

KASSU JET EXAMINATIONS

121/1

Mathematics Paper 1

SECTION A

1. Evaluate leaving your answer in simplified form (3marks)

$$\frac{\frac{2}{3} - \frac{1}{4}}{\frac{1}{2} - \frac{1}{3}}$$

2. Calculate the value of $\sqrt{\frac{1}{2}}$ using factor notation. (3marks)

3. The length of three wires are 36m, 48m and 72m. pieces of wire of equal lengths were cut from the three wires, calculate the least number of pieces obtained. (3marks)

4. A two-digit number is such that the sum of the digits is 14. When the digits are reversed its value is 36 more than the original number. Find the original number. (3marks)

5. Simplify $\frac{-4}{-y}$ (3marks)

6. The area of a rhombus is 60cm² given that one of its diagonal is 15cm long, calculate the perimeter of the rhombus (4marks)

7. The sum of two numbers is 23 and their difference is 3. Find the sum of the squares of the two numbers. (3marks)

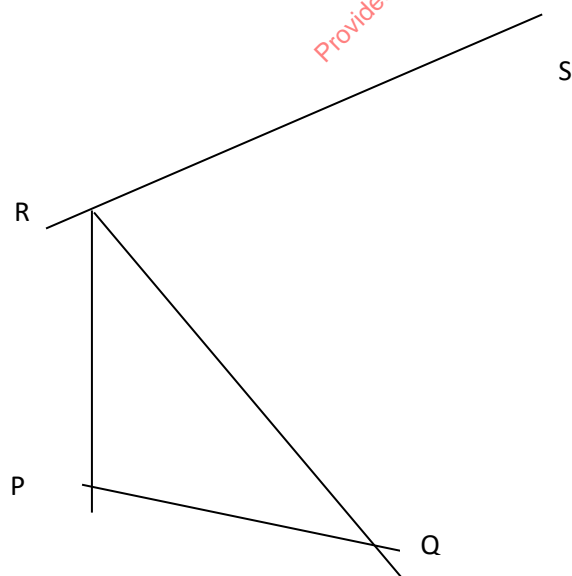
8. A Kenyan bank buys and sells foreign currency as shown in the table below.

	Buying (Ksh)	Selling (Ksh)
1 US dollar	95.34	95.87
1 UK pound	124.65	125.13

A tourist arrived in Kenya with 15000 pounds which he converted into Ksh at a commission of 8%. He later used half of the money before changing the balance into dollars at no commission. Calculate to the nearest dollar the amount he received. (3marks)

9. 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 and hence name it (3marks)

10. The figure below shows a solid wedge PQRSTU. Complete the solid showing all the hidden edges with dotted lines. (3marks)

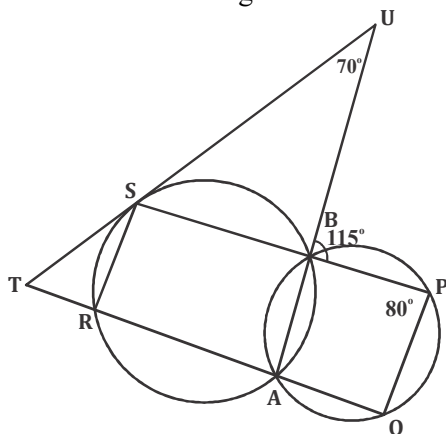


11. Solve the equation (3marks)
 $3^x \times 3^y = 1$
 $2^{2x-y} - 64 = 0$
12. Using tables, find the reciprocal of 0.432 and hence evaluate $\frac{\sqrt{0.1225}}{0.432}$ (3marks)
13. The angle of elevation of the top of a building from a point P is 45° . From another point T, 15 meters nearer the foot of the building, the angle of elevation of the top of the building is 52° . Calculate the height of the building. (3marks)
14. The data below represents the ages in months at which 6 babies started walking; 9, 11, 12, 13, 14 and 10. Find the root mean squared deviation of the data (4marks)
15. Find all the integral values of x which satisfy the inequalities (3marks)
 $20 - x > 5 + 2x \geq x + 5$
16. a) Matrices P and Q are given by $P = \begin{pmatrix} 3 & 1 & 2 \end{pmatrix}$ and $Q = \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$ Find the product PQ. (1mk)
- b) Given $A = \begin{pmatrix} 10 & 7 & 5 \\ 9 & 11 & 12 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 4 \\ 1 & 6 \\ 0 & 3 \end{pmatrix}$ find AB (2mks)

