

**GEM SUB-COUNTY JOINT EVALUATION EXAMS 2016**

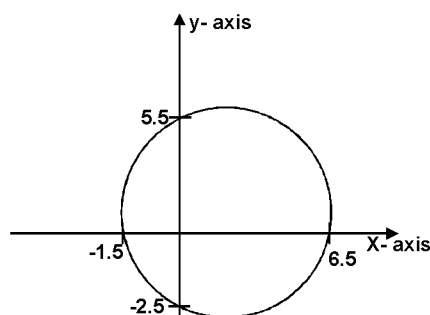
Kenya Certificate of Secondary Education

**MATHEMATICS**

Paper - 121/

**July/August 2016****Time:** 2½ hours**SECTION 1 (50 MARKS)****Answer all the questions in this section in the spaces provided**

1. Use logarithms, correct to 4 significant figures to evaluate: (4 marks)
 
$$\left( \frac{\log 13.7}{0.8452 \times 69.3} \right)^{\frac{1}{5}}$$
2. A quadratic curve passes through the points  $(-\sqrt{3}, 0)$  and  $(\sqrt{3}, 0)$ . Find the equation of the curve in the form  $y = ax^2 + b$  where  $a$  and  $b$  are integers. (2 marks)
3. Given that  $\frac{3}{3+\sqrt{5}} + \frac{3\sqrt{5}}{3-\sqrt{5}} = a + b\sqrt{5}$ . Find the values of  $a$  and  $b$ . (3 marks)
4. A trader mixes imported sugar costing Kshs 100 per kilogram with local sugar costing Kshs 150 per kilogram. When he sells the mixture at Kshs 165 he makes a profit of 44%. Find the ratio in which he mixes the two types of sugar. (3 marks)
5. Solve the equation  $8 \sin^2 x + 2 \cos x - 5 = 0$  for  $0^\circ \leq x^\circ \leq 180$  giving your answers to two decimal places. (4 marks)
6. The diagram below shows a sketch of a circle drawn in the Cartesian plane such that it cuts the axes at  $x = -1.5$ ,  $x = 6.5$ ,  $y = 5.5$  and  $y = -2.5$ .



- a) State the co-ordinates of the centre of the circle. (1 mark)
- b) State the radius of the circle in surd form. (1 mark)
- c) Find the equation of the circle in the form  $ax^2 + ay^2 + bx + cy + d$  where  $a, b, c$  and  $d$  are integers. (2 marks)
7. a) Expand and simplify  $(1 - \frac{1}{2}x)^5$  in ascending powers of  $x$  up to the term  $x^3$ . (1 mark)
- b) Use the expansion above to estimate the value of  $(0.98)^5$  to 3 decimal places. (2 marks)
8. Make  $R$  the subject of the formula; (3 marks)
 
$$m = \frac{CR}{\sqrt[3]{R^3 - C}}$$
9. The position vectors of points  $A$  and  $B$  are  $-i + j - 8k$  and  $2i + 3j - 2k$  respectively. Find the magnitude of the  $\overrightarrow{AB}$ . (3 marks)
10. A quantity  $P$  is a partly constant and partly varies inversely as  $Q$ .  $Q = 9$  when  $P = 3$  and  $Q = 18$  when  $P = 9$ . Find  $P$  when  $Q = 12$ . (4 marks)

11. The marks scored by a student in a test of 11 subjects were as follows.

Subject	Marks
English	40
Kiswahili	90
Mathematics	50
Biology	40
Physics	70
Chemistry	60
History	20
Geography	10
CRE	60
Computer	70
French	80

Determine the quartile deviation of the student's scores.

