. It is found to be 9 less than the number formed when the digits are interchanged. Find the number. (3marks)

- 14 The surface area of two similar bottles are
- $12\text{cm}^2$
- and
- $108\text{cm}^2$
- respectively. If larger one has a volume of
- $810\text{cm}^3$
- .Find the volume of the smaller one. (3marks)

- 15 The exterior angle of a regular polygon is equal to one - third of the interior angle. Calculate the number of sides of the polygon and give its name. (3marks)

- 16 King'oo spends one-third of his salary on food, one - quarter on rent, three - fifth of the remainder on transport and saves the rest. If he spends Kshs.1800 on transport, find how much money he saves. (3marks)

**SECTION II (50MARKS)***Choose any five questions only*

- 17 John bought 3 brands of tea A, B and C.The cost price of the brands were sh.25,sh.30 and sh.45 per kilogram respectively. He mixed the brands in the ratio of 5:2:1 respectively. After selling the mixture, he made a profit of 20%.

a) How much profit did he make per kilogram of the mixture. (4marks)

b) After one year, the cost price of each brand was increased by 12%.

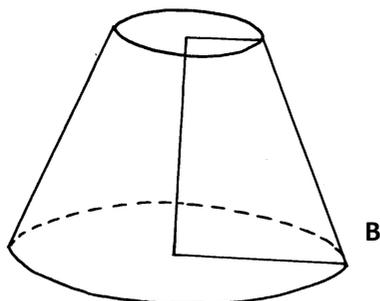
i) For how much did he sell one kilogram of the mixture to make 20% profit. (3marks)

ii) What would have been his percentage profit if he sold one kilogram of the mixture at shs.40.25? (3marks)

18 The diagram below represents a solid consisting of a hemispherical bottom and a conical frustrum at the top.

$O_1O_2=4\text{cm}$ ,  $O_2B=R=4.9\text{cm}$

$O_1A=r=2.1\text{cm}$



- a) Determine the height of the chopped off cone and hence the height of the bigger cone. (2marks)
- b) Calculate the surface area of the solid. (4marks)
- c) Calculate the volume of the solid. (4marks)

19 a) The bill for completely covering the floor of a rectangular room with carpet costing shs.70 per square

metre is shs.1960.If one side of the room is X m long; show that the length of the other side is  $\frac{28}{x} \text{ m}$  (3marks)

- b) By leaving a uniform width of  $\frac{1}{2}$  m uncovered all round, shs.700 could have been saved. Use this information to form an equation in x and show that it reduces to  $X^2 - 11x + 28 = 0$ . (4marks)
- c) Solve the equation and hence find the dimensions of the room. (3marks)

20 The angle of elevation of the top of a flagpole from a point A on a level ground is  $13^\circ$ .The angle of elevation of the top of the flagpole from another point B nearer the pole and 12m from A is  $30^\circ$ . Find;

- a) i) The height of the flagpole (5marks)
- ii) The distance from point B to the top of the flagpole. (2marks)
- b)  $\tan 105^\circ = -2 - \sqrt{3}$ .Determine the value of  $\tan 15^\circ$  in surd form. (3marks)

21 a) Draw the graph of the function below on the grid provided

$y = 2x^2 - 7x - 2$  for the values of  $-1 \leq X \leq 6$  (5marks)

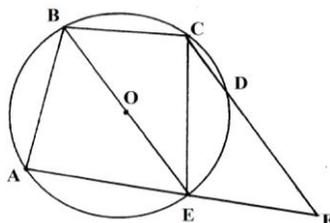
b) From your graph determine the roots of the function.  $2x^2 - 7x - 2 = 0$ . (1mark)

c) By drawing a suitable graph of function  $y = 2x - 7$  on the same axis, solve the simultaneous equations  $y = 2x^2 - 7x - 2$  and  $y = 2x - 7$ . (4marks)

22 Three people; A, B and C work together to make a certain number of tins. If person C was to work alone he will take  $4\frac{4}{9}$  hours to complete the job. If all working together they will take 1hr 40min to complete the job. They all started working together however person B left after first 40min,while person C left 20min later. Person A took a further 1hr 46min.Calculate how long it would take if all the tins were made by;

- a) Person A alone? (6marks)
- b) Person B alone? (2marks)
- c) Person A and C alone? (2marks)

23 In the figure below O, is the centre of the circle.  $\angle AEB = 50^\circ$ ,  $\angle EBC = 80^\circ$  and  $\angle ECD = 30^\circ$ .



Giving reasons, calculate

- i)  $\angle CDE$  (2marks)
- ii)  $\angle DFE$  (2marks)
- iii) Obtuse angle COE (2marks)
- iv)  $\angle ADE$  (2marks)
- v)  $\angle CAE$  (2marks)

24 Patients who attended clinic in one week grouped by age as shown in the table below.

X Age (years)	No. of patients
0 - 5	14
5 - 15	41
15 - 25	59
25 - 45	70
45 - 75	15

- a) Estimate the mean age. (4marks)
- b) On the graph provided, draw a histogram to represent the distribution. (6marks)

**NAKA JOINT EVALUATION TEST.**

121/2

**MATHEMATICS**

**PAPER 2**

**TIME: 2 ½ HOURS**

**Kenya Certificate of Secondary Education (K.C.S.E)**

1 Use logarithms only to evaluate,

$$4\sqrt{\frac{72.36 \times 0.69^2}{\log 168.4}}$$

Correct to four significant figures. (4marks)

2 Make  $t$  the subject of the formula.

$$t = \frac{2m}{n} \sqrt{\frac{L-A}{3k}}$$

(3marks)

3 Express the recurring decimal below as a fraction;  $4.372$  leaving your answer in the form of  $\frac{a}{b}$  where  $a$  and  $b$  are integers. (2marks)

4 Determine the amplitude, period and the phase angle of the wave represented by the equation.

$$y = \frac{-2}{3} \sin\left(\frac{2}{5}x + 40^\circ\right)$$

(3marks)

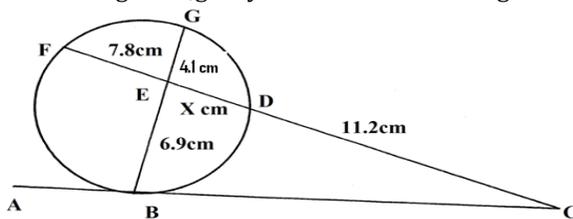
5 Given that  $\frac{3}{3+\sqrt{5}} + \frac{3\sqrt{5}}{3-\sqrt{5}} = a + b\sqrt{5}$ . Find the values of  $a$  and  $b$  (4marks)

6 The dimensions of a cuboid are 4.5cm by 3.5cm by 2cm. Find the percentage error in its volume giving your answer to 2 significant figure. (3marks)

7 A car was valued at kshs.500,000 in January 2010. Each year its value depreciated at 12% p.a. After how long would the value depreciate to kshs.250,000? (3marks)

8 Given that the matrix  $\begin{pmatrix} 5-x & 2 \\ 3x & 4 \end{pmatrix}$  has no inverse, find  $x$ . (2marks)

9 In the figure below ABC is a tangent to the circle at point B. Given that BE = 6.9cm, FE = 7.8cm, GE = 4.1cm, DC = 11.2cm and ED =  $x$ cm. Determine the length BC, give your answer in four significant figures. (4marks)



10 Find the radius and the co-ordinates of the centre of the circle whose equation is  $\frac{1}{2}x^2 + \frac{1}{2}y^2 = 3x - 5y - 9$ . (3marks)

11 A quantity  $P$  varies partly as  $t$  and partly as the square of  $t$ . When  $t = 20$ ,  $p = 45$ , and when  $t = 24$ ,  $p = 60$ .

a) Express  $p$  in terms of  $t$ . (2marks)

b) Find  $p$  when  $t = 32$ . (2marks)

12 The position vectors of points  $A$  and  $B$  are  $a = 2i + j - 8k$  and  $b = 3i + 2j - 2k$  respectively. Find the magnitude of  $AB$ . (3marks)

13 Write the expression of  $(2 - \frac{1}{5}x)^6$  up to the term in  $x^4$ . Hence use the expansion to find the value of  $(1.96)^6$  correct to 3 decimal places. (4marks)

14 Five men working 8 hours daily complete a piece of work in 3 days. How long will it take 12 men working 5 hours a day to complete the same work. (2marks)

15 Find the integral values of  $x$  which satisfy  $6 \leq 2x + 1$  and  $5x - 29 < -4$ . (3marks)

16 In a fund-raising committee of 45 people, the ratio of men to women is 7 : 2. Find the number of women required to join the existing committee so that the ratio of men to women changes to 5 : 4. (3marks)

**SECTION II (50 MARKS)**

**Attempt any five questions from this section**

17 The table below gives the income tax rates.

Income (k£)	Rate (p.a)
1-1980	10%
1981-3960	15%
3961-5940	25%
5941-7920	35%
7921-8650	45%
Over 8651	50%

a) Calculate income tax of Wang'a's taxable income of kshs.50,400 per month allowing a family relief of kshs. 520 per month. (8marks)

b) Calculate the total tax as a percentage of taxable income (2marks)

- 18 a) Draw  $\Delta PQR$  whose vertices are  $P(1,1)Q(-3,2)$  and  $R(0,3)$  on the grid provided  
 b) Find and draw the image of  $\Delta PQR$  under the transformation whose matrix is  $\begin{pmatrix} 3 & 0 \\ 1 & 1 \end{pmatrix}$  and label the image  $P'Q'R'$  (2marks)
- $P'Q'R'$  is then transformed into  $P^{11} Q^{11} R^{11}$  by the transformation with the matrix  $\begin{pmatrix} -1 & 0 \\ 1 & 3 \end{pmatrix}$  (2marks)
- c) Find the co-ordinates of  $P^{11} Q^{11} R^{11}$  and draw  $P^{11} Q^{11} R^{11}$  (3marks)  
 d) Describe fully the single transformation which maps  $PQR$  onto  $P^{11} Q^{11} R^{11}$  find the matrix of this transformation (3marks)
- 19) The probability of passing K.C.P.E depends on performance in the school mock examination. If the candidate passes in mock, the probability of passing K.C.P.E is  $\frac{4}{5}$ . If the candidate fails in mock, the probability of passing K.C.P.E is  $\frac{3}{5}$ . If the candidate passes K.C.P.E, the probability of getting employed is  $\frac{1}{3}$ , the probability of passing mock is  $\frac{2}{3}$ .

- a) Draw a well label tree diagram to represent the above information (2marks)  
 b) Use your tree diagram in (a) above to find the probability that she  
 i) Passes KCPE exams (2marks)  
 ii) Gets employed (2marks)  
 iii) Passes KCPE and gets employed (2marks)  
 iv) Passes mock and gets employed (2marks)
20. The diagram below shows triangle O.A.B in which N is the mid point of AB. Mis a point on OA such that OM :MA=2:1.Lines ON and BN meet at X such that vector OX=h vector ON and ,MX= kMB  
 Given that vector OA =a and vector OB=b

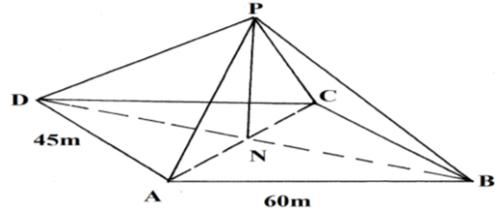
- i) Express the following interms of a and b  
 a) Vector AB (1mark)  
 b) Vector ON (2marks)  
 c) Vector BM (1mark)  
 ii) By expressing vector OX in two different ways ,determine the values of h and k. (6marks)
- 21). Using a ruler and a compass only  
 a) Construct a parallelogram ABCD such that AB = 10cm BC=7cm and  $\angle ABC 105^\circ$  (5marks)  
 b) Construct the loci of P and Q within the parallelogram such that AP < 4cm and BQ < 6cm (2marks)  
 c) Calculate the area within the parallelogram and outside the region bounded by the two loci (3marks)

22. a) Complete the table below

x	-30	0	30	60	90	120	150	180	210	240	270
Sin (x+30)	0	0.50		1.00	0.87			-0.50			-0.87
Cos (x-15)	0.71		0.97		0.26				-0.97	-0.71	-0.26

- b) Draw the graph of  $y = \sin (x+30)$  and  $y=\cos(x-15)$  for  $-30 \leq x \leq 270^\circ$  on the same grid. Take 1cm to represent  $30^\circ$  on x-axis and 1cm to represent 0.2units on y-axis.  
 a) Using your graph drawn (b) above  
 i) Find the values of x for which  $\cos (x-15) -\sin (x+30) = 0$  (2marks)  
 ii) State the co-ordinates of the turning point of the curvefor the function  $y =\cos (x-15)$  on the negative section of y-axis (1mark)  
 iii) Estimate the angle corresponding to  $\cos (x-15) = 0.6$

23. The figure below shows rectangular plot ABCD with AB =60m and BC=45m.  
 PN is a vertical pole of length 30m to which four taut wire PB<sub>1</sub>, PC<sub>1</sub>,PD and PA are attached



- Calculate  
 a) Length of the projection of PCon the plane ABCD (2marks)  
 b) the angle PC made with the base ABCD (3marks)  
 c) The angle between the planes PBC and ABCD (3Marks)  
 c) If point A is to be the North of point C. calculate the bearing of B from A (2marks)
24. a) The first term of an arithmetic progression (AP) is 2.The sum of the first 8 terms of AP is 256.  
 i) Find the common difference of AP (2marks)  
 ii) Given that the sum of the first n terms of the AP 416. Find n (2marks)  
 b) The 3<sup>rd</sup>, 5<sup>th</sup>, and 8<sup>th</sup> terms of another AP forms the first three terms of a geometric progression (GP).If the common difference of the AP is 3 .Find  
 i) The first term of GP (4marks)  
 ii) The sum of the first 9 terms of the GP to 4 s.f (2marks)

**MOSTA JOINT EVALUATION EXAMINATION 2017**

121/1

**MATHEMATICS**

**PAPER 1**

**2017**

**TIME: 2½ HOURS**

**SECTION I (50 Marks)**

**Answers all the questions in this section in the space provided.**

1. Evaluate without using tables or calculators (3marks)

$$\frac{\sqrt{45} \times (2.04)^2}{2.89 \times \sqrt{0.05}}$$

2. Momanyi spent one eighth of his February Salary on farming, half on school fees and two thirds of the remainder on food. Calculate his February salary and the amount he spend on school fees if he spent sh. 3200 on food. (3marks)
3. Makau, Wanjiru and Kemboi start a race at 9.03 a.m in the same direction to run round a circular course. Makau makes the circuit in 252 seconds, Wanjiru in 308 seconds and Kemboi in 198 seconds. If they start from the same point, at what time will they next be all at the starting point together? (3marks)
4. Use squares square roots and reciprocal tables to evaluate (3marks)

$$3.045^2 + \frac{1}{\sqrt{49.24}}$$

5. Simplify the expression (3marks)

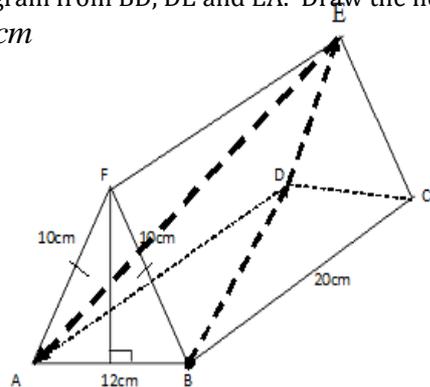
$$\frac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$$

6. A square based brass plate is 2mm high and has a mass of 1.05kg. The density of the brass is 8.4g/cm³. Calculate the length of the plate in centimeters. (3 marks)
7. The currency exchange rates of a given bank in Kenya are as follows;

Currency	Buying	Selling
1 sterling pound	135.50	135.97
1 US dollar	72.23	72.65

A tourist arrived in Kenya with 5,000 US dollars which he converted to Kenya shillings upon arrival. He spent ksh.214, 500 and converted the remaining to sterling pounds. How many pounds did he receive? (3marks)

8. The figure below shows a simple tent. AF=FB=10cm, AB=12cm and BC=FE=AD=20cm. On the tent, a tight rope is tied as shown on the diagram from BD, DE and EA. Draw the net of the tent and show the path of the rope on the net using the scale 1cm rep. 5cm (3marks)

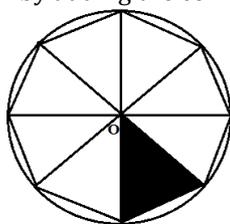


9. Mrs Wekesa paid shs 12500 for a wrist watch after the shopkeeper gave her a discount of 2%. If the shopkeeper made a profit of 20%.calculate the price the shopkeeper bought from the manufacturer. (3marks)

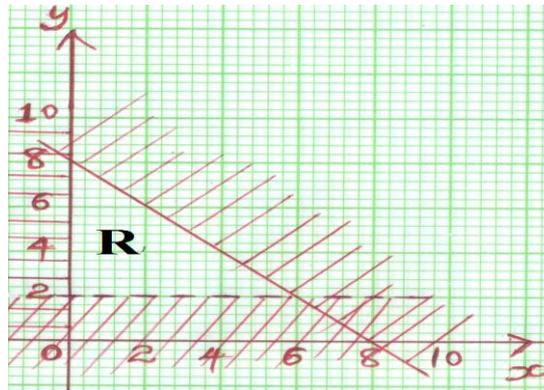
10. Solve for x in  $\left(\frac{4}{9}\right)^x \times (8)^{1-x} = 486$  (4marks)

11. Find the equation of a perpendicular bisector of line PQ if the coordinates of P and Q are (-2,6) and (4,-2) respectively, in the form  $y = mx + c$  (3marks)

12. Complete the figure below by adding the correct missing features if it has a rotational symmetry of order 4 about O. (3marks)



13. The volumes of two similar cylindrical containers are  $27\text{cm}^3$  and  $125\text{cm}^3$  respectively. Given that the height of the smaller container is  $12\text{cm}$ , find the height of the larger container. (3marks)
14. Without using calculator or mathematical tables, simplify  $\frac{\cos 30^\circ - \sin 45^\circ}{\sin^2 30^\circ + \tan^2 45^\circ}$  (4marks)
15. Form three inequalities that satisfy the unshaded region R. (3marks)

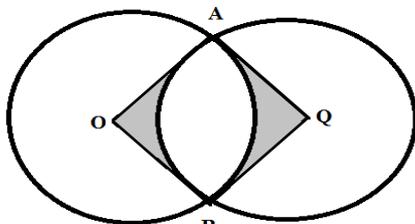


16. A railway line and a road are parallel to each other on a flat and level section of land. A  $5\text{ metre}$  long car moving at a speed of  $110\text{kmh}^{-1}$  starts overtaking a train which is  $495\text{ metres}$  and moving at  $80\text{kmh}^{-1}$ . How long will it take the car to completely overtake the train? (3marks)

**SECTION II (50 Marks)**

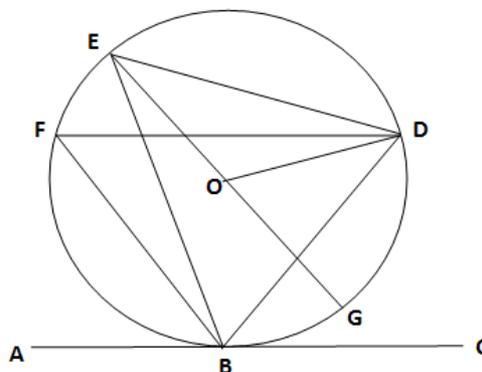
Answers only five questions from this section in the spaces provided.

17. The vertices of a parallelogram are  $O(0,0)$ ,  $A(5,0)$ ,  $B(8,3)$  and  $C(3,3)$  Plot on the same axes
- i) Parallelogram  $O'A'B'C'$ , the image of  $OABC$  under reflection in the line  $x=4$  (4marks)
- ii) Parallelogram  $O''A''B''C''$  the image of  $O'A'B'C'$  under a transformation described by the matrix  $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ . Describe the transformation. (4marks)
- iii) Parallelogram  $O'''A'''B'''C'''$ , the image of  $O''A''B''C''$  under the enlargement, centre  $(0,0)$  and scale factor  $\frac{1}{2}$  (2marks)
18. Two circles with centres  $O$  and  $Q$  and radii  $8\text{cm}$  intersect at points  $A$  and  $B$  as shown below.



- Given that the distance between  $O$  and  $Q$  is  $12\text{cm}$  and that the line  $AB$  meets  $OQ$  at  $X$ , find:
- (a) the length of the chord  $AB$ . (3marks)
- (b) the reflex angle  $AOB$ . (3marks)
- (c) the area of the shaded region.  $\pi = 3.142$  (4marks)

19. In the figure below,  $EG$  is the diameter of the circle centre  $O$ . Points  $B, G, D, E$  and  $F$  are on the circumference of the circle.  $\angle BFD = 50^\circ$ ,  $\angle BEO = 25^\circ$  and line  $ABC$  is a tangent to the circle at  $B$



Giving reasons, calculate the size of

- (a)  $\angle CBD$  (2marks)
- (b)  $\angle BED$  (2marks)
- (c) The reflex angle  $BOD$  (2marks)
- (d)  $\angle EBA$  (2marks)
- (e)  $\angle BGD$  (2marks)

20. OAB is a triangle in which  $OA = a$ ,  $OB = b$ , M is a point on OA such that  $OM:MA=2:3$  and N is another point on AB such that  $AN:NB = 1:2$ . Lines ON and MB intersect at X.

- a) Express the following vectors in terms of  $a$  and  $b$ 
  - i)  $AB$  (1mark)
  - ii)  $ON$  (1mark)
  - iii)  $BM$  (1mark)
- b) If  $OX = k ON$  and  $BX = h BM$ , express  $ON$  in two different ways. Hence or otherwise find the value of h and k (6marks)
- c) Determine the ratio OX: XN (1mark)

21. Every Sunday Alex drives a distance of 80km on a bearing of  $074^\circ$  to pick up his brother John to go to church. The church is 75km from John's house on a bearing of  $S50^\circ E$ . After church they drive a distance of 100km on a bearing of  $260^\circ$  to check on their father before Alex drives to John's home to drop him off then proceeds to his house.