SECTION B

- 17.
- (a). The price of an article is marked as sh.12,000. Mr. Mulmulwas sold the article at a discount of 10% and still made a profit of 5%. Calculate the cost of the article. (3marks)
- (b). Mr. Mulmulwas made a loss of 30% by selling an electric kettle at sh.700. What profit would he have made if she had sold it at sh.1150? (3marks)
- (c). Mr. Mulmulwas 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 and he was paid a total commission of sh.458,900. Calculate the percentage rate of commission he was paid. (4mks)
18. The coordinates of the points P and Q are (1, -2) and (4, 10) respectively. A point T divides the line PQ in the ratio 2:1.
- a. Determine the coordinates of T (3marks)
- b. Find the gradient of a line perpendicular to PQ, hence determine the equation of the line perpendicular to PQ and passing through T (4marks)
- c. If the line meets the y-axis at R, calculate the distance TR to three significant figures. (3marks)
19. A triangle PQR has vertices at P (1,1), Q (2,4) and R (4,2) Draw on the same axes triangle PQR and its image $P^I Q^I R^I$ after a reflection in the line $y = x$ (3marks)
- b) On the same axes draw $P^{II} Q^{II} R^{II}$ the image of $P^I Q^I R^I$ after -90° turn about the origin and state the co-ordinates of $\Delta P^{II} Q^{II} R^{II}$ (2marks)
- c) Describe the transformation that maps $\Delta P^{II} Q^{II} R^{II}$ onto ΔPQR . (2marks)
- d) Draw $\Delta P^{III} Q^{III} R^{III}$ the image of $\Delta P^{II} Q^{II} R^{II}$ under a reflection in the line $x = 3$. State the co-ordinates of $\Delta P^{III} Q^{III} R^{III}$. (3marks)

20. The figure above shows two circles ABPQ and ABSR intersecting at A and B. QART, PBS and ABU are straight lines. The line TSU is a tangent to the circle ABSR at S. Given that $\angle BPQ = 80^\circ$, $\angle PBU = 115^\circ$ and $\angle BUS = 70^\circ$.



Find state reasons the following angles

- a) $\angle BRS$ (2 marks)
- b) $\angle BSU$ (2 marks)
- c) $\angle STR$ (2 marks)
- d) $\angle BAR$ (2 marks)
- e) $\angle ARB$ (2 marks)

21. Helena left town A at 8:00 am and travelled towards town B at an average speed of 64 km/h. half an hour later, Joan left town B and travelled towards A at the same speed if the two towns are 384km apart:
- a. At what time of the day did they meet? (5marks)
 - b. How far from town B was their meeting point? (2marks)
 - c. How far apart were they at 10:30am (3marks)
22. Four towns A, B, C and D are such that B is 84km direct to the north of A and C is on a bearing of $N65^\circ W$ from A at a distance of 60km. D is on a bearing of 340° from C at a distance of 30km. Using a scale of 1 cm rep 10km
- a) Make an accurate scale drawing showing the relative positions of the towns (5marks)
 - b) Find the distance and bearing of B from C (2marks)
 - c) Find the distance and bearing of D from B (2marks)
 - d) Find the bearing of A from D (1mark)

23. (a) Complete the table below for the function $y = 2x^2 + 3x - 5$. (2mks)

x	-4	-3	-2	-1	0	1	2
$2x^2$		18			0		
$3x$	-12			-3			6
-5							
y							

- (b) On the grid provided draw the graph of $y = 2x^2 + 3x - 5$ for $-4 \leq x \leq 2$ (4mks)
- (c) Use your graph to state the roots of
- (i) $2x^2 + 3x - 5 = 0$ (1mark)
 - (ii) $2x^2 + 6x - 2 = 0$ (3marks)

24. The speed of projectile v m/s at a given time t is given by $v = 10(10t - t^2)$ calculate
- a. The time when the velocity is maximum (3marks)
 - b. The maximum velocity attained (2marks)
 - c. The distance travelled by the body in the first 6 seconds (3marks)
 - d. The acceleration of the projectile at $t = 6.5sec$ (2marks)

KASSU JET EXAMINATIONS 2019

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

121/2

Mathematics Paper 2

(SECTION I 50 MARKS)

1. In this question, show all the steps in your calculations, giving the answer at each stage. Use logarithms correct to decimal places, to evaluate. (4 marks)

$$\left(\frac{8.574 \log 5.843}{\sqrt{0.005124}} \right)^{\frac{-2}{5}}$$

2. Make h the subject of the formula $E = 1 - \pi \sqrt{\frac{h-0.5}{1-h}}$ (4 marks)

3.(a) Expand and simplify $\left(x - \frac{1}{2x}\right)^6$ up to the term in x^3 and state the constant term.