(3 marks)

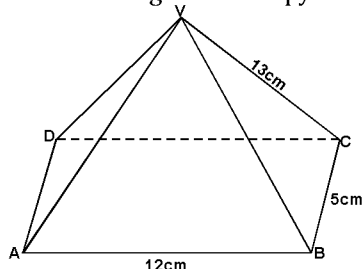
12. A triangle ABC is such that : AB is exactly 10cm; BC is 4.0cm and AC is 12.2cm measured to the nearest 2 millimetres. Calculate the maximum possible perimeter of the triangle.

(2 marks)

13. The sum of the first  $n$  terms of the sequence : 216, 72, 24 ... is  $323\frac{5}{9}$ , Determine the value of  $n$ .

(3 marks)

14. The diagram below shows a rectangular based pyramid in which  $AB = 12\text{cm}$ ,  $BC = 5\text{cm}$  and  $AV = BV = CV = DV = 13\text{cm}$ .



Calculate the angle plane DAV makes with the base ABCD correct to 4 significant figures.

(3 marks)

15. Five men working for eight hours daily complete a piece of work in three days. How long will it take twelve men working for five hours daily to complete the same piece of work.

(3 marks)

16. The points P and Q are 7.4cm apart. By construction locate the locus of R such that  $PR = 2.5\text{cm}$  and  $\angle PRQ = 90^\circ$

(3 marks)

#### SECTION 11 (50 MARKS)

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

17. A square A(-3, -3), B(-6, -3), C(-6, 0), D(-3, 0) is transformed by the matrix

(4 marks)

a) Draw ABCD and its image  $A^1B^1C^1D^1$  under P on the grid provided below.

b)  $A^{11}B^{11}C^{11}D^{11}$  is the image of  $A^1B^1C^1D^1$  under a transformation represented by the matrix .

State the co-ordinates of  $A^{11}B^{11}C^{11}D^{11}$  and draw it on the same grid above.

(3 marks)

c) State a single matrix that maps  $A^{11}B^{11}C^{11}D^{11}$  onto ABCD.

(3 marks)

18. a) A plane leaves Airport A( $40^\circ\text{S}$ ,  $36^\circ\text{W}$ ) at 1400 hrs on Monday and flies due North to airport B ( $50^\circ\text{N}$ ,  $36^\circ\text{W}$ ). Calculate the distance the plane covers in kilometres. (Take  $p = \frac{22}{7}$  and  $R = 6370\text{km}$ )

(3 marks)

b) After a 45 minutes stoppage at B, the plane flies due East to airport C, a distance of 2550 nautical miles from B. Find

i) the position of C.

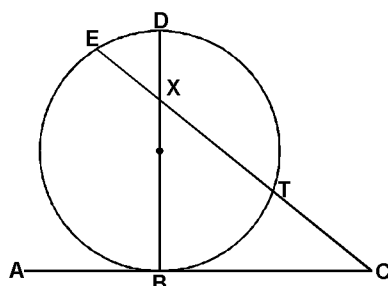
(4 marks)

ii) The local time the plane lands at C if its average speed for the whole journey is 1200km/hr

(Take 1 nautical mile = 1.854km)

(3 marks)

19. The diagram below not drawn to scale shows a circle in which BD is the diameter and ABC is a tangent to the circle at point B. EXTC is a straight line.



Given that  $BC = 6\text{cm}$ ,  $BX = 8\text{cm}$ ,  $EX = 2\text{cm}$ . Calculate

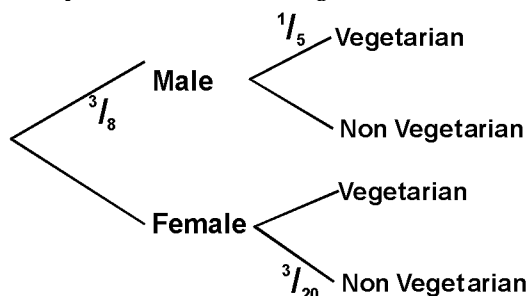
- i)  $XC$  (2 marks)
- ii)  $TC$  (2 marks)
- iii)  $DX$  (3 marks)
- iv) The radius of the circle (2 marks)
- v) Angle  $BCE$  (1 mark)

20. a) Complete the table below.