- (a) Using a scale of 1cm to represent 10km, show the relative positions of these places. (4 marks)
- (b) Use your diagram to determine:
  - (i) the true bearing of Alex's home from their father's house. (1 mark)
  - (ii) the compass bearing of the father's home from John's home. (1 mark)
  - (iii) the distance between John's home and the father's home. (2 marks)
  - (iv) the total distance Alex travels every Sunday. (2 marks)

22. The data below shows the sample of age distribution of some of the people who reside in a Yoruba village in years.

Age group	Number of persons in age group
1 - 5	4
6 - 10	12
11 - 20	9
21 - 30	6
31 - 50	18
51 - 55	4
56 - 65	2

- (a) Complete the frequency distribution table above and hence
    - (i) Calculate the mean. (3marks)
    - (ii) Calculate the median. (2marks)
  - (b) Draw a frequency polygon from the given data on the grid below (5marks)
23. Two variables x and V are known to satisfy the relation  $V = Kx^n$  where k and n are constants. The table below shows data collected from an experiment.

x	3.01	3.98	5.01	6.02	7.08	8.94
V	10.5	101	989	9600	95000	854000

- a) Write down the function  $V = Kx^n$  in linear form and make a suitable table of values correct to one decimal place. (3marks)
  - b) Draw a suitable graph to represent the relation  $V = Kx^n$  (3marks)
  - c) Use your graph to determine the values of k and n (4marks)
24. A particle moves in a straight line. It passes through point O at  $t = 0$  with velocity  $V = -4m/s$ . The acceleration  $a$   $m/s^2$  of the particle at time  $t$  seconds after passing through O is given by  $a = 10t + 1$
- a) Express the velocity V of the particle at time  $t$  seconds in terms of  $t$ . (3marks)
  - b) Find V when  $t = 3$  (1mark)
  - c) Determine the value of  $t$  when the particle is momentarily at rest (3marks)
  - d) Calculate the distance covered by the particle between  $t = 2$  and  $t = 4$  (3marks)

## MOSTA JOINT EVALUATION EXAMINATION 2017

## Kenya Certificate of Secondary Education

## MATHEMATICS

## PAPER 2

TIME: 2 ½ HOURS

1. Use logarithm table to evaluate (4marks)

$$\sqrt[5]{\frac{75.4 \times 4.83^2}{0.00521}}$$

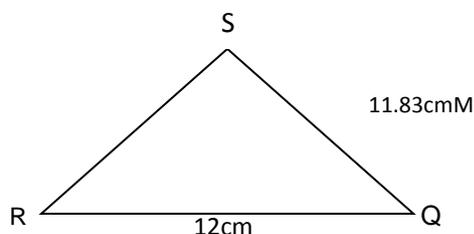
2. Make b the subject of the formula given that  $a = \frac{bd}{Nb^2 - d}$  (3 marks)
3. Line PQ is the diameter of a circle such that the coordinates of P and Q are (-2, 2) and (-2,-6) respectively. Find the equation of the circle in the form  $ax^2 + ay^2 + bx + cy + d = 0$ . (4marks)
4. Use completing the square method to solve the equation  $4 - 3x - 2x^2 = 0$  (3marks)
5. Given that  $P=4+\sqrt{2}$  and  $Q=2+\sqrt{2}$  and that  $\frac{P}{Q}=a+b\sqrt{c}$ , where a, b and c are constants, find the values of a, b and c. (3 marks)
6. The table below shows the temperature readings of four different solutions recorded by students to nearest  $0.1^\circ C$  during a laboratory lesson. Calculate the percentage error in  $\frac{P+Q}{S-R}$  to 3 d.p. (3marks)

Quantity	Temperature in $^\circ C$
P	22.5
Q	19.4
R	17.3
S	26.2

7. Use matrix method to solve the simultaneous equations  
 $2x + y = 10$   
 $2x + 2y = 14$  (3marks)
8. (a) Expand  $(1+2x)^5$  to the fourth term. (1 mark)  
 (b) Hence evaluate  $(1.02)^5$  correct to 3 decimal places. (3 marks)
9. It is known that the value of land appreciate at 7% p.a in a town. John bought a plot in the town at Ksh 500,000. Given that he plans to sell the plot after 6 years, find out how much profit he expects to get. (Give your answer correct to the nearest thousand). (3marks)
10. The mass of a wire varies jointly with its length and with the square of its diameter. A section of the wire 500m long, with diameter 3mm has a mass of 31.5kg. what is the mass of 1000m of wire of diameter 2mm? (3marks)
11. Mr. Gatua has a salary of sh.80000 per annum. He lives rent free in company house and is entitled to a monthly personal relief of sh.1056. Based on the tax rates given below, calculate his PAYE. (3 marks)

<u>Taxable income</u> (KE p.a.)	<u>Rate</u>
1 - 1500	10%
1501 - 3000	15%
3000 - 4500	25%
Above 4500	35%

12. The third term and sixth term of a geometric series are  $3^{1/3}$  and  $11^{1/4}$  respectively. Calculate the common ratio and hence find its first term. (3marks)
13. Use the figure below to answer the question that follows



Given that angle  $RSQ = 50^\circ$ ,  $SQ = 11.83$  cm and  $QR = 12$  cm. A circumcircle is drawn on the triangle. Find the radius of the circle (2marks)

14. A Business man bought commodity A and commodity B at shs.60 and sh.72 respectively. In what ratio must he mix so that when he sells at shs.78, he makes a profit of 200%. (3 marks)
15. Points A ( $x^\circ N, 30^\circ E$ ) and B ( $x^\circ N, 50^\circ E$ ) are 1935 kilometres apart. Taking  $R = 6370$  km and  $\pi = \frac{22}{7}$ , find the value of x. (3marks)

16. Find the gradient function of the curve  $y = \frac{1}{3}x^3 - 4x^2 + 9x + 4$  hence, find the gradient of the curve at point (1, -4) (3marks)
17. Use a scale of 1:1 in both axes to draw the graphs of  $y = x^2 - 6x + 7$  and  $y = x - 2$  for the domain  $0 \leq x \leq 6$ . The point of intersection of the two functions satisfy a certain quadratic equation in x. Obtain the equation in x hence calculate it's solutions. Give answer correct to 2d.p. (10 marks)
18. Points A and B are centres of two equal circles of a radius 2 cm and 10 cm apart.
- Construct the two circles in the space given below. (1mark)
  - Construct the transverse common tangents to both circles. (4marks)
  - Calculate the length of the transverse common tangents (Take  $\pi = \frac{22}{7}$ ) (5marks)
19. Albert, Bonny and Charles competed in a game of chess. Their probabilities of winning the game are  $\frac{2}{5}$ ,  $\frac{3}{5}$  and  $\frac{1}{10}$  respectively.
- Draw a probability tree diagram to show all the possible outcomes. (2 marks)
  - Calculate the probability that;
    - No one loses the game. (2 marks)
    - Only one of them wins the game. (2 marks)
    - At least one of them wins the game. (2 marks)
    - At most two of them lost the game. (2marks)
20. Construct rhombus ABCD such that  $AB=BC= 6\text{cm}$  and  $\angle ABC=60^\circ$ .
- Measure BD. (1 mark)
  - On the same diagram, construct the inscribed circle of triangle ACD. (3marks)
  - Construct the locus of points equidistant from A and C. (3 marks)
  - If x is a point on the circle in b above such that  $AX=XD$  and  $\angle AXD$  is acute, find the locus of X and make it on the diagram. (3 marks)

21. (a) Complete the table below. (2marks)
- |                |              |              |              |             |             |             |           |            |            |            |             |             |             |
|----------------|--------------|--------------|--------------|-------------|-------------|-------------|-----------|------------|------------|------------|-------------|-------------|-------------|
| X              | $-180^\circ$ | $-150^\circ$ | $-120^\circ$ | $-90^\circ$ | $-60^\circ$ | $-30^\circ$ | $0^\circ$ | $30^\circ$ | $60^\circ$ | $90^\circ$ | $120^\circ$ | $150^\circ$ | $180^\circ$ |
| $Y=2\cos x$    |              | -1.73        |              |             | 1           |             | 2         |            | 1          | 0          |             |             |             |
| $Y=\cos(x-60)$ | -0.5         |              |              | -0.9        |             | 0           |           |            | 1          |            |             |             | -0.5        |
- On the same axes plot the graphs of  $y = \cos(x-60^\circ)$  and  $y = 2 \cos x$  (use a scale of 1 unit for  $30^\circ$  on the x axis and 1 unit for 0.5 units on the y axis) (4marks)
  - Describe the transformation which maps  $y = \cos(x-60^\circ)$  to  $y = 2\cos x$ . (2marks)
  - State the period and amplitude of each of the waves above. (1mark)

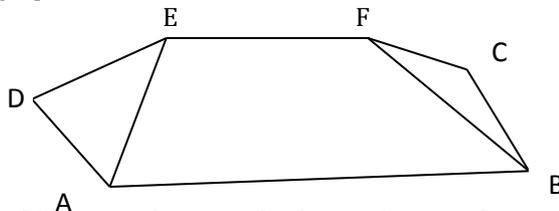
Amplitude                  Period

$$Y=2\cos x$$

$$Y=\cos(x-60)$$

- (e) Using the graph above determine the values of x for which  $\cos(x-60^\circ) - 2\cos x = 0$  (1mark)

22.



The roof of a building is as shown in the figure above with a rectangular base ABCD.  $AB = 20\text{m}$  and  $AD = 8\text{m}$ . The ridge  $EF = 10\text{m}$  and is centrally placed. The faces ADE and BFC are equilateral triangles. Calculate

- The height of E above the base ABCD (2 marks)
  - The angle between the planes ABCD and ADFE (3 marks)
  - The angle between the planes AED and ABCD (2 marks)
  - The acute angle between lines DB and EF (3 marks)
23. Kiprop has at least 50 acres of land on which he plans to plant potatoes and cabbages. Each are of potatoes requires 6 men and each are of cabbages requires 2 men. The farmer has 240men available and he must plant at least 10 acres of potatoes. The profit on potatoes is kshs.1200 per acre. If he plants x acres of potatoes and y acres of cabbages;
- Write down 3 in equalities in x and y to describe the information. (2 marks)
  - Represent these in equalities graphically. (use a scale of 1:10 for both axes) (4 marks)
  - Use your graph to determine the number of acres for each vegetable which will give maximum profit. (4 marks)
24. (a) Complete the table below for  $y = x^2 - 3x + 5$  in the range  $2 \leq x \leq 8$  (2marks)

x	2	3	4	5	6	7	8
y	3		9		23	33	

- Use the trapezium rule with six strips to estimate the area enclosed by the curve, x-axis and the lines  $x=2$  and  $x=8$ . (2marks)
- Find the exact area of the region given in (b). (4marks)
- Calculate the percentage error in the area. (2marks)

**MURANGA SOUTH A**  
**END OF TERM II EXAMINATION**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**

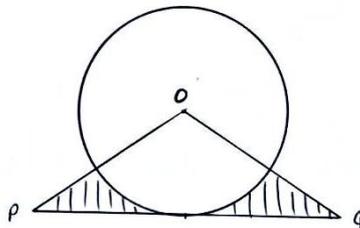
**SECTION I (50 Marks)**

Answer all the questions in this section in the spaces provided.

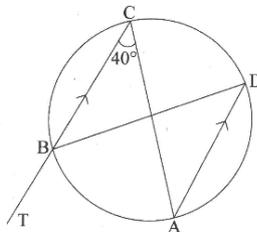
1. Without using a calculator evaluate,  $\frac{15+(-3)}{4} + \frac{20-(-3)(5)}{-5x^2-9}$  (3 marks)
2. Factorise and simplify the expression completely  $\frac{-5}{5x^2-13x-6}$  (3 marks)
3. After a certain translation, point M (-3, -2) is mapped onto point M' (5, -4).
  - i. Find the translation vector. (1 mark)
  - ii. Find the coordinates of point A, whose image is A' (3, -1). (2 marks)
4. A boat sails due north for 7.8 km and then a further 12 km on a bearing of 090°. Calculate the shortest distance from the starting point. (2 marks)
5. A wire of length 240 cm is bent four times to form a rectangle. If the width of the rectangle is half its length, find its area. (3 marks)
6. Without using a calculator, evaluate (3 marks)

$$\frac{14 \div \frac{1}{3} \text{ of } 5\frac{1}{4} - 3\frac{3}{4} \times 1\frac{1}{3}}{\frac{3}{5} \times 6\frac{1}{4} + 1\frac{1}{2}}$$

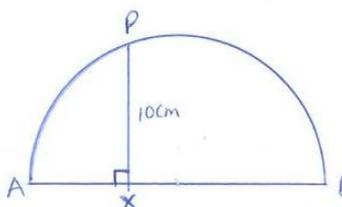
7. The figure below shows a circle centre O.



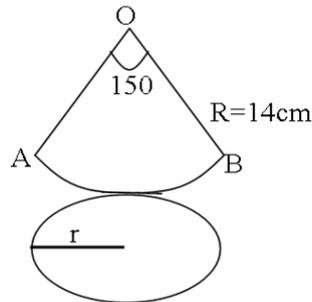
- The line PQ = 21 cm is a tangent to the circle such that OP = OQ and angle POQ = 140°. Calculate the area of the shaded region. (4 marks)
8. The lines  $3x + 2y - 7 = 0$  and  $ax + 3y + 2 = 0$  are perpendicular. Find the value of a. (3 marks)
  9. A metal rod of length 30 m is cut into pieces of length 0.157 m, another different type of rod of length 247 m is cut is cut into pieces of length 5.899 m. Use reciprocals to find the total number of whole pieces. (3 marks)
  10. In the figure below ABCD is a cyclic quadrilateral. Line TBC is parallel to line AD and angle ACB = 40°.



- Find the size of:
- a) Angle CAD. (1 mark)
  - b) Angle TBD (2 marks)
11. Find the value of x in the equation:  
 $\cos(3x - 180^\circ) = \frac{\sqrt{3}}{2}$  in the range  $0^\circ \leq x \leq 180^\circ$ . (3 marks)
  12. In the figure below O is the centre of the circle diameter AB. Angle AXP = 90°, AX = 4cm and PX = 10 cm. Calculate the radius of the semi-circle. (3 marks)



13. The curved surface area of a cylindrical container is  $1980\text{cm}^2$ . If the radius of the container is  $21\text{cm}$ , calculate to one decimal place the capacity of the container in litres (Take  $\pi = \frac{22}{7}$ ). (4 marks)
14. The following were marks scored by a student in eight subjects: 36, 22, 48, 56, 32, 50, 43, and 51. Find the quartile deviation. (3 marks)
15. The figure below shows a net of a circular cone with a lid. Given that  $\angle AOB = 150^\circ$  and  $OA = 14\text{cm}$ .

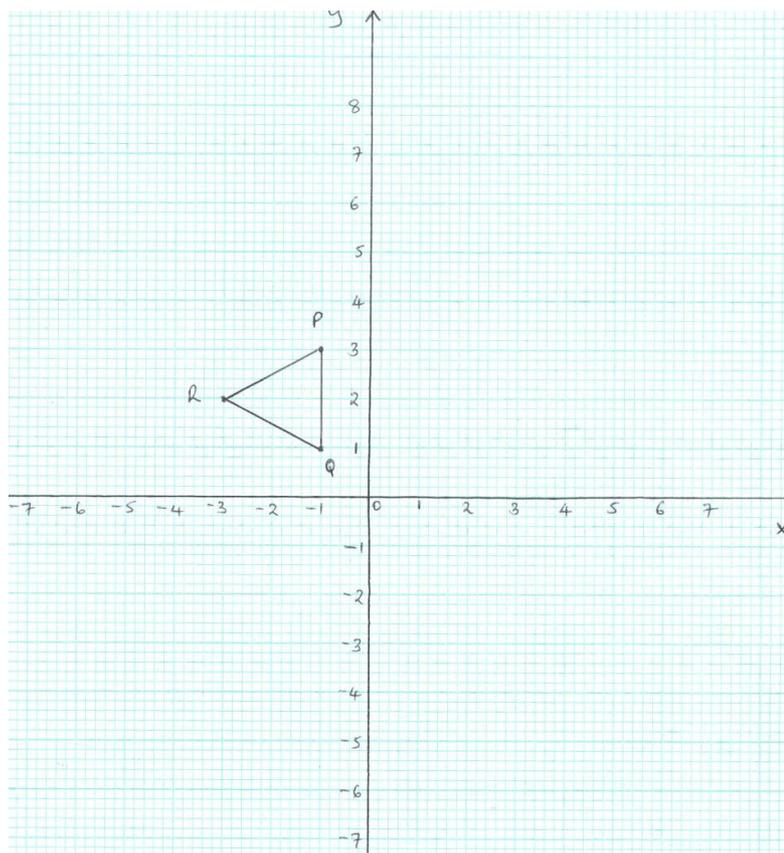


- Determine;
- The radius of the base of the cone (2 marks)
  - The total surface area of the cone (2 marks)
16. The difference between the exterior and interior angle of a regular polygon is  $100^\circ$ . Determine the number of sides of the polygon. (3 marks)

**SECTION II (50 MARKS)**

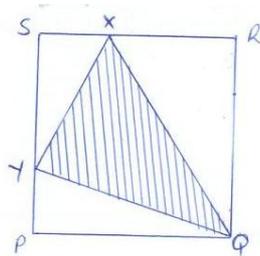
Answer any five questions in this section in the spaces provided.

17. The figure below shows triangle PQR with co-ordinates P (-1, 3) Q (-1, 1) and R (-3, 2).



- Draw triangle  $P'Q'R'$  the image of  $\Delta PQR$  under reflection in the line  $x = 0$ . (2 marks)
  - Draw the line  $y = -x$  (1 mark)
    - Draw triangle  $P''Q''R''$ , the image of  $\Delta P'Q'R'$  under reflection in the line  $y = -x$ . (2 marks)
  - Determine the matrix of transformation that maps  $\Delta PQR$  onto  $\Delta P''Q''R''$  (3 marks)
  - Describe fully a single transformation that maps  $\Delta PQR$  onto  $\Delta P''Q''R''$ . (2 marks)
18. (a) Oil flows through a pipe of external radius  $2.5\text{ cm}$  at  $50\text{ metres per minute}$ . Calculate the volume of oil delivered by the pipe per minute in litres given the thickness of the pipe is  $0.4\text{cm}$ . (4 marks)

- (b) A rectangular storage tank on a square base of height 3 m is filled by oil from this pipe and at the same rate of flow. The oil starts flowing into the empty storage tank at 9:30 a.m. and is full at 4:10 p.m. Calculate the dimensions of the base of the tank in metres to 1 decimal place. (4 marks)
- (c) A company consumes the capacity of this tank in one week. The cost of the oil is sh. 32.50 per litre plus a fixed charge of sh. 489.70. Calculate the cost of this factory oil bill for a month. (2 marks)
19. (a) Solve the inequality (3 marks)
- $$\frac{1}{4}x - \frac{1}{2} < \frac{2}{5}x - \frac{4}{5}$$
- (b) Solve the simultaneous inequalities (3 marks)
- $$4x - 5 \leq 6x + 3$$
- $$5x - 4 \leq 3x + 2$$
- (c) By drawing the appropriate straight lines and shading the unwanted regions, illustrate on graph paper the region which satisfies all the inequalities below. (4 marks)
- $3y + 4x \leq 24$
  - $2y - x < 6$
  - $5y + 3x \geq 15$
20. The velocity of a particle  $t$  seconds after passing a fixed point  $O$ , is given by  $V = at^2 + bt$  m/s, where  $a$  and  $b$  are constants. Given that its velocity is 2 m/s when  $t = 1$  sec and it returns to  $O$  when  $t = 4.5$  secs, calculate;
- The values of  $a$  and  $b$ . (4 marks)
  - Hence find;
    - The values of  $t$  when the particle is instantaneously at rest. (2 marks)
    - The total distance travelled by the particle during the first 4 seconds. (2 marks)
    - The maximum velocity attained by the particle. (2 marks)
21. In the figure PQRS is a square of side  $l$  cm. Points  $X$  and  $Y$  are on  $SR$  and  $SP$  respectively such that  $SX = \frac{1}{3}SR$  and  $SY = \frac{2}{3}SP$ .