(b) Use this expansion to calculate to 4 d.p the value of $(0.96)^6$. (2 mark)

4. Solve for x in $\log_3 \left(3^{x^2-13x+28} + \frac{2}{9}\right) = \log_5 0.5$ (3 marks)

5. Use the method of completing the square to solve (3 marks)

$$4 - 9x - 3x^2 = 0$$

6. 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 . (3 marks)

7. The radius and height of a cylindrical Kentank rounded to 1 cm are 105 cm and 300 cm respectively. Calculate the percentage error in its volume. (3 marks)

8. Given that P varies directly as V and inversely as the cube root of R and that

$$P = 12 \text{ when } V = 3 \text{ and } R = 2,$$

(i) Find an equation connecting P , V and R . (2 marks)

(ii) Find the percentage change in P if V is increased by 12% and R decreased by 36%

9. The cost of a matatu was sh. 950 000. It depreciated in value by 5% per year for the first 2 years and 15% per for the subsequent years. Calculate the value of the matatu after 5 years. (3 marks)

10. The mass of two similar solid are 324g and 768g. Find the surface area of the smaller solid if the surface area of the bigger solid is 40cm². (3 marks)

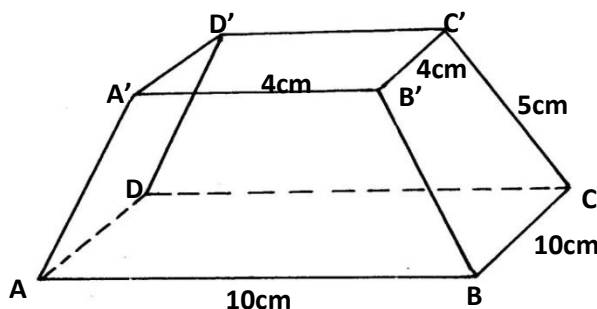
11. Calculate all the values of x between -180° and $+180^\circ$ which satisfy the equation $6 \cos (x - 30)^\circ = -3$ (3 marks)

12. 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 $x^2 + y^2 + ax + by + c = 0$. (3 marks)

13. Triangle ABC has vertices $A(1,0)$, $B(4,0)$ and $C(1,4)$ is mapped onto $A'B'C'$ under a shear matrix, x -axis invariant and $C(1,4)$ is mapped onto $C'(7,4)$. Find the shear matrix hence find the coordinates of the image of $P(2,-3)$ and $Q(-2,-3)$. (3 marks)

14. Draw a line $DF = 4.6\text{cm}$. Construct the locus of point K above DF such that angle $DKF = 70^\circ$. (3 marks)

15. The figure below shows a frustum of a square based pyramid (not drawn to scale). The based $ABCD$ is a square of sides 10cm. The top $A'B'C'D'$ is a square of side 4 cm and each slant edges of the frustum is 5cm long. Calculate the angle between AC' and the line AC . (4 marks)

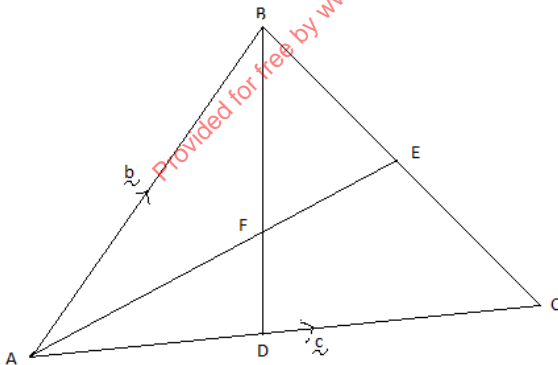


16. Two circles centres A and B and radii 2.5cm and 1.5cm respectively. The distance between A and B is 7cm.
 (a) Draw the required circles and construct the direct common tangents to the two circles. (2 marks)
 (b) Measure the length of the tangent (1 mark)