$x^\circ$	$-30^\circ$	$0^\circ$	$30^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$150^\circ$	$180^\circ$	$210^\circ$	$240^\circ$	$270^\circ$
$\sin(x + 30)^\circ$	0.00	0.50		1.00	0.87		0.00		-0.87		-0.87
$\cos(x - 15)^\circ$	0.71		0.97		0.26	-0.26		0.97		-0.71	-0.26

(2 marks)

- b) Draw the graph of  $y = \sin(x + 30)^\circ$  and  $y = \cos(x - 15)^\circ$  for  $-30^\circ \leq x \leq 270^\circ$  on the same grid. Take 1 cm to represent  $30^\circ$  on the x-axis and 1 cm to represent 0.2 units on the y-axis (5 marks)
  - c) Using your graph drawn in (b) above.
    - i) Find the values of  $x$  for which  $\cos(x - 15)^\circ - \sin(x - 30)^\circ = 0$  (2 marks)
    - ii) State the co-ordinates of the turning point of the curve for the function  $y = \cos(x - 15)^\circ$  on the negative section of y - axis. (1 mark)
21. A survey was conducted in a county of 160,00 adults to determine the relationship between their gender and eating habits. The result was presented in a tree diagram as shown below.



- a) Complete the tree diagram using appropriate fractions. (2 marks)
  - b) Determine the number of adults who are non vegetarian. (2 marks)
  - c) An adult is selected at random from the county, find the probability that she is a female vegetarian. (2 marks)
  - d) The adults were put in two groups: vegetarians verses non-vegetarians. Thereafter an adult is picked from each group. Determine the probability that the two adults picked are both male. (4 marks)
22. The table below shows annual income tax rates for the year 2010

INCOME (K£ p.a)	Tax (shs per k£)
1 - 4800	2
4801 - 9600	3
9601 - 14400	5
14401 - 19200	7
19201 - 24000	9
24001 and above	10

Mr. Karani's monthly earnings were as follows:-

Basic salary = Kshs 24,000

House allowance = Kshs 12,000

Medical allowance = Kshs 1,800

- a) Using the tax table above, calculate Mr. Karani's net Pay-As-You-Earn (PAYE) per month if his monthly family relief is Kshs 1,410. (6 marks)
  - b) If Mr. Karani pays Kshs 280 for NHIF, Ksh 3200 for hire purchase and Kshs 5,250 for loan repayment, calculate his net monthly salary. (4 marks)
23. A rectangular field measures 20 metres by 16 metres. A path of uniform width  $x$ - metres is made all round it. This make the area of the field to reduce in the ratio 7 : 16.
- a) Find an expression in  $x$  for the new length (1 mark)
  - b) Find the expression in  $x$  for the new area. (1 mark)
  - c) Find the possible value of  $x$  (4 marks)
  - d) The remaining area of the field is divided among three siblings Abdi, Bor and Celine such that the ratio of Abdi to Bor's is 3 : 4 while that of Bor's to Celine's is 6 : 5. Find the difference between the area of Celine's share and Abdi's share. (4 marks)

- 24.** A school has to transport atleast 420 students to a championship. The school uses two vans A and B. Van A carries 40 students per trip while B carries 60 students per trip. The vans are to use less than 320 litres of fuel. Van A uses 20 litres per trip while B uses 40 litres per trip.  
The number of trips made by Van A should be less than 3 times the number of trips made by van B.  
Van A should make more than 5 trips.
- a) Taking  $x$  to represent the trips made by van A and  $y$  to represent the trips made by van B, represent the above information in linear inequalities of  $x$  and  $y$ . (4 marks)
- b) On the grid provided below draw the inequalities above. (4 marks)
- c) Use the inequalities above to determine the number of trips made by A and B that would help minimise the cost of fuel used for the trips. (2 marks)