- Show that the area of the shaded region is  $\frac{7}{18}l^2$  cm<sup>2</sup>. (4 marks)
  - Show that the sum of the areas of triangles  $SXY$  and  $QXY$  is equal to half the area of the square. (3 marks)
  - Given that the area of the shaded region is 56 cm<sup>2</sup>, find the value of  $l$  and hence the area of triangle  $SXY$ . (3 marks)
22. An air craft flies from its base for 500 km on a bearing of  $025^\circ$  to  $P$ . It then flew 700 km on a bearing of  $280^\circ$  to  $Q$ . From  $Q$  it flies straight back to its base.
- Using a scale of 100 km: 1cm, draw a scale diagram to show the map of the routes. (3 marks)
  - From the diagram, find
    - The distance traveled during the first part of its journey. (2 marks)
    - The bearing of its flight during the last part of journey. (2 marks)
    - On the last part of the journey in level flight at 610m, the pilot saw over the nose of airplane at an angle of depression of  $15^\circ$  the base. Calculate how far the plane is from the base at this point. (3 marks)
23. Water flows through a pipe at a rate of 1.5m/s. If the pipe has a diameter of 2cm.
- Find the volume of water that can be drawn from this pipe in 1 minute. (4 marks)
  - If this water is collected in a rectangular tank of base area 3m<sup>2</sup>, what will be the level of water after 20 minutes? (3 marks)
  - Give the volume of water in the tank at this time in litres. (3 marks)
24. (a) Using a ruler and a pair of compass only, construct a triangle  $ABC$  in which  $\angle ABC = 37.5^\circ$ ,  $BC = 7$  cm and  $BA = 14$  cm. (3 marks)
- Drop a perpendicular from  $A$  to  $BC$  produced and measure its height. (3 marks)
  - Use your height in (b) above to find the area of the triangle  $ABC$ . (2 marks)
  - Use construction to find the radius of an inscribed circle of triangle  $ABC$ . (2 marks)

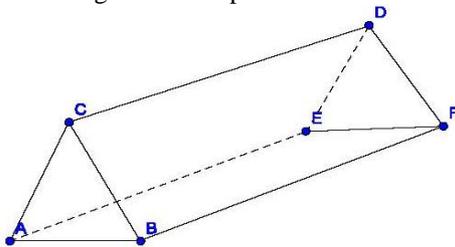
**MURANGA SOUTH A**  
**END OF TERM II EXAMINATION**  
**121/2**  
**MATHEMATICS**  
**PAPER 2**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**

**SECTION I (50 Marks)**

1. Make P the subject of the formula. (3 marks)

$$t = \frac{2R}{n} \sqrt{\frac{L-P}{3k}}$$

2. Without using a calculator or Mathematical tables express  $\frac{\sin 30^\circ}{2 + \tan 60^\circ}$  in surd form and simplify leaving your answer in the form  $a + b\sqrt{c}$  where a, b and c are rational numbers. (3 marks)
3. The radius of a spherical ball is measured as 6cm to the nearest cm. Determine, to 2 decimal places, the percentage error in calculating the surface area of the ball. (4 marks)
4. The equation of a circle is given by  $x^2 + 8x + y^2 - 2y - 1 = 0$ . Determine the radius and centre of the circle. (3 marks)
5. The matrix  $p = \begin{pmatrix} q+2 & q \\ -3 & q-2 \end{pmatrix}$  is a singular matrix. Find two possible;
- a) Values of q. (2 marks)
- b) The matrices for p. (1 mark)
6. The gradient function of a curve is given by  $\frac{dy}{dx} = 3x - 6$ .  
Determine
- a) The equation of the curve given that it passes through the point (0, 7). (2 marks)
- b) The coordinates of the turning point of the curve. (1 mark)
7. Two towns R and S are 3 000 nautical miles apart. Both towns are situated on the equator such that S is to the East of R.  
Calculate:
- a) The longitude difference between towns S and R. (1 mark)
- b) The local time at R if the local time at S is 1:15 a.m. (2 marks)
8. The volume of a cylinder is given by  $V = \pi r^2 h$ . Find the percentage change in V if r increases by 8% and h decreases by 12%. (4 marks)
9. The figure below shows a triangular prism ABCDEF. If given that AB = 12 cm, AE = 20 cm AC = ED = BC = FD = 10cm, calculate the angle between plane ADB and the base. (3 marks)



10. Solve  $\log_2(x+7) - \log_2(x-7) = 3$  (3 marks)
11. Use the trapezium rule to find the area bounded by the curve  $y = \frac{1}{1+x}$ ,  $x = 0$  and  $x = 5$ . Use strips of unit length. (3 marks)
12. Use logarithms tables to evaluate; (4 marks)
- $$4 \sqrt{\frac{3.45 + 2.62}{786 \times 0.7}}$$
13. Construct  $\Delta ABC$  with AB = 8cm, BC = 6cm and AC 7cm. On the same diagram construct the locus L of points 3cm from the midpoint of AB. (3 marks)
14. (a) Expand and simplify the binomial expression  $(2-x)^6$  up to the term in  $x^2$ . (1 mark)
- (b) Use your expansion up to term the term in  $x^2$  to estimate  $(1.99)^6$  (2 marks)
15. A plane figure of area  $50 \text{ cm}^2$  is transformed by the matrix  $\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$  and then followed by the matrix  $\begin{pmatrix} 3 & -1 \\ 0 & 4 \end{pmatrix}$ . Find the area of the final image. (2 marks)
16. In a chemistry experiment, a boy mixed some acid solution of 45% concentration with an acid solution of 25% concentration. In what proportion should the two acids be mixed in order to get  $100 \text{ cm}^3$  concentration? (3 marks)

**SECTION II (50 Marks)**

**(Answer any Five questions in this section)**

17. Wambui planned to spend sh 16 800 to buy a number of bags of maize. When she went to the market she discovered that the price of maize had increased by sh 200 per bag. She could now afford to buy two bags less than she had planned to buy with the same amount of money.
- a) Determine the number of bags she had planned to buy. (6 marks)
- b) She later sold the maize at sh 1 750 per bag. Find the percent profit she made (4 marks)
18. The gradient function of a curve is given by the expression  $2x + 1$ . If the curve passes the points  $(-4, 6)$ ;
- c) Find;
- i. The equation of the curve. (3 marks)
- ii. The values of  $x$  at which the curve cuts the line  $y = 0$ . (3 marks)
- d) Determine the area enclosed by the curve and the  $x$  axis. (4 marks)
19. The 2<sup>nd</sup> and 5<sup>th</sup> terms of an arithmetic progression are 8 and 17 respectively. The 2<sup>nd</sup>, 10<sup>th</sup> and 42<sup>nd</sup> terms of the A.P. form the first three terms of a geometric progression. Find
- a) The 1<sup>st</sup> term and the common difference. (3 marks)
- b) The first three terms of the G.P and the 10<sup>th</sup> term of the G.P. (4 marks)
- c) The sum of the first 10 terms of the G.P. (3 marks)
20. In a science class  $\frac{2}{3}$  of the class are boys and the rest girls. 80% of the boys and 90% of the girls are right handed and the rest are left handed. The probability that a right handed student will break a test tube in any session is  $\frac{1}{10}$  and the corresponding for the left handed student is  $\frac{3}{10}$ , their probability being independent of the student's sex.
- c) Draw a probability tree diagram to represent the above information. (2 marks)
- d) Find the probability that;
- i. A student chosen from the class is left handed. (2 marks)
- ii. A test tube is broken by a left handed student. (2 marks)
- iii. A test tube is broken by a right handed student. (2 marks)
- iv. A test tube is not broken in any session. (2 marks)
21. Complete the table below for the functions  $y = 3 \sin 3\theta$  and  $y = 2 \cos(\theta + 40^\circ)$ . (2 marks)

$\theta^\circ$	$0^\circ$	$10^\circ$	$20^\circ$	$30^\circ$	$40^\circ$	$50^\circ$	$60^\circ$	$70^\circ$	$80^\circ$	$90^\circ$
$3 \sin 3\theta$	0	1.50		3.00			0.00			
$2 \cos(\theta + 40^\circ)$	1.53	1.29			0.35			-0.69		

- c) On the grid provided, draw the graphs of  $y = \sin 3\theta$  and  $y = \cos(\theta + 40^\circ)$  on the same axis. (4 marks)
- d) From the graph, find the roots of the equation;
- i.  $\frac{3}{4} \sin 3\theta = \frac{1}{2} \cos(\theta + 40^\circ)$  (2 marks)
- ii.  $2 \cos(\theta + 40^\circ) = 0$  in the range  $0 \leq \theta \leq 90^\circ$  (2 marks)
22. Mr. Patrick pays sh. 2, 652 per month as income tax in his gross income. He receives sh. 2400 medical allowance and sh. 5 800 as house allowance in addition to his basic salary. He is entitled to a personal relief of sh. 10 800 p.a. Use the tax table below to answer the questions below.

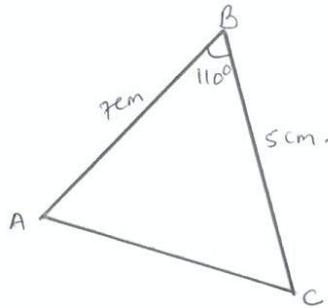
Income £ p. a.	Rate sh./£
1 – 4 000	2
4 0001 – 7 500	3
7501 – 12 000	4
Over 12 000	6

- c) Find his monthly basic salary. (to the nearest shilling). (8 marks)
- d) His net income per month if all other deductions total shs. 3849. (2 marks)
23. Two variable quantities  $R$  and  $t$  are connected by the equation  $R = kt^n$  where  $k$  and  $n$  are constants. The table below gives the values of  $R$  and  $t$ .

R	1.82	2.14	2.51	2.95	3.47	4.17	4.79	5.62	7.59
t	1.58	2.0	2.51	3.16	3.98	5.01	6.31	7.94	12.0

- d) Find a linear equation which connects  $R$  and  $t$ . (2 marks)
- e) On the graph provided, draw a suitable straight line graph to represent the relation in part (a) above. (4 marks)
- f) Hence estimate to one decimal place, the values of  $k$  and  $n$ . (4 marks)

24. Triangle ABC is such that  $AB = 7$  cm,  $BC = 5$  cm and angle  $ABC = 110^\circ$ .



Calculate to 2 decimal places;

- i. The area of the triangle ABC.
- ii. The perimeter of triangle ABC.
- iii. The size of angle ACB.

(2 marks)

(4 marks)

(4 marks)

**MURANGA SOUTH B**  
**END OF TERM II EXAMINATION**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**  
**SECTION I (50 Marks)**

1. Use square roots, reciprocal and square root tables to evaluate to 4 significant figures the expression; (4 marks)

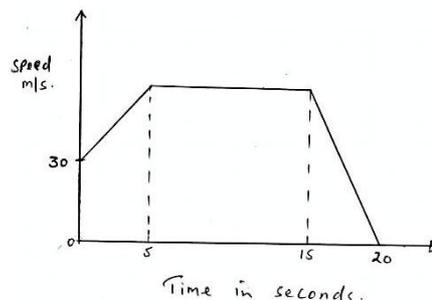
$$(0.06458)^{\frac{1}{2}} + \left(\frac{2}{0.4327}\right)^2$$

2. Find the equation of the perpendicular bisector of line AB where A is (3, 9) and B (7, 5) giving your answer in the form  $ax + by + c = 0$ . (3 marks)
3. It takes 40 road construction workers 8 days working 10 hours a day to complete a section of a road. How many days would 60 road construction workers working 8 hours a day take to complete the same section of the road working at the same rate? (3 marks)
4. A solid cylinder with radius 7 cm and height 5 cm is melted down and recast into a spherical ball. Calculate to 2 decimal places the radius of the ball. (3 marks)
5. The currency exchange rates of a given bank in Kenya are as follows;

Currency	Buying	Selling
1 Sterling pound	135.50	135.97
1 US dollar	72.23	72.65

A tourist arrived in Kenya with 5 000 US dollars which he converted to Kenya shillings. He spent Kshs. 214 500 and converted the remaining to sterling pounds. How many pounds did he receive? (3 marks)

6. Find the value of  $n$  in  $4^{n+1} + 2^{2n+1} = 384$ . (3 marks)
7. The exterior angle of a regular polygon is  $(x - 50)^\circ$  and the interior angle is  $(2x + 20)^\circ$ . Find the number of sides of the polygon. (3 marks)
8. Find  $x$  if  $\cos(3x - 30^\circ) = \sin(7x + 50^\circ)$ . (2 marks)
9. The figure below shows the motion of a particle in 20 seconds. The particle starts off at a speed of 30 m/s and accelerates at  $4 \text{ m/s}^2$  for 5 seconds. Calculate the total distance covered by the particle in 20 seconds. (4 marks)



10. Construct triangle PQR such that  $PQ = 7 \text{ cm}$ ,  $QR = 5 \text{ cm}$  and  $\angle RPQ = 30^\circ$ . Construct the locus  $L_1$  of all points equidistant from P and Q to meet the locus  $L_2$  of points equidistant from Q and R at M. Measure PM. (4 marks)
11. The surface areas of two cylindrical water tanks are  $50 \text{ m}^2$  and  $162 \text{ m}^2$  respectively. Given that the volume of water in the second tank is  $36\,450 \text{ cm}^3$ , find the volume of water in the first tank if it's half full. (4 marks)
12. Solve the inequalities below and represent the solutions on a single number line. (3 marks)
- $$1 - 2x < 5, \quad 5 - 3x \geq -10.$$
13. From the roof of a house, a boy can see an avocado tree which is 20 m away from the house. He measures the angle of elevation of the top of the tree as  $21^\circ$  and the angle of depression of the bottom of the tree as  $31^\circ$ . Find the height of the avocado tree. (3 marks)
14. Simplify (2 marks)
- $$\frac{\sqrt[2]{12x^4y^{-1}z^5}}{\sqrt{3x^{-2}y^{-3}z^3}}$$
15. The position vector of  $\mathbf{p}$  and  $\mathbf{q}$  is  $3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$  and  $2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$  respectively. Determine the column vector  $\mathbf{PQ}$  and hence calculate its length to 2 decimal places. (2 marks)

16. The table below shows the height of 50 bean plants, six weeks after planting.

Height (h) in cm	Cumulative frequency
$h \leq 4$	4
$h \leq 8$	15
$h \leq 12$	31
$h \leq 16$	44
$h \leq 20$	50

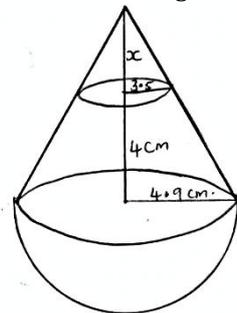
Estimate the mean height of the seedlings.

(4 marks)

### SECTION II (50 Marks)

Answer any five questions in this section in the spaces provided.

17. A trader sold an article at Ksh. 4 800 after allowing a customer a 12% discount on the marked price of the article. In so doing he made a profit of 45%.
- Calculate to 2 decimal places;
    - The marked price of the item. (3 marks)
    - Price at which the trader had bought the article. (2 marks)
  - If the trader had sold the same article without giving a discount, calculate the percentage profit he would have made. (3 marks)
  - To clear his stock, the trader decided to sell all the remaining articles at a loss of 12.5%, calculate the price at which he sold each article. (2 marks)
18. The diagram below represents a solid consisting of a hemispherical bottom and a conical frustum at the top.



- Determine the value of  $x$  and hence the height of the big cone. (2 marks)
  - Calculate the surface area of the solid. (4 marks)
  - Calculate the volume of the solid. (4 marks)
19. (a) Find the equation of a straight line  $L_1$  that passes through the points  $P(-6, -3)$  and  $Q(1, 3)$  in the form  $ay + bx = c$  where  $a$ ,  $b$  and  $c$  are constants. (2 marks)
- (b) A second line  $L_2$  is parallel to  $L_1$  and passes through  $(2, -3)$ . Find the equation of  $L_2$  in the form  $y = mx + c$ . (2 marks)
- (c) A third line  $L_3$  passes through  $(2, 3)$  and is perpendicular to  $L_1$ . Find the equation of  $L_3$  in the form  $ay + bx = c$ . (2 marks)
- (d) Use matrix method to find the coordinates of  $R$  the point where  $L_1$  and  $L_3$  intersect. (4 marks)
20. A factory blends three types of juice in the ratios  $A : B = 3 : 4$  and  $B : C = 1 : 2$
- Determine;
    - The ratio  $A : B : C$  (1 mark)
    - The amount of type A juice in a 20 litre mixture. (2 marks)
  - The cost of producing one litre of A is Ksh. 80, one litre of B is Ksh. 84 and one litre of C is Ksh. 90.
    - Find the cost of producing one litre of the mixture. (2 marks)
    - Calculate the selling price of one litre of the mixture if the factory makes a profit of 25%. (2 marks)
  - The factory uses types of machines P and Q to blend the juices. Machine P takes 7 hours to blend 14 000 litres and Q takes 5 hours to blend 12 000 litres. Determine the time it would take the factory to blend 550 000 litres. (3 marks)
21. A motorist is to follow the route ABCD. B is 250 km from A on a bearing  $N75^\circ E$  from A. C is on a bearing of  $S75^\circ E$  from A and 275 km from B. D is 300 km on a bearing of  $S80^\circ E$  from B. using a scale 1 cm to represent 50 km;
- Show the relative position of ABCD. (4 marks)
  - Determine;
    - The distance of A from C. (2 marks)
    - The bearing of B from C. (1 mark)
    - The distance of A from D. (2 marks)
    - The compass bearing of C from D. (1 mark)
22. Two towns P and Q are 550 km apart. A bus starts from town Q and travels towards P at 8:45 a.m. at an average speed of 80 km/hr. A car starts from P towards Q at 10:00 a.m. at an average speed of 100 km/hr. Calculate:
- The distance covered by the bus before the car starts its journey. (2 marks)

- b. How far from Q the vehicles met. (3 marks)
- c. The time the two vehicles met. (2 marks)
- d. The time the car arrived at town Q. (3 marks)
23. Triangle ABC has vertices A (1, 2) B (2, 3) and C (4, 1) while triangle A'B'C' has vertices A' (1, -2) B' (2, -3) and C' (4, -1).
- a. Draw triangle ABC and A'B'C' on the same grid. (2 marks)
- b. Describe fully a single transformation that maps ABC onto triangle A'B'C' (2 marks)
- c. On the same grid, draw triangle A''B''C'' the image of ABC under a reflection in the line  $y = -x$ . (2 marks)
- d. Draw triangle A'''B'''C''' such that it can be mapped onto triangle ABC by a negative quarter turn about the origin. (2 marks)
- e. Find the matrix of transformation that maps triangle ABC onto triangle A'''B'''C''' (2 marks)
24. An investment group decided to raise Shs. 960 000 to buy a piece of land costing Kshs. 80 000 per hectare. Before they paid, four of them pulled out and those that remained were supposed to pay an additional Kshs. 40 000.
- a. If the initial number of members was  $x$ , write down;
- i. An expression of what each was to contribute originally. (1 mark)
- ii. An expression of what each of remaining members contributed. (1 mark)
- b. Calculate the number of members who were initially in the group using the expression in (a) above. (5 marks)
- c. If the land was sub divided equally, calculate what size each member got. (3 marks)

**MURANGA SOUTH B**  
**END OF TERM II EXAMINATION**  
**121/2**  
**MATHEMATICS**  
**PAPER 2**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**

**SECTION I (50 Marks)**

**Answer all questions in this section**

1. Use logarithms correct to four decimal places to evaluate (4 marks)  

$$\sqrt{\frac{\log 708.4}{76.81 \times 7.034}}$$
2. Make  $y$  the subject of the formula (3 marks)  

$$T = 2\pi \sqrt{\frac{x^2 + y^2}{gx}}$$
3. The length and breadth of a sheet of metal are measured to the nearest centimetre and recorded as 25.0 cm and 16 cm respectively.
  - a) Find the maximum possible error in the area of the sheet of metal. (2 marks)
  - b) Calculate to one decimal place the percentage error in the area of the sheet. (2 marks)
4. Find the value of  $x$  in  $\log(x - 2) + \log(x + 1) = 1 + \log 4$  (3 marks)
5. Evaluate leaving your answer in surd form (3 marks)  

$$\frac{3}{2\sqrt{5} - \sqrt{7}} - \frac{2}{2\sqrt{5} + \sqrt{7}}$$
6. Expand the expression  $(2 - \frac{1}{5}x)^4$  up to the term;
  - a) in  $x^3$  (1 mark)
  - b) Hence use the expansion to evaluate  $(1.96)^4$  correct to 3 decimal places. (2 marks)
7. A quantity  $x$  varies partly as the cube of  $y$  and partly varies inversely as the square of  $y$ . When  $y = 2, x = 108$  and when  $y = 3, x = 259$ . Find the value of  $x$  when  $y = 6$ . (3 marks)
8. Machine A can do a piece of work in 6 hours while machine B can do the same piece of work in 9 hours. Machine A was set to do the work but after  $3\frac{1}{2}$  hours, it broke down and machine B did the rest of the work. Find how many hours machine B took to do the rest of work. (3 marks)
9. Object A of area  $10 \text{ cm}^2$  is mapped onto B of area  $60 \text{ cm}^2$  by a transformation whose matrix is  $\begin{bmatrix} x & 4 \\ 3 & x+3 \end{bmatrix}$ . Find the value of  $x$ . (3 marks)
10. Solve the equation  $4\sin^2x + 4\cos x = 5$  for  $0^\circ \leq x \leq 360^\circ$ , give your answer in degrees. (3 marks)
11. Given that  $A = \begin{bmatrix} 4 & 3 \\ -1 & 2 \end{bmatrix}$  and  $C = \begin{bmatrix} 17 & 17 \\ -4 & 2 \end{bmatrix}$ , find B if  $A^2 + B = C$  (3 marks)
12. Jane bought a new laptop on hire purchase. The cash price of the laptop was Ksh. 56 000. She paid a deposit of Sh. 14 000 followed by 24 equal monthly instalments of sh. 3 500 each. Calculate the monthly rate at which compound interest was charged. (4 marks)
13. Find the radius and the coordinates of the circle whose equation is  $2y^2 - 6x + 10y + 9 = 0$  (3 marks)
14. The 3<sup>rd</sup> term of a geometric sequence is 20 while the 6<sup>th</sup> term is  $-160$ . Calculate the 8<sup>th</sup> term. (3 marks)
15. Given that point A  $(-8, -2)$  and B  $(-4, 2)$ , find the coordinates of point C which divides AB in the ratio 7:  $-3$ . (3 marks)
16. Chords AB and TS of a circle intersect internally at point Q. given that  $QA = 8 \text{ cm}$ ,  $AB = 14 \text{ cm}$  and  $QT = 4 \text{ cm}$ , calculate the length of QS. (2 marks)

**SECTION II (50 Marks)**

**Answer any five questions in this section in the spaces provided.**

17. (a) A fair die and coin are thrown on a horizontal floor.
  - i. List all the possible outcomes. (2 marks)
  - ii. Find the probability of getting even number on the die and a tail on the coin or an odd number on the die and a head on the coin. (3 marks)
  - iii. Find the probability of getting a number greater than or equal to 3 on the die and a head on the coin. (2 marks)

(b) The probability that a student gets an A in mathematics is  $\frac{9}{10}$ . If she gets grade A in mathematics then the probability that she gets grade A in physics is  $\frac{4}{5}$ . If she does not get an A in mathematics, the probability of getting an A in physics is  $\frac{3}{8}$ . Calculate the probability of getting at least one A in the two subjects. (3 marks)

18. (a) Complete the table below for the functions  $y = \sin x$  and  $y = 2\sin(x + 30^\circ)$  for  $0^\circ \leq x \leq 360^\circ$ . (1 mark)

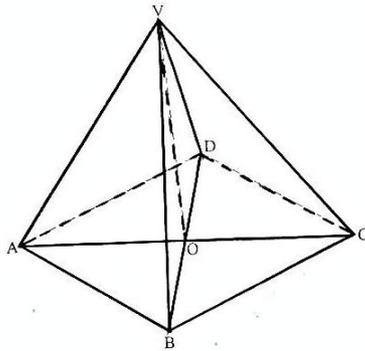
$x^\circ$	$0^\circ$	30	60	90	120	150	180	210	240	270	300	330	360
$\sin x$		0.5	0.87		0.87	0.5	0		-1.87	-1		-0.5	0
$2 \sin(x + 30^\circ)$	1		2	1.73		0	-1	-1.73		-1.73	-1	0	1

(b) On the same axis draw the graphs of  $y = \sin x$  and  $y = 2\sin(x + 30^\circ)$  for  $0^\circ \leq x \leq 360^\circ$  (4 marks)

(c) Use the graph to;

- i. State the amplitude of the graph  $y = 2\sin(x + 30^\circ)$  (1 mark)
- ii. State the period of the graph  $y = \sin x$  (1 mark)
- iii. Solve  $\sin x - 2\sin(x + 30^\circ) = 0$  (1 mark)
- iv. State the transformation that maps  $y = \sin x$  onto  $y = 2\sin(x + 30^\circ)$  (2 marks)

19. The figure below is a square based pyramid with  $AD = DC = 6$  cm and height  $VO = 10$  cm.



- a) State the projection of VA on the base ABCD. (1 mark)
- b) Find;
  - i. The length of VA. (3 marks)
  - ii. The angle between VA and ABCD. (2 marks)
  - iii. The angle between the planes VDC and ABCD. (2 marks)
  - iv. Volume of the pyramid. (2 marks)

20. The table below gives the ages of 56 students in a school.

Age	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34
No. of students	7	10	16	14	6	3

Estimate

- a) The mean age using an assumed of 17 years. (3 marks)
  - b) The interquartile range. (3 marks)
  - c) The standard deviation. (2 marks)
  - d) The percentage of students whose ages are below 25 years. (2 marks)
21. (a) Complete the table below for  $y = 3x^2 + 4x + 6$  (2 marks)

$x$	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
$3x^2 + 4x + 6$											

- (b) Using trapezium rule of 5 strips determine the area under the curve  $y = 3x^2 + 4x + 6$ , the lines  $x = 1$  and  $x = 6$  and the x axis. (2 marks)
- (c) Using mid ordinate rule of 5 strips determine the area under the curve  $y = 3x^2 + 4x + 6$ , the lines  $x = 1$ ,  $x = 6$  and x – axis. (2 marks)
- (d) Find the exact area by integration. (2 marks)
- (e) Find the percentage error in using the trapezium rule. (2 marks)

22. A bookseller has enough money to buy a maximum of 120 books of two types; Atlases and dictionaries. He has to buy twice as many dictionaries as atlases. There must be at most 70 atlases and the number of dictionaries must be atleast 15 but not more than 60.