SECTION II (50 MARKS)

(Answer ANY FIVE questions in the spaces provided)

17. An aeroplane that moves at a constant speed of 600 knots flies from town A (14°N , 30°W) southwards to town B ($X^{\circ}\text{S}$, 30°W) taking $3\frac{1}{2}$ hrs. It then changes direction and flies along latitude to town C ($X^{\circ}\text{S}$, 60°E). Given $\pi = 3.142$ and radius of the earth $R = 6370 \text{ km}$
 (a) Calculate
 (i) The value of X (3 marks)
 (ii) The distance between town B and town C along the parallel of latitude in km. (2 marks)
 (b) D is an airport situated at (5°N , 120°W), calculate
 (i) The time the aeroplane would take to fly from C to D following a great circle through the South Pole (3 marks)
 (ii) The local time at D when the local time at A is 12.20 pm (2 marks)
18. The first term of A.P is 3.5, the common difference is d if the difference of 20^{th} and 6^{th} terms is 40.
 (a) (i) find the common difference, d (2 marks)
 (ii) calculate the sum of the first 40 terms of the AP (2 marks)
 (b) The progression is such that the 2^{nd} , 14^{th} and 85^{th} terms of the AP forms the first 3 terms of a G.P. If the common difference of A.P is 2.5
 Find
 (i) 2^{nd} term of the G.P (3 marks)
 (ii) Sum of the two 10 terms of G.P (3 marks)
19. The probability that a boy goes to school by bus is $\frac{1}{3}$ and by matatu is $\frac{1}{2}$. If he uses a bus the probability that he is late to school is $\frac{1}{5}$ and if he uses a matatu the probability of being late is $\frac{3}{10}$. If he uses other means of transport, the probability of being late is $\frac{1}{20}$. What is he probability that;
 (a) He will be late to school (2 marks)
 (b) He will not be late to school (3 marks)
 (c) He will be late to school if he does not use a matatu (3 marks)
 (d) He neither uses a bus nor matatu but arrives to school early. (2 marks)
20. In the figure below, E is the midpoint of BC. $AD : DC = 3:2$ and F is the meeting point of BD and AE.



- (a) Express the following vectors in terms of \mathbf{b} and \mathbf{c}
 (i) \vec{BD} (2 marks)
 (ii) \vec{AE} (2 marks)
 (b) If $\mathbf{BF} = t\mathbf{BD}$ and $\mathbf{AF} = n\mathbf{AE}$, find the value of t and n (5 marks)
 (c) State the ratio in which F divides BD and AE (1 mark)
21. (a) Using trapezoidal rule estimate the area bounded by the curve $y = 3x^2 - 2$ and the lines $x = -4$, $x = 4$ and $x - axis$. (4 marks)
 (b) find the actual area bounded by the curve $y = 3x^2 - 2$ and the lines $x = -4$, $x = 4$ and $x - axis$. (3 marks)

(c) Calculate the percentage error when trapezoidal rule is used. (3 marks)

22. The table below gives the marks obtained in a mathematics test by 47 students.

23.

Marks	41-45	46-50	51-55	56-60	61-65	66-70
No of students	3	7	14	13	7	3

(a) State the modal class (1 mark)

(b) Draw a cumulative frequency curve to represent the above data. (4 marks)

(c) Use your graph to estimate

(i) Median (1 mark)

(ii) Lower quartile (1 mark)

(iii) Upper quartile (1 mark)

(d) Calculate the quartile deviation (2 marks)

24. The table below shows the income tax rates

Income per annum in K£	Rate in Sh per K£
1-1980	2
1981-3960	3
3961-5940	5
5941-7920	7
7921-9920	9
Over 9920	10

Juma is a salaried employee who is given an automatic house allowance of sh8000 monthly. He also gets a single relief of Ksh1320. If his P.A.Y.E is Ksh 5420 a month,

(a) Find his total tax in shillings per annum (3 marks)

(b) How much does he earn per month? (7 marks)

24. A certain uniform supplier is required to supply two types of shirts: one for girls labeled G and the other for boys labeled 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. (4 marks)