- a. Taking  $x$  to be the number of atlases and  $y$  the number of dictionaries,
  - i. Write down all the inequalities from the constraints listed above. (4 marks)

- ii. Plot a graph of the above inequalities. (4 marks)
- b. The profit of an atlas is sh. 75 and that of a dictionary is sh. 60. Find the number of each type of book that he should buy in order to make maximum profit. (2 marks)
23. A ( $20^{\circ} S, 105^{\circ} E$ ) and B ( $20^{\circ} S, 75^{\circ} W$ ) are two places on the earth's surface. (Use  $\pi = \frac{22}{7}$ , radius 6370 km)
- a. Calculate
- i. Distance between A and B along the parallel of latitude in km to 1 d.p. (3 marks)
- ii. Distance between A and B via the South Pole in km to 1 d.p. (3 marks)
- b. A plane flies from A to B via the South Pole at a speed of 1 000 nm/hr. Calculate the time taken by the plane. (3 marks)
- c. If the plane left at 7:00 a.m., what is the time at B then? (1 mark)
24. Jane earns a monthly basic salary of Ksh. 20 000 per month, a house allowance of Ksh. 10 000 per month, a medical allowance of Ksh. 3 000 per month and commuter allowance of Ksh 2 500 per month. She receives a tax relief of Ksh. 1 162 per month. The table below shows the tax rates charged that year.

Income in Ksh per month	Rate in %
1 – 9680	10 %
9681 – 18800	15 %
18801 – 27920	20 %
27971 – 37040	25 %
Above 37040	30 %

- a. Calculate Jane's taxable income in Kshs per month. (2 marks)
- b. Calculate Jane's net tax per month. (4 marks)
- c. Jane pays Ksh 200 to NHIF, Ksh 250 to NSSF and she has a bank loan which she pays Ksh 3 000 per month.
- i. Calculate Jane's total deductions. (2 marks)
- ii. Calculate Jane's net salary in Kshs per month. (2 marks)

**MURANGA SOUTH C  
END OF TERM II EXAMINATION  
121/1  
MATHEMATICS  
PAPER 1  
FORM 4  
JULY 2017**

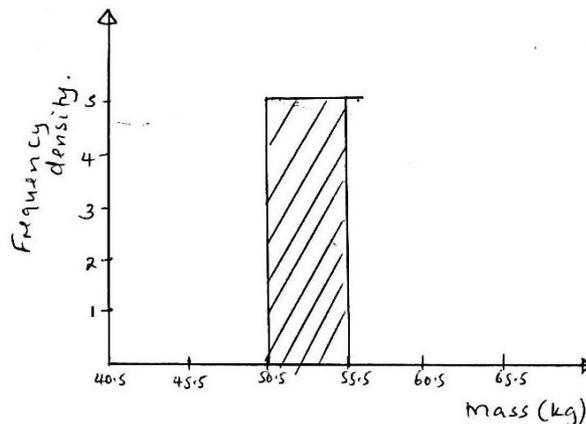
**TIME: 2 1/2 HOURS**

**SECTION I (50 Marks)**

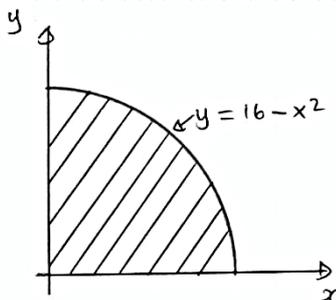
**Answer all questions in this section in the spaces provided.**

- Evaluate  $\frac{-8 \div 2 + 12 \times 9 - 4 \times 6}{56 \div 7 \times 2}$  (3 marks)
- (a) Express 10500 in terms of its prime factors. (2 marks)  
(b) Determine the smallest positive number P such that 10500P is perfect cube. (2 marks)
- Solve the equation  $\sin(3x + 30^\circ) = \frac{\sqrt{3}}{2}$  for  $0^\circ \leq \theta \leq 90^\circ$  (4 marks)
- Find the range of x if  $2 \leq 3 - x < 5$  (2 marks)
- Two towns A and B are 220 km apart. A bus left town A at 11:00 a.m. and travelled towards B at 60 km/hr. At 11:30 a.m., a matatu left town B for town A and travelled at 80 km/hr. Find the time of the day when the two vehicles met. (4 marks)
- The size of an interior angle of a regular polygon is  $3x^\circ$  while its corresponding exterior angle is  $(x - 20)^\circ$ . Find the number of sides of the polygon. (3 marks)
- Given that  $x = -2$ , find the values of y and z for the simultaneous equations. (3 marks)  
 $x + y - z = -1$   
 $x - 2y + z = -7$
- A square whose vertices are P (1, 1), Q (2, 1) R (2, 2) and S (1, 2) is given an enlargement with centre (0, 0). Find the images of the vertices if the scale factor is 3. (3 marks)
- The following data was obtained from the mass of a certain animal. Complete the table and the histogram below. (3 marks)

Mass (kg)	41 - 50	51 - 55	56 - 65
Frequency	20		40



- The position vectors of A and B are  $\vec{a} = 2i - 3j + 4k$  and  $\vec{b} = -2i - j + 3k$  respectively. Find to 2 decimal places the length of vector AB. (3 marks)
- Find the radius and the coordinate of the centre whose equation is  $\frac{1}{2}x^2 + \frac{1}{2}y^2 - 3x + 4y + 6\frac{3}{8} = 0$  (3 marks)
- Find the exact area of the shaded region. (3 marks)

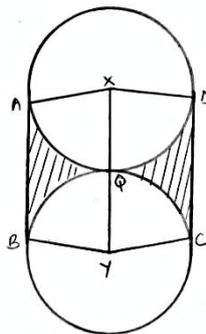


13. Determine the value of  $x$  for which the matrix below is singular  $\begin{pmatrix} x & 4 \\ 1 & x-3 \end{pmatrix}$  (3 marks)
14. Find the values of  $\theta$  in the equation  $2 \sin^2 \theta - 5 \cos \theta + 1 = 0$  for  $0^\circ \leq \theta \leq 360^\circ$  (3 marks)
15. Three business partners Kamau, Njoroge and Mwangi are to share Sh. 12 000 in the ratio 5: 6:  $x$ . If Kamau received Sh. 4 000, determine the value of  $x$ . (3 marks)
16. Factorise  $2x^2y^2 - 5xy - 12$  (3 marks)

**SECTION II (50 Marks)**

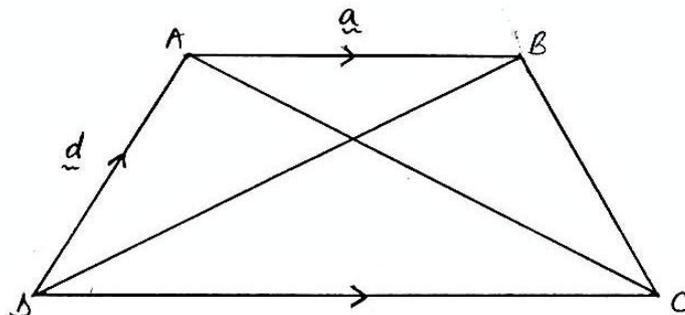
**Answer ANY FIVE questions in the spaces provided.**

17. Two aeroplanes P and Q, leave an airport at the same time. P flies on a bearing of  $240^\circ$  at 900km/h while Q flies due east at 750 km/h.
- a) Using a scale of 1 cm to represent 100 km, make a scale drawing to show the positions of the aeroplanes after 40 minutes. (4 marks)
- b) Use the scale drawing to find the distance between the two areoplanes after 40 minutes (2 marks)
- c) Determine the bearings of;
- i. P from Q (2 marks)
- ii. Q from P (2 marks)
18. The figure below shows two circles each of radius 7 cm with centres at X and Y. the circles touch each other at point Q.



Given that  $\angle AXD = \angle BYC = 120^\circ$  and lines AB, XQY and DC are parallel, calculate the area of;

- a) The minor sector XAQD. (Take  $\pi = \frac{22}{7}$ ) (3 marks)
- b) The trapezium XABY (4 marks)
- c) The shaded region. (3 marks)
19. Given  $y$  is inversely proportional to  $x^n$  and  $k$  as the constant of proportionality;
- a) (i) Write down a formula connecting  $y, x, n$  and  $k$ . (1 mark)
- (ii) If  $x = 2$  when  $y = 12$  and  $x = 4$  when  $y = 3$  write down two expressions for  $k$  in terms of  $n$ , hence, find the value of  $n$  and  $k$ . (7 marks)
- b) Using the value of  $n$  obtained in (a) (ii) above, find  $y$  when  $x = 5\frac{1}{3}$  (2 marks)
20. In the figure below, ABCD is a trapezium. AB is parallel to DC diagonals AC and DB intersect at X and  $DC = 2 AB$ .  $AB = \vec{a}$   $DA = \vec{d}$ ,  $AX = k AC$  and  $DX = h DB$ , where  $h$  and  $k$  are constants.



- c) Find in terms of  $\vec{a}$  and  $\vec{d}$ ;
- i. BC (2 marks)
- ii. AX (2 marks)
- iii. DX (1 mark)
- d) Determine the values of  $h$  and  $k$ . (5 marks)
21. (a) Complete the table given below for the equation  $y = 5 + 3x - 2x^2$  by filling in the blank spaces. (3 marks)

X	-2	-1.5	-1	-0.5		0.5	1	1.5	2	2.5	3	3.5
Y	-9			3		6	6	5			-4	

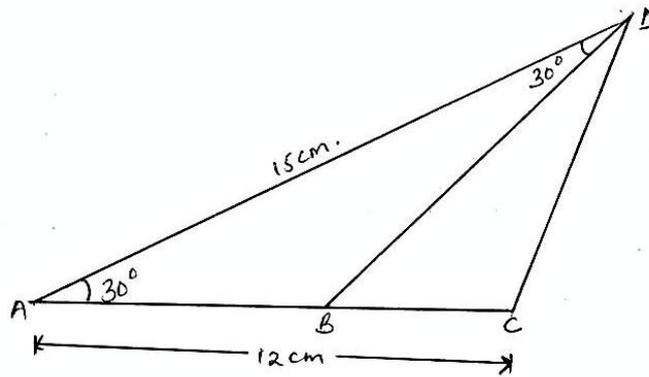
- (b) Use the values from the table above to draw the graph of  $y = 5 + 3x - 2x^2$  (4 marks)

(c) Use your graph to determine the ranges of values of  $x$  which satisfy the equation

(3 marks)

$$5 + 3x - 2x^2 \leq -2$$

22. In the figure below,  $AC = 12$  cm,  $AD = 15$  cm and  $B$  is a point on  $AC$ ,  $\angle BAD = \angle ADB = 30^\circ$



Calculate to 2 d.p.

- a) The length of CD. (3 marks)
  - b) The length of AB. (3 marks)
  - c) The area of the triangle BCD. (2 marks)
  - d) The size of  $\angle BDC$ . (2 marks)
23. The product of the first three terms of a geometric progression is 64. If the first term is  $a$  and the common ratio is  $r$
- a) Express  $r$  in terms of  $a$ . (3 marks)
  - b) Given that the sum of the three terms is 14;
    - i. Find the values of  $a$  and  $r$  and hence write down two possible sequences each up to 4<sup>th</sup> term. (5 marks)
    - ii. Find the product of the 50<sup>th</sup> term of the two sequences. (2 marks)
24. Two towns A and B are 80 km apart. Juma started cycling from town A to town B at 10.00 a.m. at an average speed of 40 km/h. Mutuku started his journey from town B to A at 10.30 a.m. and travelled by car at an average speed of 60 km/h.
- c) Calculate;
    - i. The distance from town A when Juma and Mutuku met. (5 marks)
    - ii. The time of the day when the two met. (2 marks)
  - d) Kamau started cycling from town A to town B at 10.21 a.m. He met Mutuku at the same time as Juma did. Determine Kamau's average speed. (3 marks)

**MURANGA SOUTH C**  
**END OF TERM II EXAMINATION**  
**121/2**  
**MATHEMATICS**  
**PAPER 2**  
**FORM 4**  
**JULY 2017**  
**TIME: 2 1/2 HOURS**

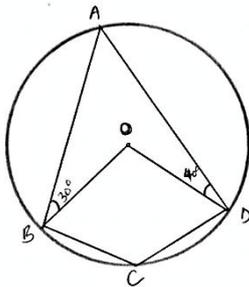
**SECTION I (50 Marks)**

Answer all questions in this section in the spaces provided.

- Use logarithms to evaluate; (4 marks)  

$$\left( \frac{6.79 \times 0.3911}{\log 5} \right)^{\frac{3}{4}}$$
- The equation of a line is  $-\frac{3}{5}x + 3y = 6$ . Find the
  - Gradient of the line. (1 mark)
  - Equation of a line passing through point  $(-1, 2)$  and perpendicular to the given line. (3 marks)
- A shirt whose marked price is sh. 800 is sold to a customer after allowing him a discount of 13%. If the trader makes a profit of 20%, find how much the trader paid for the shirt. (3 marks)
- Simplify  $\frac{\sqrt{11}}{\sqrt{11}-\sqrt{7}}$  (2 marks)
- The length and width of a rectangular signboard are  $(3x + 12)$  cm and  $(x - 4)$ cm respectively. If the diagonal of the signboard is 200 cm, determine its area. (4 marks)
- Find the value of  $x$  given that; (3 marks)  
 $\log(x - 1) + 2 = \log(3x + 2) + \log 25$
- Use the expansion of  $(x - y)^5$  to evaluate  $(9.8)^5$  correct to 4 d.p. (3 marks)
- Evaluate  $\int_2^4 (x^2 + 2x - 15) dx$  (3 marks)
- Make  $y$  the subject of formula: (3 marks)  

$$P = \frac{xy}{x - y}$$
- In the figure below, ABCD is a cyclic quadrilateral. Point O is the centre of the circle.  $\angle ABO = 30^\circ$  and  $\angle ADO = 40^\circ$ .

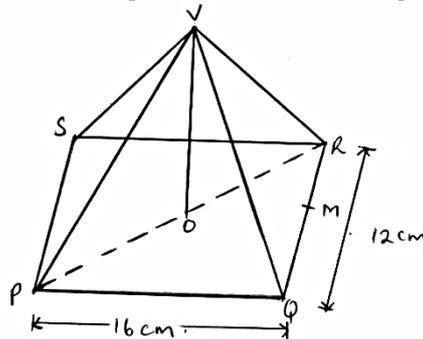


- Calculate the size of angle BCD. (2 marks)
- Find the number of terms of the series  $2 + 6 + 10 + 14 + 18 \dots$  that will give a sum of 800. (2 marks)
  - A bag contains 10 balls of which 3 are red, 5 are white and 2 are green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and then a ball chosen at random from the bag. Find the probability that the ball chosen is red. (3 marks)
  - The point  $(5, 2)$  undergoes the transformation  $\begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$  followed by a translation  $\begin{pmatrix} -6 \\ 11 \end{pmatrix}$ . Determine the coordinates of the image. (3 marks)
  - The latitude and the longitude of two stations A and B are  $(47^\circ N, 25^\circ E)$  and  $(47^\circ N, 70^\circ E)$ . Calculate the distance in nautical miles between A and B along latitude  $47^\circ N$ . (3 marks)
  - Using a ruler and a pair of compass only;
    - Construct a parallelogram PQRS in which  $PQ = 6$  cm, and  $QR = 4$  cm and  $\angle SPQ = 75^\circ$  (3 marks)
    - Determine the perpendicular distance between PQ and SR. (1 mark)
  - The mass of a mixture A of beans and maize is 72 kg. The ratio of beans to maize is 3:5 respectively.
    - Find the mass of maize in the mixture. (1 mark)
    - A second mixture B of beans and maize of mass 98 kg is mixed with A. The final ratio of beans to maize is 8:9 respectively. Find the ratio of beans to maize in B. (3 marks)

**SECTION II (50 Marks)**

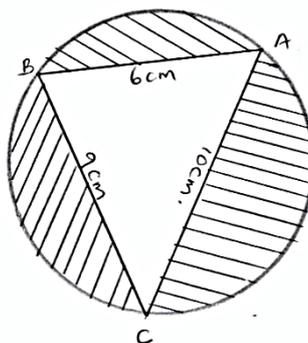
**Answer any five questions in the spaces provided in this section**

17. Given the simultaneous equations  
 $5x + y = 19$   
 $-x + 3y = 9$
- a) Write the simultaneous equations in matrix form. Hence solve the simultaneous equations. (6 marks)
- b) Find the distance of the point of the intersection of a line  $5x + y = 19$  and  $-x + 3y = 9$  from the point  $(11, -2)$  (4 marks)
18. A particle was moving along a straight line. The acceleration of the particle after  $t$  seconds was given by  $a = (9 - 3t)ms^{-2}$ . The initial velocity of the particle was  $7 m/s$ . Find:
- a) The velocity ( $V$ ) of the particle at any given time ( $t$ ). (4 marks)
- b) The maximum velocity of the particle. (3 marks)
- c) The distance covered by the particle by the time it attained maximum velocity. (3 marks)
19. The figure below represents a right pyramid with vertex  $V$  and a rectangular base  $PQRS$ .  $VP = VQ = VR = VS = 18 cm$ ,  $PQ = 16 cm$  and  $QR = 12 cm$ .  $M$  and  $O$  are the mid points of  $QR$  and  $PR$  respectively.



Find;

- a) The length of the projection of line  $VP$  on the plane  $PQRS$ . (3 marks)
- b) The size of the angle between line  $VP$  and the plane  $PQRS$ . (3 marks)
- c) The size of the angle between the planes  $VQR$  and  $PQRS$ . (4 marks)
20. Two towns  $A$  and  $B$  lie on the same latitude in the northern hemisphere. When it is 8:00 a.m. at  $A$ , the time at  $B$  is 11:00 a.m.
- a) Given that the longitude of  $A$  is  $15^\circ E$ , find the longitude of  $B$ . (3 marks)
- b) A plane leaves  $A$  for  $B$  and takes  $3\frac{1}{2}$  hours to arrive at  $B$  travelling along a parallel of latitude at  $850 km/h$ . Find,
- i. The radius of the circle of latitude of towns  $A$  and  $B$ . (4 marks)
- ii. The latitude of the two towns. (3 marks)
21. The gradient function of a curve is given by the expression  $2x + 1$ . If the curve passes through the point  $(-4, 6)$ ,
- a) Find;
- i. The equation of the curve. (3 marks)
- ii. The values of  $x$  at which the curve cuts the  $x$ -axis. (3 marks)
- b) Determine the area enclosed by the curve and the  $x$ -axis. (4 marks)
22. The transformation  $A$  given by the matrix  $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$  maps  $\begin{pmatrix} 17 \\ 0 \end{pmatrix}$  to  $\begin{pmatrix} 15 \\ 8 \end{pmatrix}$  and  $\begin{pmatrix} 0 \\ 17 \end{pmatrix}$  to  $\begin{pmatrix} -8 \\ 15 \end{pmatrix}$
- a) Determine the matrix  $A$  giving  $a, b, c$  and  $d$  as fractions. (4 marks)
- b) Given that  $A$  represent a rotation through the origin, determine the angle of rotation. (3 marks)
- c)  $S$  is a rotation through  $180^\circ$  about the point  $(2, 3)$ . Determine the image of  $(1, 0)$  under followed by  $A$ . (3 marks)
23. The figure below shows a triangle  $ABC$  inscribed in a circle (not drawn to scale.)  $AB = 6 cm$ ,  $BC = 9 cm$  and  $AC = 10 cm$ .



Calculate;

- a) The radius of the circle. (6 marks)
- b) The area of the shaded parts. (4 marks)
24. In an experiment involving two variables  $t$  and  $r$ , the following results were obtained.

$t$	1.0	1.5	2.0	2.5	3.0	3.5
$r$	1.50	1.45	1.30	1.25	1.05	1.00

- a) On the grid provided, draw the line of best fit for the data. (4 marks)
- b) The variables  $r$  and  $t$  are connected by the equation  $r = at + k$  where  $a$  and  $k$  are constants. Determine;
- The values of  $a$  and  $k$ . (3 marks)
  - The equation of the line of best fit. (1 mark)
  - The value of  $t$  when  $r = 0$ . (2 marks)

**IMENTI CENTRAL**  
**121/1**  
**MATHEMATICS, ALT.A**  
**PAPER 1**  
**JULY 2017**  
**2 ½ Hours**

**SECTION I (50 MARKS)**

Answer all the questions in this section in the spaces provided.

1. A mixed day secondary school has eleven teachers. The number of girls in the school is eighteen times the number of teachers. The number of boys is 54 more than the number of girls in the school. On 2<sup>nd</sup> June this year  $\frac{1}{3}$  of the girls and  $\frac{1}{4}$  of the boys visited Meru Agricultural show. Find the number of students that remained in the school that day. (3mks)

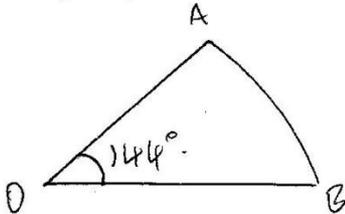
2. Simplify  

$$\frac{9x^3 - xy^2}{3x^2 + 2xy - y^2}$$
 (3mks)

3. A fruit juice dealer sells the juice in packets of 300mls and 750 mls. Find the size of the smallest container that can fill each of the packets and leaver a remainder of 200 mls. (2mks)
4. Use logarithms correct to four decimal places to evaluate. (4mks)

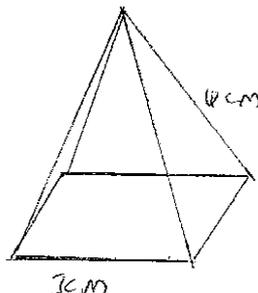
$$\left(\frac{78.37+1.53}{0.618 \times 42.17}\right)^{-\frac{1}{3}}$$

5. The figure below shows a sector of a circle with centre O. Arc Ab is 26.4 cm.



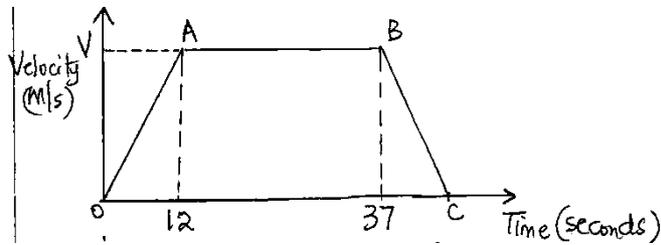
Determine:

- (a) The radius of the sector. ( $\pi = \frac{22}{7}$ ) (2mks)
- (b) The perimeter of the sector. (1mk)
6. The masses of two similar pieces of wood are 32g and 0.5kg respectively. If the area of the cross-section of the small wood is 48cm<sup>2</sup>, find the cross-section area of the larger wood. (3mks)
7. Use tables of square roots, cubes and reciprocals to evaluate correct to 4 decimal places. (4mks)
- $$\frac{3}{\sqrt{42.15}} + \frac{4}{(3.152)^3}$$
8. A line L passes through point A(2,6) and B(-4,10). Find:
- (i) The gradient of line L. (1mk)
- (ii) The equation of the perpendicular bisector of line L taking A and B as its end points. (3mks)
9. Kanini is paid a commission of 2% for sales she makes and a salary of ksh 12,000. On a certain month her total earnings was ksh. 16,480. Calculate her total sales that month. (3mks)
10. The diagram below represent a right pyramid on a square base of side 3 cm. The slant height of the pyramid is 4cm.



- (a) Draw a net of the pyramid. (2mks)
- (b) On the net drawn measure the height of the triangular face. (1mk)
11. The sum of interior angles of a regular polygon is 1440°. Find the number of sides of the polygon and hence name the polygon. (3 mks)

12. OABC is a velocity-time graph of a motorist.



If the distance covered by the motorist in the first 37 seconds is 558 metres, find:

- (a) The value of V. (1mk)
  - (b) The total time for the journey if the final deceleration is  $9 \text{ m/s}^2$ . (2mks)
13. If  $\vec{OA} = 7\mathbf{i} - 4\mathbf{j} + 4\mathbf{k}$  and  $\vec{OB} = 2\mathbf{i} - 5\mathbf{j} + 7\mathbf{k}$ , find  $|2\mathbf{a} - 3\mathbf{b}|$  correct to two decimal places. (3mks)
14. Solve the following inequalities and state the integral values of X. (3mks)

$$7x - 4 \leq 9x + 2 < 3x + 14$$

15. Without using a calculator evaluate (3mks)

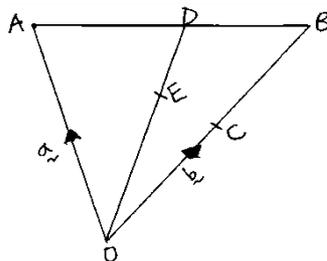
$$\frac{2^{5/6} \times 2^{1/34} - 9^{3/4} \div 3^{5/7}}{2/3 \text{ of } 12 - (1\frac{1}{3} + 1\frac{1}{4})}$$

16. The mass of a mango juice is 384g and its density is  $0.6 \text{ g/cm}^3$ . If the juice is stored in a cylindrical container of diameter 6.4cm, find the height of the cylindrical container. (3mks)

**SECTION II (30 MARKS)**

Answer only five questions in this section in the spaces provided.

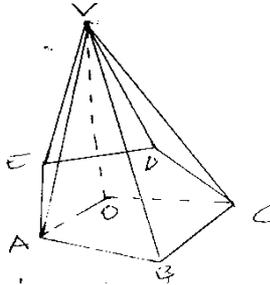
17. The ministry of sports in Meru central sub-county decided to distribute its finances among three departments; volleyball, football and hockey. The ratio of distribution was volleyball to football 2:3 and football to hockey 5:2. The hockey department received ksh. 288,000.
- (a) Find the amount received by volleyball department. (4mks)
  - (b) The football department decided to organize a tournament in which 21 teams participated. The department spent  $\frac{1}{5}$  of its share in buying balls each at sh 4,500. Determine the number of balls that were bought. (3mks)
  - (c) The football department spent 30% of the remaining amount in officiating and awarding the winners. The remaining amount was used to buy uniforms for all the 21 teams that participated in the competition. Determine the cost of one team's uniform. (3mks)
18. The figure below shows OAB in which  $AD:DB = 2:1$ ;  $OE:ED = 3:2$  and C is the midpoint of OB.



Given that  $\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$ ,

- (a) Express the following vectors in terms of a and b.
    - (i)  $\vec{AB}$  (1mk)
    - (ii)  $\vec{OD}$  (2mks)
    - (iii)  $\vec{AE}$  (2mks)
  - (b) (i) Show that points A, E and C are collinear. (4mks)  
 (ii) State the ratio of AE : EC. (1mk)
19. Four towns Amani, Baraka, Chema and Dalili are such that Baraka is at a distance of 750 km on a bearing of  $050^\circ$  from Amani. Chema is 500 km on a bearing of  $340^\circ$  from Baraka while Dalili is on a bearing of  $570^\circ\text{W}$  a distance of 1250 km from Chema.
- (a) Using a scale of 1 cm to represent 125 km draw a diagram to represent the four towns. (4mks)
  - (b) From the diagram find:
    - (i) The distance of Amani from Chema. (2mks)
    - (ii) Compass bearing of Amani from Dalili. (1mk)
  - (c) A pilot flew from Dalili at 7.30 a.m. to Amani directly at a speed of 250km/h. At what time did he arrive at Amani. (3mks)

20. Triangle PQR has vertices at P(3,2), Q(-1,1) and R(-3, -1).  
 (a) Draw triangle PQR on the grid provided. (1mk)  
 (b) Under a rotation, the vertices of triangle P'Q'R' are P'(1,0), Q'(0,4) and R'(-2,6). Find the centre and angle of rotation by construction. (4mks)  
 (c) Triangle PQR is enlarged with scale factor 3 with centre (0,0) to give triangle P''Q''R''. Draw triangle P''Q''R''.  
 (d) Triangle P'Q'R' undergoes reflection in the line  $y + x = 0$  to give triangle P'''Q'''R'''. Draw triangle P'''Q'''R''' and state its coordinate. (3mks)
21. The figure below shows a right pyramid VABCDE with a regular pentagonal base ABCDE.  $VA = VB = VC = VD = VE = 50$  cm and  $VO = 48$ cm.



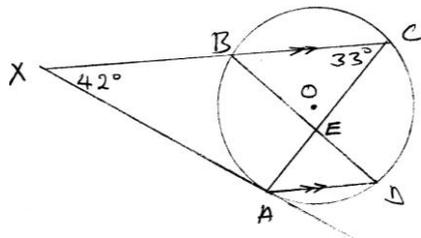
- (a) Calculate the length AO. (1mk)  
 (b) Calculate correct to two decimal places:  
 (i) The base area of the solid. (2mks)  
 (ii) The total surface area of the solid. (4mks)  
 (c) The above pyramid was melted and then recasted to form a sphere. Calculate the radius of the sphere formed correct to 1 decimal place. (3mks)
22. 560 youth groups in a certain country were to be funded by the government. The groups were such that each county had the same number of groups. Before the funding of the groups occurred, there was a change in government in the country. The new government increased the number of counties by 5 and each county governor was required to reduce the number of groups in his/her county by 2. As a result, the number of groups in the country remained the same.  
 (a) By taking  $y$  to be the number of groups per county before change in government, form an expression for:  
 (i) Number of counties before change in government. (1mk)  
 (ii) Number of counties after change in government. (1mk)  
 (b) Form an equation from the expressions in (a) above and determine the number of counties that were formed by the new government. (5mks)  
 (c) Only 360 groups in the country were active one year after being funded. If 360 groups were distributed equally in each county, find the number of groups in any given county that had collapsed a year after being funded. (3mks)
23. Onyango and Juma live 190 km apart. One day Onyango left his house at 7.00a.m. and travelled toward Juma's house at an average speed of 30km/h. Juma left his house at 7.30a.m. on the same day and travelled towards Onyango's house at an average speed of 40km/h.  
 (a) Determine:  
 (i) The time they met. (4mks)  
 (ii) The distance from Onyango's house where they met. (2mks)  
 (iii) How far was Onyango from Juma's house when they met? (1mk)  
 (b) The two men took 15 minutes at the meeting point and then travelled to Juma's house. If they arrived at 1335 hours, find the speed at which they travelled. (3mks)
24. The distance of a particle from a point P moving in a straight line is given by  
 $S = \frac{1}{3}t^3 - 2t^2 + 3t + 5$   
 Find :  
 (a) The distance covered by the particle from P after six seconds. (2mks)  
 (b) The value of  $t$  when the particle is momentarily at rest. (3mks)  
 (c) The minimum velocity attained by the particle. (3mks)  
 (d) The acceleration of the particle after 4 seconds. (2mks)

**IMENTI CENTRAL**  
**121/2**  
**MATHEMATICS, ALT.A**  
**PAPER 2**  
**JULY, 2017**  
**2 ½ HOURS**  
**SECTION I (50 MARKS)**

**Answer ALL the questions in this section in the spaces provided.**

- The radius and height of a cylinder are stated as 21.7cm and 15.6cm respectively. Find the percentage error in calculating its volume (3marks)
- Make  $f$  the subject of the formula. (3marks)  

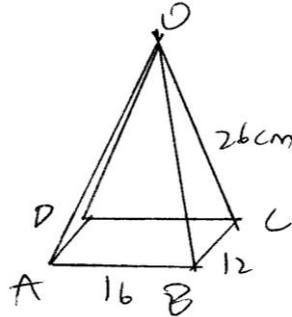
$$V = \sqrt{\frac{m}{f^2}} - t$$
- Find the sum of the 11<sup>th</sup> term to 20<sup>th</sup> term of the series. (3marks)  
 $1 \times \frac{1}{2} \times 0 - \frac{1}{2} \times \dots$
- Use binomial tables to evaluate. (3marks)  
 $(\sqrt{5} + \sqrt{2})^5 - (\sqrt{5} - \sqrt{2})^5$
- Solve for  $x$  in the equation (3marks)  
 $\log(15 - 5x) - 1 = \log(3x - 2)$
- Given that  $3y = 4 \cos\left(\frac{2}{3}\theta - 60\right)$ , find the; (1mark)  
 a) Amplitude. (2marks)  
 b) Period. (2marks)
- Find the point of intersection of the line  $2x - 3y = 21$  and  $5x + y = 10$  using matrix method. (4marks)
- Below, angle  $AXB=42^\circ$  and  $ACB=33^\circ$ .  $XC$  is parallel to  $AD$ ;  $O$  is the centre of the circle.



Calculate the size of angles.

- ABX (2marks)
  - AEB (2marks)
- a) Construct two circle centre P and Q radii 4 and 1.5cm respectively. The distance between their centre is 9cm.  
 b i) Construct a common external tangent to the two circle. (2marks)  
 ii) Measure the tangent. (1mark)
  - a curve is given by the equation  
 $y=4X^3-6X^2 \times 3 \times 2$   
 Find the;  
 a) Gradient of the curve at  $X=1$  (2marks)  
 b) Equation of the normal to the curve at the point (1, 3) (2marks)
  - A variable R varies as the square of t and inversely as the square root of m. what is the percentage change in R if  $t$  is increased by 15% and m decreased by 36%. (4marks)
  - Three business partners Kinyua, Nteere and Mary are to share sh.28, 000 in the ratio 5:3: m respectively. If Kinyua received ksh.10 000, determine the value of m. (2marks)
  - Solve for X in  $2 \cos^2 x \times \sin x - 1=0$ .  
 Where  $0 \leq x \leq 360^\circ$  (4marks)

14. OABCD is a right pyramid on a rectangular base ABCD  
 AB=16cm, BC=12cm, OA=OB=OC=OD=26cm.



- Calculate the angle between OC and ABCD. (3marks)
15. A house appreciates at the rate of 12%p.a. if it was valued at ksh.90 000 at the beginning of January 1998, calculate its value at the end of December 2013. (2marks)
16. The local time at town P ( $10^{\circ}50'S, 14^{\circ}E$ ) is 10:34am while the local time at town Q that lies on latitude  $70^{\circ}N$  is 7:14am. Find the position of town B. (3marks)

**SECTION II (50 MARKS)**

17. A community water tank is in the shape of a cuboid at base 8m by 5m and height 6m. A feeder pipe of diameter 14cm supplies water to this tank at the rate of 40cm/sec.
- a) Calculate the;
- Capacity of the tank in litres. (2marks)
  - Amount of water, in litre delivered to this tank in one hour. (3marks)
  - Amount of water, in litre delivered to this tank in one hour. (2marks)
- b) Each family consumes an average of 150 litres per day and the community consumes a full tank a day. If each family pays uniform rate of sh.350 per month, find the total amount of money due monthly. (3marks)
18. The table below shows income tax rate in 2017.

Monthly income (ksh)	Rate(%)
0-11,180	10
11,181-21,713	15
21,714-32,246	20
32,247-42,779	25
42,780 and above	30

Each employee in the year 2017 was entitled to a tax relief of ksh.1, 280 per month. Mrs.Marete paid a net income tax of ksh.5, 963.05 in the month of March 2017.

- a) Determine:
- Her gross tax during the month. (1mark)
  - Her taxable income during that month. (5marks)
- b) Mrs.Marete's taxable income included a house allowance of ksh.9, 600 and a commuter allowance of ksh.2, 400. If Mrs.Marete had the following deductions in addition to income tax;
- NHIF ksh.1, 100
  - Loan repayment ksh.3,500
  - WCPS 2% of her basic salary
- Calculate her net earning during that month. (4marks)
19. A transport company run a fleet of two types of buses operating between Meru and Nairobi. A coach bus carries 52 passengers and 200kg of luggage. A mini-bus carries 32 passenger and 300kg of luggage. On one Saturday there were 500 passengers with 3 500kgs of luggage to be transported. The company could only use a maximum of 15 buses altogether.
- a) If the company uses  $x$  coach bus and  $y$  mini-bus, write down all the inequalities satisfied by the given condition. (4marks)
- Represent the inequalities graphically, on the grid provided. Use scale: 1cm to represent 1 unit. (3marks)
  - Use your graph to determine the smallest number of bus that could be used. (1mark)
- c) If the cost of running one coach bus is sh.7 200 and that of running one mini-bus is sh.6 000, find the main cost running the bus. (2marks)
20. a) Sketch the graph of  $y = 8 - 2x - x^2$  (1mark)
- b) With 6 strips, use mid-ordinate rule to estimate the area enclosed by the curve  $y = 8 - 2x - x^2$  and X-axis. (4marks)

- c) Using integration, find the exact area enclosed by the curve  $y = 8 - 2x - x^2$  (3marks)  
 d) Find the percentage error that occur by using mid-ordinate rule. (2marks)

21. The table below shows the mark obtained by student in grand final in mathematics contest

Mark	No.of students
1-10	3
11-20	13
21-30	20
31-40	48
41-50	73
50-60	105
61-70	108
71-80	160
81-90	50
91-100	20

- a) Calculate the  
 i) Median mark (3marks)  
 ii) Interquartile range (4marks)  
 b) If 55% of the students passed the test, find the pass mark (3marks)
22. John works in a company and he stays alone he usually sets the alarm clock to wake him up in the morning. The probability that he remembers to set the alarm before going to sleep is  $1/4$ . If he does not set the alarm, he never wake up before 6.30am. if he sets the alarm for 6.00am, the probability that it wakes him up is only 0.9. When he wakes up at 6.00am, he is never late for work, but if he wakes up at 6.30am, the probability that he will be late for work is 0.8. Calculate the probability that;
- a) John wakes up at 6.00am. (2marks)  
 b) He forgets to set the alarm at the night before but manages to reach the company on time. (2marks)  
 c) He sets the alarm but it fails to wake him up and yet reaches company punctually. (2marks)  
 d) He is late for work. (4marks)
23. Using a ruler and a pair of compasses only, construct triangle PQR in which  $PQ=9\text{cm}$   $QR=8.0\text{cm}$  and angle  $QPR=60^\circ$ . (2marks)
- b) On the same side of PQ as R;  
 i) Construct the locus of a point A such that angle  $PAQ=60^\circ$ . (3marks)  
 ii) Construct the locus of B such that  $PB>4.5\text{cm}$  within the triangle. (2marks)  
 iii) Determine the locus of T such that angle  $PRT \geq$  angle  $QRT$ . (2marks)

24. i) Complete the table below for the function.

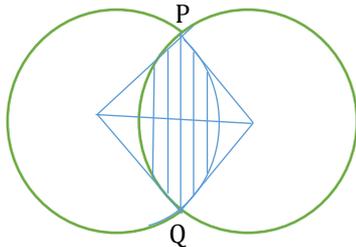
$y = x^3 + 4x^2 - x - 6$  for  $-5 \leq x \leq 3$  (2marks)

X	-5	-4	-3	-2	-1	0	1	2	3
y	-26					-6			54

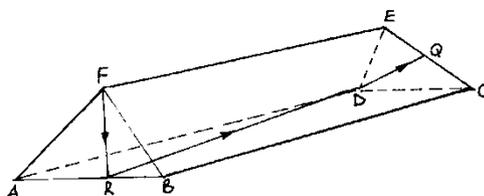
- ii) On the grid below, draw the graph of  $y = x^3 + 4x^2 - x - 6$  (3marks)  
 Scale: horizontal **1cm** represents **1unit**  
 Vertical **1cm** represents **5 units**
- b) Use your graph to solve the following equations.  
 i)  $x^3 + 4x^2 - x - 6 = 0$  (1mark)  
 ii)  $-x^3 - 4x^2 + 2x + 9 = 0$  (4marks)

**MOKASA**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**  
**2017**  
**2 ½ HOURS**  
**SECTION I (50 MARKS),**

1. Simplify  $\frac{1}{2} \text{ of } 4\frac{2}{5} \div \frac{1}{3} - 2\frac{1}{5}$  (3mks)  
 $3\frac{2}{5} + 7\frac{4}{5} \div 1\frac{1}{12}$
2. Use logarithms table to evaluate  $\left(\frac{0.275 \times 563}{456.5(33 + \log 4.5)}\right)^{\frac{1}{5}}$  (4 mks)
3. Given that  $8^{2n} \times 3^m = 36$ , find the values of n and m. (3mks)
4. The perimeter of a triangle is given as 32cm. Two sides of the triangle are 10cm and 8cm respectively, find the length of the third side, hence find the area of the triangle. (3mks)
5. Factorize and simplify the expression (3mks)  
 $\frac{x^2 + 6x + 9}{3x^2 - 27}$
6. Express the inequalities  $\frac{1}{3}x - 4 \leq 7 + 2x \leq 4 + \frac{1}{4}x$  in the form  $p \leq x \leq q$  hence state the integral values (3mks)
7. A number P is formed by writing all the prime numbers between 40 and 50 in descending order. If K is arrived by adding 20 to P. Perform divisibility test of 11 for the number K. (3mks)
8. Twenty one minutes, fifteen minutes and nine minutes are the intervals at which three sirens ring. The sirens will next ring together 5.00 p.m. Find the time the sirens had last rang together. (3mks)
9. Two similar cylindrical containers are such that the capacity of the larger container is 5 litres and that of the smaller is 320 millilitres. If the base area of the larger container is  $0.25 \text{ m}^2$ . Find the base area of the smaller container. (3mks)
10. Ksh 10,000 is invested for a period of 4 years. The total amount accrued is Ksh 14,800. Calculate the rate of simple interest per annum for that investment. (3mks)
11. The figure below shows two equal intersecting circles with common chord PQ and centres A and B. Given that  $AP = PB = 10 \text{ cm}$  and the common chord  $PQ = 15 \text{ cm}$ . Calculate the area of the shaded part (4mks)



12. Given that  $\cos A = \frac{16}{25}$ , without using mathematical table or calculator find:  
 i)  $\sin A$  (2mk)  
 ii)  $\tan (90-A)$  (1mk)
13. Use reciprocal and square root tables to evaluate  $\frac{0.3}{0.0351} + \sqrt{0.498}$  (3mks)
14. A trader mixes 50 kg of beans costing sh.38 per kilogram with 150 kg of beans costing sh. 34 per kilogram. At what price per kilogram must he sell the mixture to make a profit of 30% (3mks)
15. The angle of elevation of the top of a vertical tower from a point A on a horizontal level as the foot of the tower is  $40^\circ$ . From a point B in direct line between A and the foot of the tower and at a distance 10 m from A the angle of elevation to the top of the tower is  $60^\circ$ . Find the height of the tower (3mks)
16. The figure below shows a triangular prism ABCDEF. Its cross-section is an equilateral triangle of sides 3cm and its length is 5cm. A string runs from F to Q through R and D.



a) Draw a well labelled net of the solid such that the string is not cut

(3mks)

17.

a) A straight line  $L_1$  passes through the points  $(-2,4)$  and  $(3,0)$ . Find the equation of line  $L_1$  in the form  $\frac{x}{a} + \frac{y}{b} = 1$

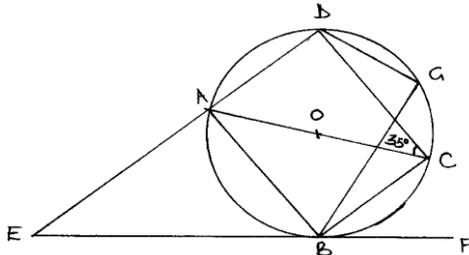
(3mks)

b) Another line  $L_2$  passes through the points  $(5,6)$  and  $(3,0)$ . Find the acute angle between lines  $L_1$  and  $L_2$  at the point of intersection.