(b) On the grid provided draw the inequalities and shade the unwanted regions. (4 marks)

(c) Given that type G costs Ksh 500 per shirt and type B costs Ksh. 300 per shirt

(i) Use the graph in (b) above to determine the number of shirts of each type that should be made to maximize profit. (1 mark)

(ii) Determine the maximum profit (1 mark)

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11. In the figure below, angle ABE is equal to angle ADC AE = 6cm, ED = 9cm and AB = 8cm, calculate the length of BC. (3mks)
12. Simplify the expression below leaving your answer in rationalized surd form of $a + b\sqrt{c}$

$$\frac{1 + \tan 120^\circ}{1 + \cos 330^\circ}$$
 (4mks)
13. The two sides of a triangle are given 6 cm and 5 cm. the angle between them is 130° . calculate the area of the triangle (giving your answer to 2 decimal places) (3mks)
14. Given that $k\mathbf{m} + h\mathbf{n} = \mathbf{r}$ and that $\mathbf{m} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$, $\mathbf{n} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} -6 \\ 0 \end{pmatrix}$. Find the scalars k and h (3mks)
15. A Kenyan bank buys and sells foreign currencies as shown.

	Buying (Kshs.)	Selling (Kshs.)
1 Euro	84.15	84.26
100 Japanese Yen	65.37	65.45

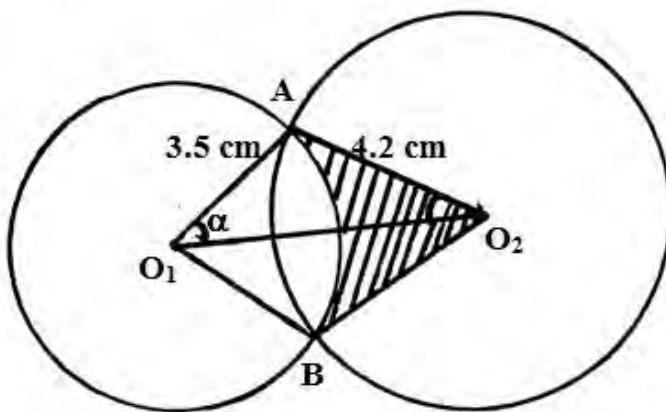
A Japanese travelling from France to Kenya had 5000 Euros. He converted all the 5000 Euros to Kenya shillings at the bank. While in Kenya, he spent a total of Kshs. 289,850 and then converted the remaining Kenya shilling to Japanese Yen. Calculate the amount in Japanese Yen that he received. (3mks)

16. The length of a rectangular mat is 1.5 m longer than its width. Find the length of the mat if its area is 6.5 m^2 (give your answer to 4 significant figures) (3mks)

SECTION II

Answer only five questions from this section

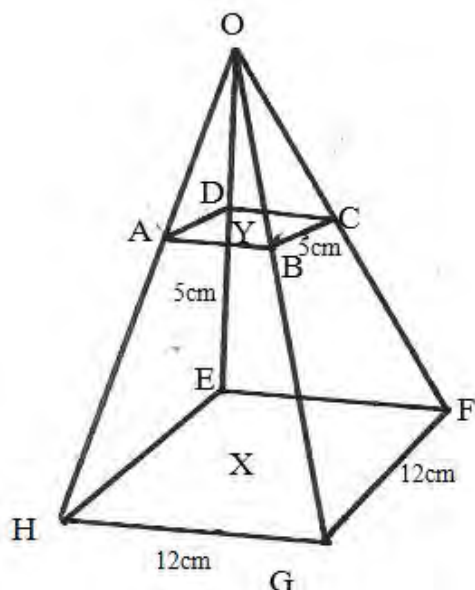
17. Five towns V,W,X,Y and Z are situated such that W is 200km east of V. X is 300km from W on a bearing of 150° . Y is 350km on a bearing of 240° from X. Z is 150° from V but 200° from X. Draw the diagram representing the position of the towns. (use a scale of 1cm to represent 50km). (5mks)
- (b) From the diagram determine
 (i) the distance in km of V from Z (1mk)
 (ii) The bearing of Y from W (1mk)
- (c) A plane heading to town X takes off from town Y and flies upwards at a constant angle which is less than 90° . After flying a distance of 350km in the air it sees town X at an angle of depression of 50° . Calculate the distance of the plane from X at this point to the nearest km. (3mks)
18. Two circles of radii 3.5 and 4.2 cm with centres O_1 and O_2 respectively intersect at points A and B as shown in the figure below. The distance between the two centres is 6 cm.