(4mks)

c) Find the equation of a line perpendicular to  $L_1$  and passing through  $(2,1)$  in the form  $y=mx+c$  (3mks)

18. In the figure below  $AOC$  is a diameter of the circle centre  $O$ .  $AB = BC$  and  $\angle ACD = 35^\circ$ ,  $EBF$  is a tangent to the circle at  $B$ .  $G$  is a point on minor arc  $CD$ .



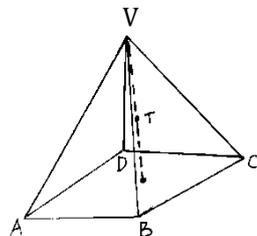
Calculate the size of the following angles giving reasons in each case.

- (a)  $\angle BCD$ . (2mks)
- (b) Obtuse angle  $BOD$ . (2mks)
- (c)  $\angle BAD$ . (2mks)
- (d)  $\angle CGD$ . (2mks)
- (e)  $\angle AEB$ . (2mks)

19. A matatu left town A at 8.00 a.m. and travelled towards town B at an average speed of 75 km/h. At the same time, a car left town B and travelled towards town A at an average speed of 80 km/h. The distance between the two towns is 160 km. Calculate;

- (a) The time the matatu arrived at its destinations. (2mks)
- (b) After travelling for 30 minutes the car got a puncture which took 30 minutes to repair then it continued with the journey with its initial speed. Find the time they met. (6mks)
- (c) find the time the car arrived at its destination. (2mks)

20. The right pyramid with a rectangular base below has  $AB = 12\text{cm}$  and  $BC = 16\text{cm}$ .  $O$  is the centre of the base with  $OV = 15\text{cm}$ .



- a. Calculate the surface area of the pyramid (5mks)
- b. The pyramid is chopped at point  $T$  to form a frustum such that  $T$  divides  $OV$  in the ratio 2:1. Find the volume of the frustum. (5mks)

21. The temperature outside a school was measured at regular intervals on 80 occasions. The frequency distribution is as shown.

Temperature $x$ (°C)	(f)
30.0 - 30.2	6
30.3 - 30.5	12
30.6 - 30.8	15
30.9 - 31.1	20
31.2 - 31.4	13
31.5 - 31.7	9
31.8 - 32.0	5

a. Use the above data to calculate:

- i) mean (3mks)
- ii) median (3mks)

22. Draw a histogram to represent the information on the grid below (4mks)

23. A plane B is on a bearing of  $080^\circ$  from airport A and at a distance of 96 km. Another plane is stationed at airport D which is on a bearing of  $S20^\circ W$  from airport A and a distance of 124 km from B. A plane leaves B and moves directly due south to P which is on a bearing of  $S40^\circ E$  from A.

a) Using a scale of 1 cm rep 20 km, make a scale drawing to show the relative positions of A, B, D and P. (4mks)

- b) Hence find:
- i) Distance from A to D (2mks)
  - ii) True bearing of D from B (1mk)
  - iii) Compass bearing of P from D (1mk)
  - iv) Distance from P to D (2mks)

23. A triangle ABC A (2, 1) B (3, 3) C (4, 1) is enlarged to A'B'C' through a scale factor 2 about the origin.

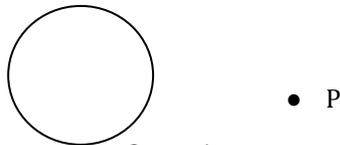
- (a) Draw the triangle ABC and A'B'C' (3mks)
  - (b) A''B''C'' is the image of A'B'C' under a rotation of  $-90^\circ$  about the origin. On the same axes draw triangle A''B''C'' (2mks)
  - (c) A'''B'''C''' is the image of A''B''C'' under a reflection in the line  $x - y = 0$ . Draw the triangle A'''B'''C''' (2mks)
  - (d) State the coordinates A''B''C'' and A'''B'''C''' (2mks)
  - (e) Describe a single transformation that maps A'''B'''C''' onto A'B'C' (1mk)
- 24 a) Complete the table below for  $y = \sin 2x$  and  $y = \sin (2x + 30)$  giving values to 2d.p (2mks)

X	0	15	30	45	60	75	90	105	120	135	150	165	180
Sin 2x	0				0.87				-0.87				0
Sin (2x + 30)	0.5				0.5				-1				0.5

- b) Draw the graphs of  $y = \sin 2x$  and  $y = \sin (2x + 30)$  on the grid provided below (3mks)
- c) Use the graph to solve  $\sin (2x + 30) - \sin 2x = 0$  (2mks)
- d) Determine the transformation which maps  $\sin 2x$  onto  $\sin (2x + 30)$  (1mk)
- e) State the period amplitude of  $y = \sin (2x + 30)$  (2mks)

**MOKASA****121/2****MATHEMATICS****PAPER 2****2017****2 ½ HOURS****SECTION I (50 MARKS).**

1. Make  $r$  the subject of the formula (3mks)  
 $V = \sqrt[3]{\pi r^2 + h}$
2. Using completing of the square method solve for  $X$ ; (3mks)  
 $2x^2 - 7x = -5$
3. Joe bought a cow for Ksh. 5,000. After two years, he sold it for ksh. 8,600. Calculate the annual rate of appreciation in the value of the cow. (3mks)
4. State the period, the amplitude and the phase angle of the function. (3mks)  
 $Y = 5\cos(5x+50)$
5. A book cost ksh.3,600 when bought in cash. A customer bought at hire purchase by making a down payment of ksh.1,000, then a ten monthly instalments of ksh.300 per month. Calculate the rate of interest per month. (3mks)
6. Using the line below, measure out Line AB of length 3cm, construct on one side of line AB the locus of a point P such that  $\angle APB = 30^\circ$ . (3mks)
7. Akinyi bought maize and beans from a wholesale. She then mixed the maize the maize and beans in the ratio 4:3. She bought the maize at ksh.21 per Kg and the beans at ksh.42 per Kg. if she was to make a profit of 30%, what should be the selling price of 1Kg of the Mixture. (3mks)
8. Expand and simplify the expression  $(2+3x)^6$  to the power of  $X^2$  hence use your expansion to solve  $(1.91)^6$  to 1 decimal place (4mks)
9. The first, the third and the ninth terms of an increasing arithmetic progression are the three consecutive terms of the geometric progression. If the first term of the A.P is 3, determine the common difference and the common ratio of the GP. (3mks)
10. A quantity P varies partly as the square of Q and partly as the cube of Q. when  $Q=20$ ,  $P=416$  and when  $Q=40$ ,  $P=3264$ . Find P when  $Q=10$ . (3mks)
11. In the circle below, draw tangents from the point P to the circle and measure the length of the tangent. (3 mks)



12. Given that  $T \begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix}$  and  $A \begin{pmatrix} 3 & -1 \\ -5 & 2 \end{pmatrix}$ 
  - (a) Find the matrix  $TA$ . (1mk)
  - (b) Hence solve the simultaneous equation given below by matrix method (2mks)  
 $2y + x = 4$   
 $5y + 3x = 11$
13. Solve for  $y$  in the following. (3mks)  
 $\log_3 y - 4 = \log_3 5$
14. Solve for  $X$  for the range of  $0^\circ \leq X \leq 360^\circ$  in (4mks)  
 $\cos(2x-5) = -0.6231$
15. Express in surd form and simplify the expression by rationalizing the denominator. (3mks)  
 $\frac{1}{2} \frac{1 - \cos 45^\circ}{1 + \cos 45^\circ}$
16. Find the percentage error in the calculation of the area of a plot whose measurement is given as  $6.0 \text{ cm} \times 3.5 \text{ cm}$  (3mks)

**Section II**

17. Mr Onyango is an employee and earns a basic salary of kshs.20, 000. In addition he gets, medical allowances of ksh. 2,500, house allowance of ksh. 2,000 and a non-taxable risk allowance of ksh. 2,000. He is entitled to a personal relief of ksh.1, 056 per month. His other deductions include Sacco loan of ksh. 10,000, water and electricity of ksh. 2,500. Using the table below, calculate

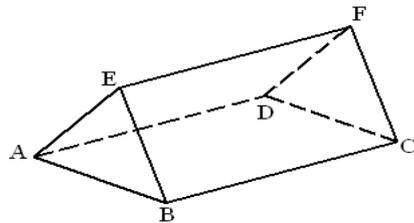
Income in kenya pounds per annum	Rate in shs/pound
1 - 5808	2
5809 - 11280	3
11281 - 16752	4
16753 - 22224	5
Over 22224	6

- (a) Taxable income in Kenya pounds per annum. (2mks)
- (b) Calculate his P.A.Y.E in Kenya shillings. (5mk)
- (c) Calculate his net pay. (3mks)

18. The probabilities that James, Shadrack and Olusala will be late for breakfast are  $\frac{1}{4}$ ,  $\frac{1}{5}$  and  $\frac{1}{6}$  respectively. Using a tree diagram, calculate the probability that on any morning;
- (a) Draw the tree diagram. (2mks)
  - (b) None of them will be late. (2mks)
  - (c) Only one of them will be late. (2mks)
  - (d) At least one of them will be late. (2mks)
  - (e) Atmost one of them will be late. (2mks)
19. The positions of two towns A and B on the earth's surface are  $(61^{\circ}\text{N}, 140^{\circ}\text{E})$  and  $(61^{\circ}\text{N}, 39^{\circ}\text{W})$  respectively. (Take  $\pi = \frac{22}{7}$  and radius of the earth as 6370km).

- (a) Find the difference in the Longitude between A and B, hence find the distance between two towns in nautical miles. (3mks)
- (b) The position of another point C is  $(61^{\circ}\text{N}, 40^{\circ}\text{W})$ . Calculate the shortest distance between A and C. (3mks)
- (c) Another point D is 430km east of town B and on the same latitude. Find the position of D. (4mks)

20. The figure below represents a prism with a cross section of an equilateral triangle of side 7cm and length 13cm, as shown below.

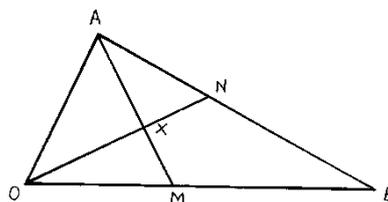


- (a) Calculate the angle between line EB and the plane ABCD. (2mks)
  - (b) **Calculate** the angle between the plane ABCD and the line BF. (2mks)
  - (c) M is the midpoint of EF. **Calculate**
    - (i) The length BM (2mks)
    - (ii) The angle between the line BM and the plane ABCD. (2mks)
  - (d) **Calculate** the angle between the plane ABM and the base plane ABCD. (2mks)
21. The table below shows marks of 50 candidates in an exam.

Marks	F
21 - 30	5
31 - 40	7
41 - 50	9
51 - 60	11
61 - 70	8
71 - 80	5
81 - 90	5

Calculate

- (a) The interquartile range. (4mks)
  - (b) The standard deviation using an assumed mean of 55.5. (6mks)
22. A certain uniform supplier is required to supply two types of shirts: one for girls labelled G and the other for boys labelled B. The total number of shirts must not be more than 400. He has to supply more of type G than of type B. However the number of type G shirts must not be more than 300 and the number of type B shirts must not be less than 80. by taking x to be the number of type G shirts and y the number of type B shirts,
- (a) **Write down** in terms of x and y all the inequalities representing the information above. (2mks)
  - (b) On the grid provided in the next page **draw** the inequalities and shade the unwanted regions. (4mks)
  - (c) Given that type G costs Shs. 500 per shirt and type B costs Shs. 300 per shirt. Use the graph in above to **determine** the number of shirts of each type that should be made to maximize profit. (2mks)
  - (d) **Calculate** the maximum possible profit. (2mks)
23. In the figure below M and N are points on OB and BA respectively such that  $OM:MB=2:3$  and  $BN:NA=2:1$ . ON and AM intersect at x.



- a) Given that  $\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$  express ON, AM and AB in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

(3mks)

(b) By taking  $\vec{OX} = h \vec{ON}$  and  $\vec{AX} = k \vec{AM}$ , where  $h$  and  $k$  are scalars. Find two expressions for  $\vec{OX}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .  
 Hence determine the constants  $h$  and  $k$  and ratio in which  $x$  divides  $AM$ . (7mks)

24. a) Complete the table for the function  $y = -x + 4x^2 - 6 + x^3$ . (2mks)

X	-5	-4	-3	-2	-1	0	1	2
Y	-26			4		-6		16

(a) Use the table values to draw the graph of  $y = -x + 4x^2 - 6 + x^3$  on the grid below. (5mks)

(b) Use your graph to solve the following equations

(i)  $X^3 + 4x^2 - x - 6 = 0$  (1mk)

(ii)  $3x^3 + 12x^2 - 15x - 21 = 0$  (2mks)

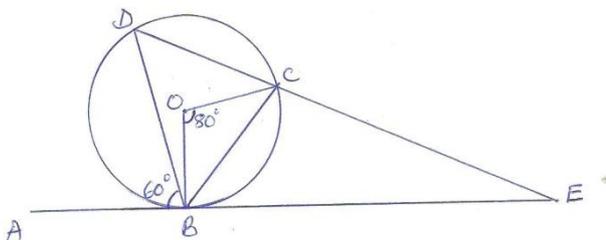
**KASSU**  
**121/1**  
**Mathematics Paper 1**  
**June Exams**  
**Form 4**  
**2 ½ Hours**  
**Term 2, 2017**

**SECTION I**

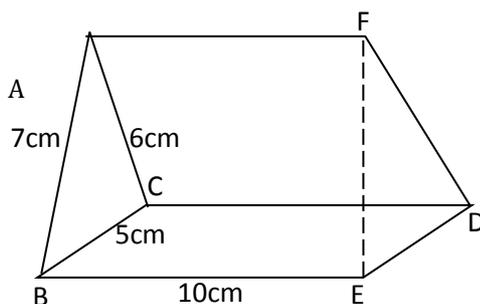
- Evaluate  $\frac{8\frac{1}{8} - 2\frac{1}{2}}{5\frac{3}{20} - 1\frac{1}{6} \text{ of } 1\frac{1}{5}}$  (3mks)
  - A bus service number 4 leaves a terminus every 15 minutes. Services 8 and 3 leaves after every 20 and 30 minutes respectively. If all the three services leave together at 6.00 am, what is the earliest time the three buses will leave together again? (3mks)
  - Use tables of reciprocals and square roots to evaluate. (3mks)
- $$\sqrt{\frac{2}{0.5893} + \frac{1.06}{846.3}}$$
- A Line passes through A (1, 1) and B(x, y). The mid-point of AB is (3, 5). If line BC is perpendicular to AB, find the equation of line BC. (3mks)
  - Solve for the equation  $\left(\frac{27}{8}\right)^{x+7} - \left(\frac{4}{9}\right)^{-3x} = 0$  (3mks)
  - Elvis exchanged Ksh.600,000 to Sterling pounds. After settling the bills worth £1200, he changed the balance to Euros. He then purchased goods worthy 200 Euros. Using the exchange rates below, calculate his balance in Kenyan shillings. (3mks)

	<u>Buying (Ksh)</u>	<u>Selling (Ksh)</u>
1 Sterling pound	114.20	114.50
1 Euro	101.20	101.30

- Find the mass of a wooden beam 4m long, 25cm wide and 18cm deep if the density of the wood is 625kg/m<sup>3</sup>. (3mks)
- Solve the inequality below hence represent the solution in a number line (3mks)  
 $3 + 2x < 3x - 1 \leq 2x + 7$
- In the diagram below ABE is a tangent to a circle at B and DCE is a straight line. If  $\angle ABD = 60^\circ$ ,  $\angle BOC = 80^\circ$  and O is the centre of the circle.



- Find the value of  $\angle BEC$  and give reasons. (3mks)
- The marks obtained by 10 pupils were 15, 14, 12,13,9,16,11,12, 13 and 17. Calculate the standard deviation correct to 4 s.f. (4mks)
  - Each exterior angle of a regular polygon is a fifth of the interior angle. (2mks)
    - Find the size of the exterior angle
    - Find the number of sides of the polygon (1mk)
  - The figure below shows a solid prism:-

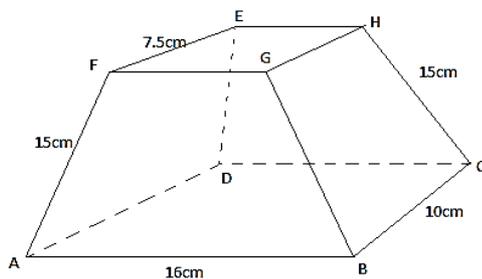


- Sketch the net of the prism above and show with arrows the path ACDB and F via E (3mks)
13. Solve the equation  $6\cos^2x + 7\sin x = 8$  for  $0^\circ \leq x \leq 90^\circ$  (4mks)
14. Solve for y in the equation. (3mks)  
 $\log_{10}(3y + 2) - 1 = \log_{10}(y - 4)$
15. The angle of elevation of the top of a flag post from a point x on level ground is  $13^\circ$ . The angle of elevation of the top of the flag post from another point y nearer the flag post and 120 metres from x is  $30^\circ$ . Y is between A and the bottom of the flag post and the three points are collinear. Find the height of the flag post. (3mks)
16. Simplify the expression  $\frac{x-1}{x} - \frac{2x-1}{3x}$ . Hence solve the equation  $\frac{x-1}{x} - \frac{2x-1}{3x} = \frac{2}{5}$  (3mks)

**SECTION II**

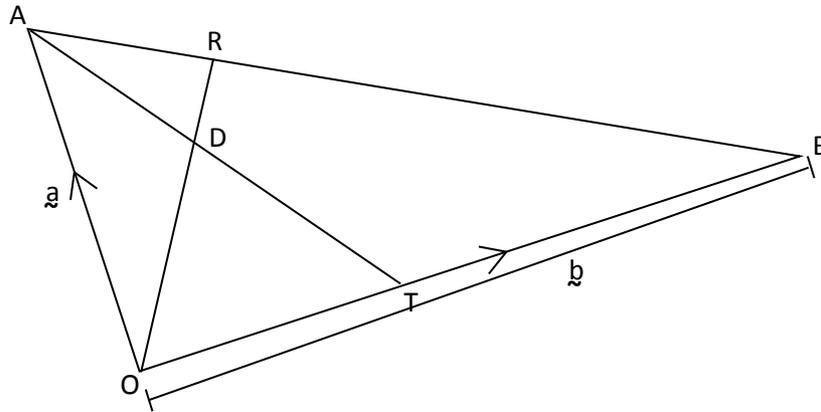
*(Answer ANY FIVE questions in the spaces provided)*

17. Town B is 20km N $60^\circ$ W from village A. Town B is 25km  $040^\circ$  from town C. Village D is due East of town C and dues South of village A
- (a) Using a scale 1:500,000 draw a diagram showing a relative position of town B, town C, village A and village D (3mks)
- (b) Determine;
- (i) Distance between village A and town C (1mk)
- (ii) Distance between town C and village D (1mk)
- (iii) Compass bearing of town C from village A (1mk)
- (iv) Compass bearing of village D from town B (1mk)
- (c) Determine the area enclosed by the diagram in (a) above in hectares (3mks)
18. John bought 3 brands of tea A, B and C. The cost price of the three brands were sh.25, sh.30 and sh.45 per kilogram respectively. He mixed the three brands in the ration 5:2:1 respectively. After selling the mixture he made a profit of 20%.
- a) How much profit did he make per kilogram of the mixture? (3mks)
- b) After one year the cost price of each brand was increased by 12%.
- i) How much did he sell one kilogram of the mixture to make 20% profit? Give your answer to the nearest 5cents. (4mks)
- iii) What would have been the percentage profit if he sold one kilogram of the mixture at Ksh.40.25. (3mks)
19. The distance S meters from a fixed point O, covered by a particle after t seconds B given by the equation  $S = t^3 - 6t^2 + 9t + 5$
- (a) Calculate the gradient of the curve at  $t = 0.5$  seconds (3mks)
- (b) Determine the values of S at the turning points of the curve (3mks)
- (c) Sketch the curve in the space provided. (4mks)
20. The figure below shows a frustrum made from a right pyramid, such that  $AB=DC=16\text{cm}$ ,  $BC=AD=10\text{cm}$ ,  $FG=EH=18\text{cm}$ ,  $GH=FE=7.5\text{cm}$ ,  $CH=BG=AF=DE=15\text{cm}$ . If the altitude of the frustrum is 14.6cm, find:



- (a) The altitude of the pyramid made from the frustrum. (2mks)
- (b) The surface area of the frustrum. (5mks)
- (c) The volume of the frustrum. (3mks)
21. Alex and James live in two towns 240km apart. One day at 9.45am, Alex left his town and drove towards James' town at an average speed of 60km/h. James left his town at 10.50 a.m. on the same day and drove towards Alex's town at an average speed of 80km/h. Determine
- (a) the distance from Alex's town where the two met. (7mks)
- (b) the time of day they met (3mks)

22. The figure below is a triangle OAB where  $OA = \mathbf{a}$  and  $OB = \mathbf{b}$ . A point R divides AB in the ratio 2: 5 and a point T divides OB in the ratio 1: 3. OR and AT intersect at D.



(a) Find in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

(i)  $\mathbf{BT}$ . (1mk)

(ii)  $\mathbf{OR}$  (2mks)

(iii)  $\mathbf{AT}$  (2mks)

(b) Given that  $\mathbf{AD} = k\mathbf{AT}$  and  $\mathbf{RD} = h\mathbf{RO}$  where  $k$  and  $h$  are scalars. Find the values of  $k$  and  $h$ . Hence express  $\mathbf{AD}$  in term of  $\mathbf{a}$  and  $\mathbf{b}$ . (5mks)

23. (a) The members of a photography club decided to buy a camera worth Ksh 4000 by each one contributing the same amount of money. Fifteen members fail to pay their contribution and as a result each of the other members has to pay Ksh 60 more. Find the number of members in the club. (8mks)

(b) What is the percentage increase in the contribution per member? (2mks)

$x$	$0^\circ$	$\frac{\pi^\circ}{6}$	$\frac{\pi^\circ}{3}$	$\frac{\pi^\circ}{2}$	$\frac{2\pi^\circ}{3}$	$\frac{5\pi^\circ}{6}$	$\pi^\circ$	$\frac{7\pi^\circ}{6}$	$\frac{4\pi^\circ}{3}$	$\frac{3\pi^\circ}{2}$	$\frac{5\pi^\circ}{3}$	$\frac{11\pi^\circ}{6}$	$2\pi^\circ$
$3\sin x$			2.6	3			0	-1.5	-2.6	-3		-1.5	
$2\cos x$		1.7	1.0			-1.7	-2	-1.0			1.0	1.7	2

24.(a) Complete the table below for the functions  $y = 3 \sin x$  and  $y = 2 \cos x$ . (2mks)

(b) Using a scale of 2cm to represent 1 unit on the y- axis and 1cm to present  $30^\circ$  on the x-axis ,draw the graphs of  $y = 3\sin x$  and  $y = 2\cos x$  on the same axes on the grid provided. (5mks)

(c) From your graphs:

i) State the amplitude of  $y = 3\sin x$ . (1mk)

ii) Find the values of  $x$  for which  $3\sin x - 2\cos x = 0$ . (1mk)

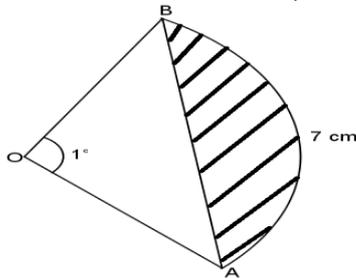
iii) Find the range of values of  $x$  for which  $3\sin x \geq 2\cos x$  (1mk)

KASSU  
121/2  
Mathematics Paper 2  
June Exams  
Form 4  
2 ½ Hours  
Term 2, 2017

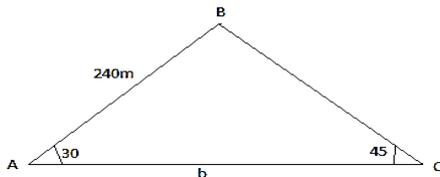
## SECTION I

(Answer all the questions in the spaces provided)

- Use tables of logarithms to evaluate  $\frac{4.28 \times 0.01677}{\tan 20^\circ}$  (3marks)
- All prime numbers between ten and twenty are arranged in descending order to form a number.
  - Write down the number. (1mark)
  - State the total value of the third digit of the number formed in (i) above. (1mark)
- The diagram below shows a sector of a circle centre O with arc AB=7 cm and subtends an angle of  $1^\circ$  at the centre. Calculate the shaded area to 4 s.f. (Take  $\pi = \frac{22}{7}$ ). (3marks)



- Expand  $\left(1 + \frac{1}{x}\right)^9$  up to the term  $x^3$  hence use your expansion to find the estimate value of  $100(1.05)^9$  correct to 4 significant figures. (4marks)
- In the figure below it shows a triangle ABC not drawn to scale. Calculate the value of b given that  $AB = 240\text{m}$ ,  $\angle BAC = 30^\circ$  and  $\angle ACB = 45^\circ$  (3marks)

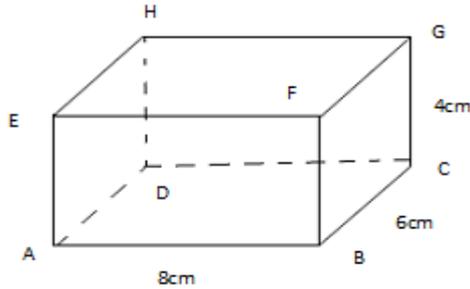


- Kipkemboi running at 10m/s starts 5 m ahead of Mutola who is running at 12m/s. How far from Kipkemboi's starting point does Mutola overtake him? (3marks)
- Make L the subject given that  $H = \sqrt{\frac{3d(L-d)}{10L}}$  (3marks)
- Without using a mathematical tables or calculators, simplify  $\frac{3}{\sqrt{7}-\sqrt{2}} - \frac{2}{\sqrt{2}+\sqrt{7}}$  (3marks)
- The volume of cuboid A is  $64\text{ cm}^3$  while that of a similar cuboid B is  $8\text{ cm}^3$ . If the width of cuboid A is 2 cm, find the width of cuboid B. (3marks)
- Show that  $4y^2 + 4x^2 = 12x - 12y + 7$  is the equation of a circle, hence find the co-ordinates of the centre and radius. (3marks)
- The dimensions of a rectangle are given as 4.1cm by 2.8cm. Calculate the relative error in the area. (3marks)
- If  $2.5 \times 0.45 = \frac{a}{b}$  where a and b are in their simplest forms. Find the values of a and b. (3marks)
- The seventh term of an arithmetic sequence is 17, three times the third term is 3. Calculate the first term and the common difference of the sequence. (3marks)
- At the start of the 1<sup>st</sup> year, Mr Chepyator, deposited Ksh. 180,000 in a bank which gives an interest of 12% p.a, compounded quarterly. Find the interest earned by Mr. Chepyator at the start of the 4<sup>th</sup> year. (3marks)
- A quantity P varies partly as n and partly as the square of n. When  $P = -3$ ,  $n = -1$  and when  $P = 18$ ,  $n = 2$ . Find P when  $n = 1$  (3marks)
- Find the inverse of  $\begin{pmatrix} 5 & -2 \\ 2 & -1 \end{pmatrix}$  hence find the point of intersection of the lines whose equations are  $5x - 2y = 5$  and  $y = 2x - 3$  (4marks)

**SECTION II**

***(Answer ANY FIVE questions in the spaces provided)***

16. In the cuboid below,  $AB = 8\text{cm}$ ,  $BC = 6\text{cm}$ ,  $AE = 4\text{cm}$



Calculate,

- a) The length  $BD$  (2marks)
- b) The angle which  $BH$  makes with the plane  $ABCD$ . (2marks)
- c) The angle between  $EC$  and the plane  $ADHE$  (2marks)
- d) The angle between  $EA$  and  $AG$  (2marks)
- e) The angle between planes  $ABCD$  and  $EBCH$  (2marks)

17. There are 2 bags A and B. Bag A has 4 white balls and 6 red balls. Bag B has 2 white balls and 3 red balls. Each bag has an equal chance of being picked. If a bag is selected randomly and 2 balls picked with replacement in bag A and without replacement in bag B. Find the probability that:

- (a) They are both white. (2marks)
- (b) They are of different colours. (3marks)
- (c) At least one ball is red. (2marks)
- (d) None of the balls is white. (3marks)

18. The table below shows marks obtained by form three students in Kiswahili third term exam.

Marks	20-25	26-30	31-39	40-45	46-51	52-59	60-68	69-75	76-80
Frequency	2	8	14	24	30	20	10	8	4

- (a) Calculate the mean (2marks)
- (b) Draw an ogive (3marks)
- (c) From the ogive curve in (b) above
  - (i) estimate the median. (1mk)
  - (ii) estimate the quartile deviation. (2mark)
  - (iii) if 40% of the students are to pass, determine the pass mark (2marks)

19. (a) Integrate the function  $y = (x - 1)(x - 3)$  (2marks)
- (b) Find the exact area bounded by the curve  $y = (x - 1)(x - 3)$ , y-axis, x-axis and the line  $x = 3$  (3marks)
- (c) Use trapezium rule with three trapezia to estimate the area bounded by the curve  $y = (x - 1)(x - 3)$ , y-axis, x-axis and the line  $x = 3$ . (3marks)
- (d) Calculate the percentage error introduced by using the trapezium rule in (c) above. (2marks)

20. Triangle ABC has  $A(1,4)$ ,  $B(1,1)$  and  $C(3,3)$ . Draw  $\triangle ABC$  on the grid provided. (1 mark)

- (a)  $\triangle ABC$  is reflected in the line  $x = 0$  to give  $\triangle A_1 B_1 C_1$ . Draw  $\triangle A_1 B_1 C_1$  on the same grid and state its coordinates. (3marks)
- (b)  $\triangle A_2 B_2 C_2$  is the image of  $\triangle A_1 B_1 C_1$  under a stretch with x- axis invariant and scale factor 2. Determine the coordinates of  $\triangle A_2 B_2 C_2$  and draw it on the same grid. (3 marks)
- (c)  $A_3(-1,7)$  and  $B_3(-1,1)$  are the images of  $A_2$  and  $B_2$  respectively under a shear with y-axis invariant. Determine the coordinates of  $C_3$  and draw  $\triangle A_3 B_3 C_3$  on the same grid. (3 marks)

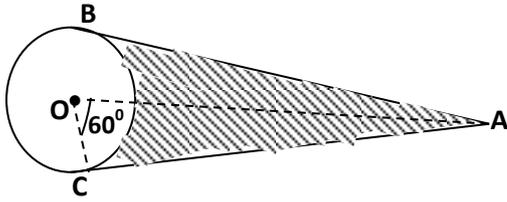
21. Use a pair of compass and ruler only in this question

- a) Construct a parallelogram ABCD in which  $AB = 6\text{cm}$ ,  $AD = 4\text{cm}$  and angle  $BAD = 60^\circ$  (3marks)
- b) Measure the length AC (1mark)
- c) Show the locus of point P which moves so that it is equidistant from A and C (3marks)
- d) The locus of point Q which moves so that angle  $BQD = 90^\circ$  (3marks)

22. A plane leaves an airport P ( $10^\circ\text{S}$ ,  $62^\circ\text{E}$ ) and flies due north at 800km/h.

- (a) Find its position after 2 hours (3marks)
- (b) The plane turns and flies at the same speed due west. It reaches longitude Q,  $12^\circ\text{W}$ .
  - (i) Find the distance it has traveled in nautical miles. (3marks)
  - (ii) Find the time it has taken (Take  $\pi = \frac{22}{7}$ , the radius of the earth to be 6370km and 1 nautical mile to be 1.853km) (2marks)
- (c) If the local time at P was 1300 hours when it reached Q, find the local time at Q when it landed at Q (2mks)

24 In the figure below AB and AC are tangents to the circle center O at B and C respectively, the angle  $\text{AOC} = 60^\circ$ , radius of the circle 5cm.



Calculate;

- |                                  |          |
|----------------------------------|----------|
| a) The length of AC              | (2marks) |
| b) The area of triangle OAC      | (2marks) |
| c) The area of minor sector COD  | (2marks) |
| d) The area of the shaded region | (4marks) |

## SUKEMO JOINT EVALUATION TEST- 2017

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## MATHEMATICS

## Paper 1

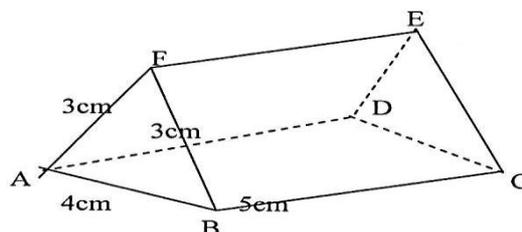
July/August - 2017

Time: 2 ½ Hours

## SECTION I (50 MARKS)

Answer all questions in this Section

1. Evaluate :  $\frac{\sqrt{\frac{1}{9} \text{ of } 2\frac{1}{3} + \frac{2}{3} \left( \frac{5}{3} - \frac{3}{2} \right)}}{\frac{2}{5} \text{ of } 3\frac{1}{3} \div \frac{1}{3}}$  (3 marks)
2. Simplify completely  $\frac{12x^2 - 11xy + 2y^2}{18x^3 - 8xy^2}$  (3mks)
3. Use the exchange rates below to answer this question.
- |             | Buying | Selling |
|-------------|--------|---------|
| 1 US dollar | 63.00  | 63.20   |
| 1 UK £      | 125.30 | 125.95  |
- A tourist arriving in Kenya from Britain had 9600 UK Sterling pounds (£). He converted the pounds to Kenya shillings at a commission of 5%. While in Kenya, he spent  $\frac{3}{4}$  of this money. He changed the balance to US dollars after his stay. If he was not charged any commission for this last transaction, calculate to the nearest US dollars, the amount he received. (3mks)
4. Solve for x in the following equation.  $4^x (8^{x-1}) = \tan 45^\circ$  (3mks)
5. The sum of interior angles of two regular polygons of sides; n and n + 2 are in the ratio 3:4. Calculate the sum of the interior angles of the polygon with n sides. (3mks)
6. Use logarithms to evaluate the following correct to 4 decimal places.
- $$\sqrt[4]{\frac{2 \times 1.764^{-2} \times 0.324}{5.42}}$$
- (3mks)
7. Find the region defined by the following inequalities  $2y < x + 4$ ;  $4y \geq -x - 4$ ;  $x \leq 2$  (3mks)
8. Find the equation of locus of points equidistant from A (6, 5) and B (-2, 3) (3mks)
9. The GCD three numbers is 6 and their LCM is 900. If two of the numbers are 36 and 60, find the least possible third number. (3mks)
10. Use the tables of squares, cube roots and reciprocals to evaluate  $\frac{\sqrt[3]{0.008}}{0.375} - \frac{10}{37.5^2}$  (3mks)
11. Solve the following pair of simultaneous equations using substitution method  $4b + 3t - 475 = 0$   $5t + 2b = 325$  (3mks)
12. Given that  $\sin \theta = \frac{4}{5}$  and  $\theta$  is an acute angle, find without using tables or calculators  
(a)  $\tan \theta$  (2mks)  
(b)  $\cos (180 - \theta)$  (1mk)
13. The figure below is a triangular prism of uniform cross-section in which AF = FB = 3cm, AB = 4cm and BC = 5cm. Draw a clearly labeled net of the prism. (3mks)



14. The mass of two similar cans is 960g and 15000g. If the total surface area of the smaller can is  $144\text{cm}^2$ , determine the surface area of the larger can. (3mks)

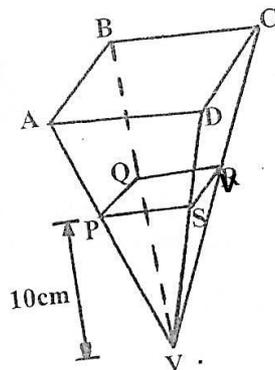


- b) Using the grid provided draw the graph of  $y = 3x^2 + 4x - 2$  for  $-4 \leq x \leq 3$  (3mks)
- c) Using the graph, find the solution to the equations.
- i)  $3x^2 + 4x - 2 = 0$  (2mks)
- ii)  $3x^2 + 7x + 2 = 0$  (3mks)

21. A triangle ABC has vertices A(2,1), B(5,2) and C(0,4).
- (a) On the grid provided plot the triangle ABC. (2 mks)
- (b)  $A^1B^1C^1$  is the image of ABC under a translation  $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$ . Plot  $A^1B^1C^1$  and state its coordinates. (2mks)
- (c) Plot  $A^{11}B^{11}C^{11}$  the image of  $A^1B^1C^1$  after a rotation about the origin through a negative quarter turn. State its coordinates. (3 mks)
- (d)  $A^{111}B^{111}C^{111}$  is the image of  $A^{11}B^{11}C^{11}$  after a reflection on the line  $y = 0$ . Plot  $A^{111}B^{111}C^{111}$  and state its coordinates. (3 mks)
22. Two bus stations P and Q are such that Q is 500km due East of P. Two buses M and N Leave from P and Q respectively at the same time. Bus M moves at 360km/h on a bearing of N 30°E. Bus N moves at a speed of 240km/h on a bearing of N45°W. The two buses stop after 1 ½ hrs.

Using a scale of  $\frac{1}{10^7}$

- a) Show the relative positions of the buses after 1 ½ hrs. (6mks)
- (b) Find the distance between the buses after 1 ½ hrs. (2mks)
- (c) Find the true bearing of;
- i) M from N
- ii) N from M after 1 ½ hrs. (2mks)
23. The diagram below represents square based pyramid standing vertically. AB = 12cm, PQ = 4cm and the height of pyramid PQSV is 10cm.



- (a) If PQRSV is a solid, find the volume of material used to make it. (2mks)
- (b) Find the
- (i) height of the frustrum ABCDPQRS (2mks)
- (ii) Volume of the frustrum (3mks)
- (c) The liquid from a hemisphere is poured into PQRS. Find radius correct to 4 significant figures of the hemisphere if the liquid from hemisphere filled the solid completely. Use  $\pi = \frac{22}{7}$  (3mks)
24. The displacement h metres of a particle moving along a straight line after t seconds is given by  $h = -2t^3 + \frac{3}{2}t^2 + 3t$
- (a) Find the initial acceleration. (3mks)
- (b) Calculate
- (i) The time when the particle was momentarily at rest. (3mks)
- (ii) Its displacement by the time it comes to rest momentarily. (2mks)
- (c) Calculate the maximum speed attained. (2mks)

**SUKEMO JOINT EXAMINATION**

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**MATHEMATICS**

**PAPER 2**

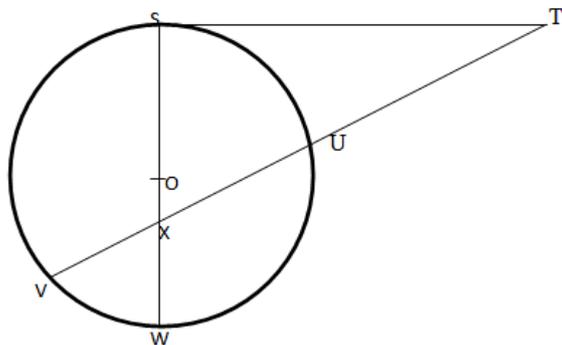
**JULY/AUGUST 2017**

**TIME: 2 ½ HOURS**

**SECTION I**

**Answer all the questions in the spaces provided (50mks)**

1. The expression  $x^2 + 10x + c + 2 = 0$ , where  $c$ , is a constant is a perfect square. Find the value of  $c$ . (2mks)
2. Ken was asked to truncate  $\frac{7}{9}$  to 3 significant figures. He rounded it off instead to 3 decimal places. Calculate the percentage error resulting from his rounding off. (3mks)
3. The co-ordinates of a point A is (2, 8, 3) and B is (-4, -8, -5). A point P divides  $\overline{AB}$  externally in the ratio 7: -3. Find the co-ordinates of P (3mks)
4. In a triangle XYZ, XY = 2cm, YZ (2√3-1) cm, and angle YXZ = 60°. Determine Sin (XZY) giving your answer in the form  $\frac{m + \sqrt{3}}{n}$ , where M and N are integers (4mks)
5. Find the term independent of X in the expansion of  $(X^3 - \frac{2}{x^3})^6$  (3mks)
6. Solve for X:  $(\log_3 X)^2 - \frac{1}{2} \log_3 X = \frac{3}{2}$  (3mks)
7. The cash price of a T.V set is Ksh.13,800. A customer opts to buy the set on hire purchase terms by paying deposit of Ksh.2,280. If simple interest of 20% p.a is charged on the balance and the customer is required to pay by 24 monthly instalments, calculate the amount of each instalment. (3mks)
8. Make x the subject of the formula  $ax = \frac{3r}{2} - \frac{x^2}{2}$  (3mks)
9. Calculate the area under the curve  $y = 3x^2 + 8$ , x-axis,  $x = 1$  and  $x = 5$ , using the mid-ordinate rule with 4 ordinates. (3mks)
10. A circle is tangent to the y - axis and intersects the x- axis at (2,0) and (8,0). Obtain the equation of the circle, (4mks)
11. A variable y varies as the square of x and inversely as the square root of Z. Find the percentage change in y when x is changed in the ratio 5:4 and Z reduced by 19% (3mks)
12. Solve for X in the equation:  $2 \sin^2 x - 1 = \cos^2 x + \sin x$ , for  $0^\circ \leq x \leq 360^\circ$  (3mks)
13. A die is biased so that when tossed, the probability of a narrator of a number n showing up, is given by  $p(n) = kn$  where is a constant and  $n = 1, 2, 3, 4, 5, 6$  (the numbers of the faces of the die)
  - i) Find the value of k (1mk)
  - If the die is tossed twice, calculate the probability that the total score is 11 (2mks)
14. In the figure below, the tangent ST meets chord VU produced at T. Chord SW passes through the Centre, O of the circle and intersects chord VU at X. Line ST = 12cm and UT = 8cm.



- a. Calculate the length of chord VU (1mk)
  - b. If WX = 3cm and VX : XU = 2 : 3, Find SX (2mks)
15. The heights in centimeters of 100 trees seedlings are shown in the table below

Height	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
No. of Seedlings	9	16	19	26	20	10

- Calculate the quartile deviation (4mks)
16. Given that the ratio  $x:y = 2:3$ , find the ratio  $(5x - 2y) : (x + y)$  (2mks)

**SECTION II****Answer any five questions (50mks)**

17. A curve is represented by the function

$$y = \frac{1}{3}x^3 + x^2 - 3x + 2$$

- a) Find  $\frac{dy}{dx}$  (1mk)  
 b) Determine the values of y at the turning points of the curve (4mks)

In the spaces provided below, sketch the curve  $y = \frac{1}{3}x^3 + x^2 - 3x + 2$ . (5mks)

18. Complete the table below for the functions
- $y = 3 \cos \theta$
- and
- $y = \sin 2\theta$
- correct to 2 decimal places. (2mks)

$0^\circ$	$-180^\circ$	$-150^\circ$	$-120^\circ$	$-90^\circ$	$-60^\circ$	$-30^\circ$	$0^\circ$	$30^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$150^\circ$	$180^\circ$
3 Cos $\theta$	-3		-1.50	0		2.60	3	2.60		0	-1.50		-3
Sin 2 $\theta$	0	0.87	0.87	0		-0.87	0	0.87	0.87	0			0

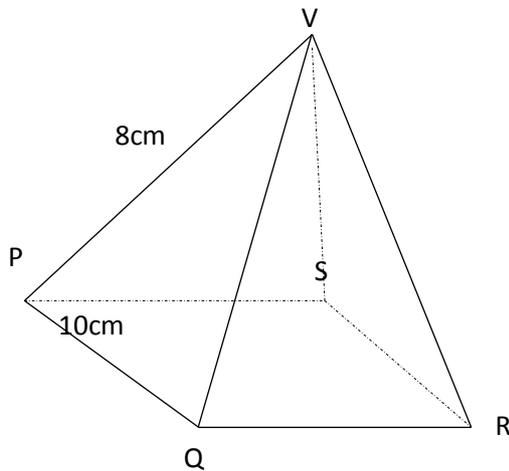
- a) Plot the graph of  $y = 3 \cos \theta$  and  $y = \sin 2\theta$  on the same axis for  $-180^\circ \leq \theta \leq 180^\circ$  (5marks)  
 b) Use the graph in (a) to find  
 i) The value of  $\theta$  which satisfy the equation  $3 \cos \theta - \sin 2\theta = 0$  (2mks)  
 ii) The difference in values of y when  $\theta = 45^\circ$  (1mk)
19. A rectangle PQRS with vertices P(2,0), Q(4,0), R(4,4), and S(2,4) is given a stretch transformation with the line  $X = 2$  invariant and point Q (4,0) is mapped onto Q' (6,0). The image P'Q'R'S' of the rectangles is enlarged with scale factor of -2 Centre origin, followed by a reflection in the line  $y = 0$
- a) Plot the rectangle PQRS and the images of its successive transformation (5mks)  
 b) Describe the transformations which map the third image onto the first image (2mks)  
 c) Determine the single matrix that will map the third image onto the second image (1mk)  
 d) Give the matrix of transformation that will rotate PQRS through  $90^\circ$  about the origin (2mks)
20. Use ruler and a pair of compasses only in this question  
 a) i) Construct triangle ABC in which  $AB = 8\text{cm}$ ,  $BC = 7.5\text{cm}$  and  $\angle ABC = 112 \frac{1}{2}^\circ$  (3mks)  
 ii) Measure length of AC (1mk)  
 b) By shading the unwanted regions show the locus of P within the triangle ABC such that:  
 i)  $AP \leq PB$   
 ii)  $AP > 3\text{cm}$   
 Mark the required region as P (3mks)  
 c) Construct a perpendicular from C to meet AB at D (1mk)  
 d) Locate the locus of R in the same diagram such that the area of triangle ARB is  $\frac{3}{4}$  the area of triangle ABC
21. Income tax rate are as shown below

Income (k£ p.a)	Rate (Ksh per £)
1 - 4200	2
4201 - 8000	3
8001 - 12600	5
12601 - 16800	6
16801 and above	7

Momanyi pays Sh.4000 as PAYE per month. He has a monthly house allowance of Ksh.10800 and is entitled to a personal relief of Ksh.1100 per month.