Calculate

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23.



The diagram shows a frustum ABCDEF GH formed from a smaller pyramid ABCDO. The base the top of the frustums are squares of sides 12cm and 5 cm respectively. If $Ob = 6\text{cm}$ and each of the slant edges of the frustum is 15 cm long. Calculate to 1 decimal place:

- (a) the height OY of the small pyramid (3mks)
- (b) the vertical height X Y of the frustum (4mks)
- (c) the volume of the frustum (3mks)

24. The table below shows the income tax rates

Total income per month In Kenya Pounds	Rate in shillings per pound
1 - 325	2
326 - 650	3
651 - 975	4
976 - 1300	5
1301 and above	7

Mr. Musango earned a basic salary of shs. x and a house allowance of shs. 3000 per month. He claimed a tax relief for a married person of shs. 455 month. He paid shs. 1794 income tax per month.

- a) Calculate Mr. Musango's basic salary in shs. per month (6mks)
- b) Apart from the income tax, the following monthly deductions are made. Service charge – shs. 100, health insurance fund – shs 280 and 2% of his basic salary as widow and children pension scheme.

Calculate:

- i) The total monthly deductions (2mks)
- ii) Mr. Musango's net income p.m (2mks)

MOMALICHE
121/2
MATHEMATICS PAPER 2
FORM

SECTION I

1. Use logarithms tables to evaluate

$$\sqrt[3]{\frac{36.72 \times (0.46)^2}{185.4}} \quad (4\text{mks})$$

2. T is a transformation represented by the matrix $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$ under T, a square of area 10cm^2 is mapped onto a square of area 110cm^2 . Find the value of x (3mks)

3. Given that $2\cos(2x - 30^\circ) = -\frac{6}{5}$ find x where $180^\circ \leq x \leq 360^\circ$ (3mks)

4. Make A the subject of the formula

$$T = \frac{2m}{n} \sqrt{\frac{L-A}{3K}} \quad (3\text{mks})$$

5. A quantity P is partly constant and partly varies inversely as square of t. $P = 6$ when $t = 6$ and $p = 18$ when $t = 3$. Find t when $p = 11$ (3mks)

6. i) Expand $\left(5 + \frac{x}{2}\right)^6$ up to the term in x^3 . (2mks)

ii) Use your expansion to estimate the value of $\left(\frac{11}{2}\right)^6$. Correct to one decimal place. (2mks)

7. Solve for x in the equation. (3 Mks)

$$\text{Log}_8(x + 6) - \text{Log}_8(x - 3) = \frac{2}{3}$$

8. Solve for x and y in the simultaneous equation below. (3 mks)

$$\begin{aligned} xy + 6 &= 0 \\ x - 2y &= 7 \end{aligned}$$

9. The size of each interior angle of a regular polygon is five times the size of the exterior angle. Find the number of sides of the polygon. (3mks)

10. If $\frac{1}{3 - \sqrt{5}} - \frac{2 + 2\sqrt{5}}{3 + \sqrt{5}} = a + b\sqrt{c}$, find the value of a, b and c (3 mks)

11. The data below shows marks scored by 8 form four students in Molo district mathematics contest 44, 32, 67, 52, 28, 39, 46, 64. Calculate the mean absolute deviation. (3 Mks)

12. Steve deposited ksh.50, 000 in a financial institution in which interest is compounded quarterly. If at the end of second year he received a total amount of ksh79, 692.40. Calculate the rate of interest p.a (3 Mks)

13. 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 (1mk)

(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 (2mks)

14. Pipe x can fill an empty tank in 3 hours while pipe y can fill the same tank in 6 hours. When the tank is full, it can be emptied by pipe z in 8 hours. pipe x and y are opened at the same time when the tank is empty. If one hour later pipe z is also opened, find the total time taken to fill the tank. (3marks)

15. Fatima bought maize and beans from Kami. She mixed the maize and beans in the ratio 3: 2 she bought the maize at sh.90 per kg and the beans at sh.150 per kg. If she was to make a profit of 30% what would be the selling price of 1kg of the mixture. (3mks)

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