- a) Determine;  
 i) His gross tax p.a in Ksh (2mks)  
 ii) His taxable income in k£ p.a (4mks)  
 iii) His basic salary in Ksh p.m (2mks)  
 b) Given that the following deductions are made from his pay every month; NHIF Sh320, WCPS Sh.560 and NSSF 6% of his basic pay. calculate his net salary per month (2mks)
22. The first term of an arithmetic progression (AP) is 2. The sum of the first 8 terms of the AP is 156.  
 i) Find the common difference of the AP (2mks)  
 ii) Given that the sum of the first n terms of the AP is 416, find n (2mks)
- b) The 3<sup>rd</sup>, 5<sup>th</sup> and 8<sup>th</sup> terms of another AP Correspond to the first three consecutive terms of a GP. If the common difference of the AP is 3, find;  
 i) The first term of the GP (4mks)  
 ii) The sum of the first 8 terms of the GP to 4 significant figures (2mks)

23. a) Two towns on latitude  $30^{\circ}\text{S}$  are 3000km apart. Find the longitude difference of the two towns. ( $\pi = \frac{22}{7}$  and the radius of the earth to be 6370km) (3mks)
- b) The position of the airport P and Q are  $P(60^{\circ}\text{N}, 45^{\circ}\text{W})$  and  $Q(60^{\circ}\text{N}, k^{\circ}\text{E})$ . It takes a plane 5 hours to travel due East from P to Q at an average speed of 600 knots.
- i) Calculate the value of k (2mks)
- ii) The local time at P is 10.45am. What is the local time at Q when the plane reaches there? (3mks)
- c) Calculate the shortest distance between  $\{(30^{\circ}\text{S}, 36^{\circ}\text{E})$  and  $30^{\circ}\text{S}, 144^{\circ}\text{W}\}$  in nautical miles (2mks)
24. PQRSV is a right pyramid on a horizontal square base of side 10cm. The slant edges are all 8cm long. Calculate;



- a) The height of the pyramid (2mks)
- b) The angle between
- i) Line VP and the base PQRS (2mks)
- ii) Line VP and line RS (2mks)
- iii) Planes VPQ and the base PQRS (2mks)
- c) Volume of the pyramid (2mks)

**MERU**  
**SCHOOL BASED FORM 4 EXAM JULY-AUGUST 2017**  
**Kenya Certificate of Secondary Education (K.C.S.E)**  
**MATHEMATICS**  
**Paper 1**  
**July/August 2016**  
**Time :2 ½ Hours**

**SECTION A**

1. Evaluate (3 mks)  

$$\frac{\frac{1}{2} \text{ of } 2\frac{1}{3} + \frac{2}{3} (\frac{5}{3} - \frac{3}{2})}{\frac{3}{4} \text{ of } 3\frac{1}{3} \div \frac{1}{4}}$$
2. Use tables of squares, square roots and reciprocals to evaluate:- (4 mks)  

$$4.2052 + \frac{1}{\sqrt{512.4}}$$
3. Three bells ring at intervals of 9 minutes, 15 minutes and 21 minutes. The bells will next ring together at 11.00 p.m. Find the time the bells had last rang together. (3 mks)
4. Using a ruler and a pair of compasses only, construct triangle PQR such that PQ = 5cm, PR = 8cm and angle RPQ = 45°. Construct an inscribed circle and measure its radius. (4 mks)
5. A Kenyan businessman bought goods from Japan worth 2,950,000 Japanese yen. On arrival in Kenya, custom duty of 20% was charged on the value of the goods. If the exchange rates were as follows;  
 1 US dollar = 118 Japanese Yen  
 1 US dollar = 76 Kenya shillings  
 Calculate the duty paid in Kenya shillings. (3 mks)
6. The masses of people during a clinic session were recorded as shown in the table below.  

Mass (kg)	40-44	45-49	50-54	55-59	60-64	65-69	70-74
No. of people	1	2	12	10	2	2	1

 Calculate the mean mass. (3 mks)
7. Solve for x in the equation. (3 mks)  

$$\frac{81^{2x} \times 27^x}{9^x} = 729$$
8. Solve the following inequalities and state the integral values. (3 mks)  
 $x - 2 \leq 3x + 1 < x + 11$
9. Simplify the expression: (3 mks)  

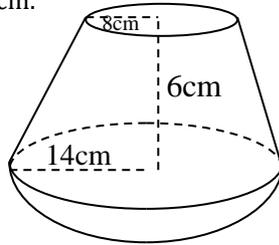
$$\frac{4x - 9x^3}{3x^2 - 4x - 4}$$
10. A straight line L passes through the points (3, -2) and is perpendicular to a line whose equation is  $2y - 4x = 1$ . Find the equation of L in the form  $y = mx + c$ , where m and c are constants. (3 mks)
11. A man is 24 years older than his daughter. After 10 years, he will be 3 times as old as his daughter. How old is the daughter? (3 mks)
12. The shortest side of a triangle is 12cm and the area of the triangle is 80cm<sup>2</sup>. A similar triangle has an area of 18cm<sup>2</sup>. Calculate the shortest side of this triangle. (3 mks)
13. Given that  $\sin(x + 60)^\circ = \cos(2x)^\circ$ . Find  $\tan(x + 60)^\circ$ . (3 mks)
14. Three business partners, Kioko, Njau and Osiakom, are to share Sh. 12,000 in the ratio 5:6:x respectively. If Kioko received Sh. 4,000, determine the amount Osiako received. (3 mks)
15. Give that  $\vec{P} = 5\vec{a} - 2\vec{b}$  where  $\vec{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$  and  $\vec{b} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$   
 Find the:  
 (a) Column vector P (2 mks)  
 (b) P<sup>l</sup>, the image of P under a translation vector  $\begin{pmatrix} -6 \\ 4 \end{pmatrix}$
16. The sum of interior angles of a regular polygon is 24 times the size of the exterior angle. Find the number of sides of the polygon. (3 mks)

**SECTION II**

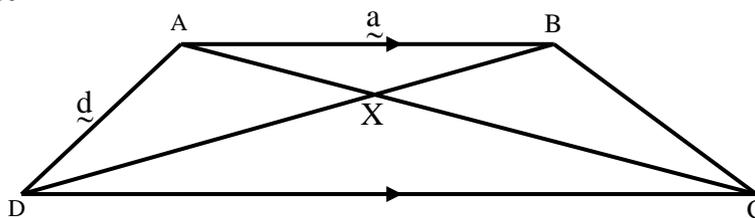
**Answer any 5 questions from this section.**

17. Three partners Amina, Bosire and Karuri contributed a total of KSh. 4,800,000 in the ratio 4 : 5 : 7 to buy an 8 hectares piece of land. The partners set aside  $\frac{1}{4}$  of the land for social amenities and subdivided the rest into 15m by 25m plots.  
 (a) Find  
 (i) the amount of money contributed by Karuri. (2 mks)  
 (ii) the number of plots that were obtained. (3mks)  
 (b) The partners sold the plots at KSh. 50,000 each. Spent 30% of the profit realised to pay for administrative costs. They shared out the rest of the profits in the ratio of their contributions.  
 (i) Calculate the net profit realised. (3 mks)  
 (ii) Find the difference in the amount of profit earned by Amina and Bosire. (2 mks)

18. The figure below shows a solid structure in the shape of a cone with a hemispherical bottom. The radius of the hemispherical part is 14cm and is equal to the radius of the bottom of the frustum. The frustum has a top radius of 8cm and height of 6cm.



- (a) Calculate to 2 decimal places:-  
 (i) the volume of the frustum. (5 mks)  
 (ii) the volume of the solid. (3 mks)
- (b) Given that the solid has a mass of 1kg. Find its density in g/cm<sup>3</sup>. (2 mks)
19. A bus left Mombasa and travelled towards Nairobi at an average speed of 60km/hr. After 2 ½ hours, a car left Mombasa and travelled along the same road at an average speed of 100km/hr. If the distance between Mombasa and Nairobi is 500km, determine,  
 (a) (i) the distance of the bus from Nairobi when the car took off. (2 mks)  
 (ii) the distance the car travelled to catch up with the bus. (4 mks)  
 (b) Immediately the car caught up with the bus, the car stopped for 25 minutes. Find the new average speed at which the car travelled in order to reach Nairobi at the same time as the bus. (4 mks)
20. In the figure below, ABCD is a trapezium. AB is parallel to DC, diagonals AC and DB intersect at X and DC = 2AB. AB = a,  $\vec{DA} = d$ ,  $\vec{AX} = k\vec{AC}$  and  $\vec{DX} = h\vec{DB}$  where h and k are constants.



- (a) Find in terms of a and d  
 (i)  $\vec{BC}$  (2 mks)  
 (ii)  $\vec{AX}$  (2 mks)  
 (iii)  $\vec{DX}$  (1 mk)  
 (b) Determine the values of h and k (5 mks)
21. Four hospitals P, Q, R and S are such a way that Q is 25 km on a bearing of 060° from P. The bearing of S from P is 220° a distance of 7.5km. The bearing of R from S is 135° a distance of 50km. Use a scale of 1cm to represent 5 km.  
 (a) Draw a diagram to show the relative positions of the four hospitals. (4 mks)  
 (b) Use your diagram to find:-  
 (i) the distance of R from Q (2 mks)  
 (ii) the bearing of R from Q. (1 mk)  
 (iii) distance of Q from S. (2 mks)  
 (iv) the bearing of Q from S. (1 mk)
22. A line L passes through points (-2, 3) and (-1,6) and perpendicular to a line at (-1,6)  
 (a) Find the equation of L. (2 mks)  
 (b) Find the equation of P in form ax + by = c where a, b and c are constants. (2 mks)  
 (c) Given that another line Q is parallel to L and passes through point (1, 2). Find the x and y intercepts of Q. (3 mks)  
 (d) Find the point of intersection of lines P and Q. (3 mks)
23. (a) Using the trapezium rule with seven ordinates, estimate the area of the region bounded by the curve  $y = -x^2 + 6x + 1$ , the line  $x = 0$ ,  $y = 0$  and  $x = 6$ . (5 mks)  
 (b) Calculate:  
 (i) the area of the region in (a) above by integration. (3 mks)  
 (ii) the percentage error of the estimated area to the actual area of the region, correct to two decimal places. (2 mks)
24. A sales woman is paid a commission of 2% on goods worth over KSh. 100,000. She is also paid a monthly salary of KSh. 12000. In a certain month, she sold 360 handbags at KSh. 500 each.  
 (a) Calculate the salesman's earnings that month. (3 mks)  
 (b) The following month, the salesman's monthly salary was increased by 10%. Its total earnings that month were KSh. 17600. Calculate:-  
 (i) the total amount of money received from the sales of handbags that month (5 mks)  
 (ii) the number of handbags sold that month. (2 mks)

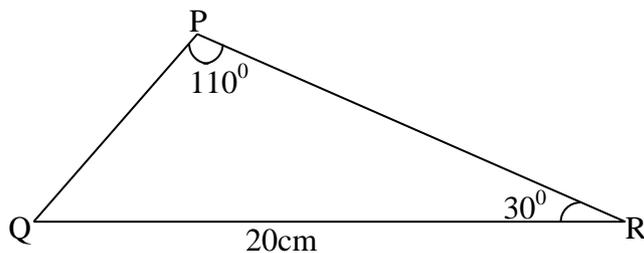
**MERU**  
**SCHOOL BASED FORM 4 EXAM JULY-AUGUST 2017**  
**Kenya Certificate of Secondary Education (K.C.S.E)**  
**MATHEMATICS**  
**Paper 1**  
**July/August 2016**  
**Time: 2 ½ Hours**  
**SECTION I (50 Marks)**

**Answer all the questions in this section**

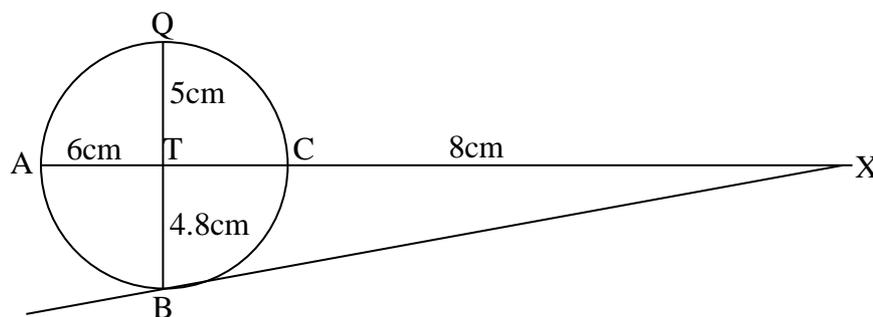
- Use logarithm tables to evaluate. (4 mks)  

$$\sqrt[3]{\frac{3.782 \times 0.000288}{76.54}}$$
- Make Z the subject of the formula. (3 mks)  

$$2x = \left(\frac{wz^2}{y+z^2}\right)^{\frac{1}{3}}$$
- Without using mathematical tables or a calculator, simplify  $\frac{2}{3-\sqrt{7}} - \frac{2}{3+\sqrt{7}}$  in the form  $a\sqrt{b}$  (3 mks)
- The length and breadth of a rectangular floor were measured and found to be 4.1m and 2.2m respectively. If a possible error of 0.01m was made in each of the measurements, find the; (2 mks)  
 (a) Maximum and minimum area of the floor.  
 (b) Maximum possible wastage in a carpet ordered to cover the floor. (1 mk)
- A quantity p varies partly as t and partly the square of t. When t = 10, p = 45 and when t = 24, p = 60. Find p when t = 32. (4 mks)
- Solve the equation  $\text{Log}_{10}(6x - 2) - 1 = \text{Log}_{10}(x - 3)$  (3 mks)
- The figure below shows triangle PQR in which QR = 20cm, angle QPR = 110° and PRQ = 30°. Calculate to 1 d.p, the length of PQ and find the area of triangle PQR. (4 mks)



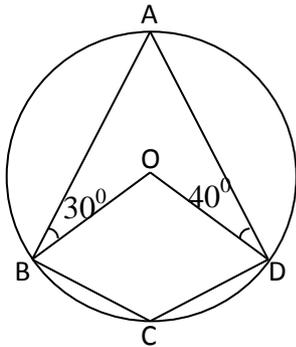
- (a) Expand  $(1 - \frac{1}{2}x)^5$  upto the term in  $x^3$  (1 mk)  
 (b) Use the expansion above to find the value of  $(0.95)^5$ . (2 mks)
- The equation of a circle centre (a,b) is  $x^2 + y^2 - 10y + 30 = 0$ . Find the values of a and b. (3 mks)
- A transformation is represented by the matrix  $\begin{pmatrix} 1 & 2 \\ 3 & 2 \end{pmatrix}$ . This transformation maps triangle ABC of the area 3cm<sup>2</sup> onto another triangle A'B'C'. Find the area of triangle A'B'C'. (3 mks)
- Two places P and Q are at (36°N, 125°W) and (36°N, 55°E) respectively. Calculate the distance in nautical miles between P and Q measured along the great circle through the North pole. (3 mks)
- A pyramid VABCD has a rectangular horizontal base ABCD with AB = 12cm and BC = 9cm. The vertex V is vertically above A and VA = 6cm. Calculate the volume of the pyramid. (2mks)
- In the figure below, BX is a tangent to the circle at B. ATCX and BTQ are straight lines. AT = 6cm, CX = 8cm, BT = 4.8cm and TQ = 5cm.



Find the length of:-

- TC (2 mks)
  - BX (2 mks)
- The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term. (3 mks)

15. Solve the equation  $4 \sin^2 \theta + 4 \cos \theta = 5$  for  $0^\circ \leq \theta \leq 360^\circ$ . (3 mks)
16. In the figure below, ABCD is a cyclic quadrilateral. Point O is the centre of the circle. Angle ABO =  $30^\circ$  and angle ADO =  $40^\circ$ . Calculate the size of angle BCD. (2 mks)



**SECTION II**

**Answer only five questions in this section**

17. The table below shows the monthly income tax rates for the year 2010.

Monthly taxable income (KSh. )	Tax rates
1 - 9680	10%
9681-18800	15%
188001 - 27920	20%
27921 - 37040	25%
37041 and above	30%

In the year 2010 Kawira's monthly earnings were as follows:-

Basic salary	KSh. 30,000
House allowance	KSh. 14,000
Medical allowance	KSh. 2500
Travelling allowance	KSh. 500

- (a) Calculate Kawira's monthly income. (2 mks)
- (b) Calculate Kawira's monthly gross tax. (5 mks)
- (c) Kawira is also deducted KSh. 180 and KSh. 140 towards his NSSF respectively. Calculate his monthly net pay. (3 mks)
18. (a) Complete the table below for the functions  $y = 3x \cos x$  and  $y = \sin 2x$ . (2 mks)
- | x          | $-180^\circ$ | $-150^\circ$ | $-120^\circ$ | $-90^\circ$ | $-60^\circ$ | $-30^\circ$ | 0 | $30^\circ$ | $60^\circ$ | $90^\circ$ | $120^\circ$ | $150^\circ$ | $180^\circ$ |
|------------|--------------|--------------|--------------|-------------|-------------|-------------|---|------------|------------|------------|-------------|-------------|-------------|
| $3 \cos x$ | -3           | -2.5         |              | 0           | 1.5         | 3           |   | 1.5        |            |            |             | -2.6        |             |
| $\sin x$   | 0            |              | 0.87         | 0           |             | -0.87       | 0 | 0.87       |            | 0          | -0.87       |             | 0           |
- (b) On the same axis, draw the graph  $f y = 3 \cos x$  and  $y = \sin 2x$  for  $-180^\circ \leq 180^\circ$ . Scale 1cm represent  $30^\circ$  on the x - axis, 1cm represent 0.5 units on y axis. (5 mks)
- (c) Use the graph in (b) above to
- (i) Solve the equation  $3 \cos x - \sin 2x = 0$  (1 mk)
- (ii) Find the range of values of x such that  $3 \cos x \geq 1.5$ . (1 mk)
- (iii) State the amplitude of  $y = \cos x$  and period of  $y = \sin 2x$ . (1 mk)

19. The table below shows the marks scored by Form 4 students in a certain school.

Marks	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84
Frequency	5	4	8	6	13	4	5	3	2

- (a) State
- (i) the modal class (1 mk)
- (ii) the model frequency (1 mk)
- (b) By using an assumed mean of 62, calculate:-
- (i) the mean (3 mks)
- (ii) the variance (3 mks)
- (iii) the standard deviation (1 mk)
- (c) Determine the percentage of students who failed if the pass mark was 55. (1 mk)
20. A trader deals in two types of rice, type A and B. Type A costs KSh. 400 per bag and type B costs KSh. 350 per bag.
- (a) The trader mixes 30 bags of type A with 50 bags of type B. If he sells the mixture at a profit of 20%, calculate the selling price of one bag of the mixture. (4 mks)
- (b) The trader now mixes type A with type B in the ratio  $x : y$  respectively. If the cost of the mixture is KSh. 383.50 per bag, find the ratio  $x : y$ . (4 mks)

- (c) The trader mixes one bag of the mixture in part (a) with one bag of the mixture in part (b) above. Calculate the ratio of type A rice to type B rice in this mixture. (2 mks)
21. The displacement,  $S$  metres, of a moving particle after  $t$  seconds is given by  $S = 2t^3 - 5t^2 + 4t + 2$
- (a) the velocity of the particle when  $t = 3$  seconds. (3 mks)
- (b) the value of  $t$  when the particle is momentarily at rest. (3 mks)
- (c) the displacement when the particle is momentarily at rest. (2 mks)
- (d) the acceleration of the particle when  $t = 3$  seconds. (2 mks)
22. A box contains 3 brown, 9 pink and 15 white cloth pegs. The pegs are identical except for the colour.
- (a) Find the probability of picking
- (i) a brown peg. (1 mk)
- (ii) a pink or a white peg (2 mks)
- (b) Two pegs are picked at random, one at a time, without replacement. Find the probability that:
- (i) a white peg and a brown peg are picked. (3 mks)
- (ii) both pegs are of the same colour. (4 mks)
23. (a) Complete the table below for  $y = x^3 + 4x^2 - 5x - 5$  (2 mks)
- |                       |    |    |    |    |    |   |   |   |
|-----------------------|----|----|----|----|----|---|---|---|
| $x$                   | -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 |
| $x^3 + 4x^2 - 5x - 5$ |    |    |    |    |    |   |   |   |
- (b) On the grid provided draw the graph of  $x^3 + 4x^2 - 5x - 5$  for  $-5 \leq x \leq 2$  (3 mks)
- (c) (i) Use the graph to solve the equation  $x^3 + 4x^2 - 5x - 5 = 0$  (2 mks)
- (ii) By drawing a suitable straight line on the graph, solve the equation  $x^3 + 4x^2 - 5x - 5 = -4x - 1$
24. A trader bought 2 cows and 9 goats for a total of KSh. 98200. If she bought 3 cows and 4 goats, she would have spent KSh. 2200 less.
- (a) Form two equations representing the above information. (2 mks)
- (b) Use matrix method to determine the cost of a cow and that of a goat. (4 mks)
- (c) The trader later sold the animals she had bought making a profit of 30% per cow and 40% per goat.
- (i) Calculate the total amount of money she received. (2 mks)
- (ii) Determine, correct to 4 significant figures, the percentage profit the trader made from the sale of the animals. (2 mks)