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# MATHEMATICS PAPER 1

## KCSE 2011

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1.3.1 Mathematics Alt. A Paper 1 (121/1)

SECTION 1 (50 marks)

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

1 Without using a calculator, evaluate;

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

(3 marks)

2 The diagonal of a rectangular garden measures  $11\frac{1}{4}$  m while its width measures  $6\frac{3}{4}$  m. Calculate the perimeter of the garden. (2 marks)

3 A motorist took 2 hours to travel from one town to another town and 1 hour 40 minutes to travel back. Calculate the percentage change in the speed of the motorist. (3 marks)

4 A square room is covered by a number of whole rectangular slabs of sides 60 cm by 42 cm. Calculate the least possible area of the room in square metres. (3 marks)

5 Given that  $\sin(x + 60)^\circ = \cos(2x)^\circ$ , find  $\tan(x + 60)^\circ$ . (3 marks)

6 Simplify the expression:

$$\frac{4x - 9x^3}{3x^2 - 4x - 4}$$

(3 marks)

7 The external length, width and height of an open rectangular container are 41 cm, 21 cm and 15.5 cm respectively. The thickness of the material making the container is 5 mm. If the container has 8 litres of water, calculate the internal height above the water level. (4 marks)

8 Factorise  $2x^2y^2 - 5xy - 12$  (2 marks)

9 Using a ruler and a pair of compasses only:

(a) construct a parallelogram PQRS in which PQ = 6 cm, QR = 4 cm and angle SPQ =  $75^\circ$ ; (3 marks)

(b) determine the perpendicular distance between PQ and SR. (1 mark)

10 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 marks)

- 11 A customer paid Ksh 5 880 for a suit after she was allowed a discount of 2% on the selling price. If the discount had not been allowed, the shopkeeper would have made a profit of 20% on the sale of the suit. Calculate the price at which the shopkeeper bought the suit. (3 marks)

Three vertices of a parallelogram PQRS are P(-1, 2), Q(8, -5) and R (5,0).

- (a) On the grid provided below draw the parallelogram PQRS. (1 mark)
- (b) Determine the length of the diagonal QS. (2 marks)
- 13 In January, Mambo donated  $\frac{1}{6}$ th of his salary to a children's home while Simba donated  $\frac{1}{5}$ th of his salary to the same children's home. Their total donation for January was Ksh 14 820. In February, Mambo donated  $\frac{1}{8}$ th of his salary to the children's home while Simba donated  $\frac{1}{12}$ th of his salary to the children's home. Their total donation for February was Ksh 8 675. Calculate Mambo's monthly salary. (4 marks)
- 14 (a) Express 10500 in terms of its prime factors. (1 mark)
- (b) Determine the smallest positive number P such that 10500P is a perfect cube. (2 marks)
- 15 Three police posts X, Y and Z are such that Y is 50 km on a bearing of  $060^\circ$  from X while Z is 70 km from Y and on a bearing of  $300^\circ$  from X.
- (a) Using a suitable scale, draw a diagram to represent the above situation. (3 marks)
- (b) Determine the distance, in km, of Z from X. (1 mark)
- 16 A small cone of height 8 cm is cut off from a bigger cone to leave a frustum of height 16 cm. If the volume of the smaller cone is  $160 \text{ cm}^3$ , find the volume of the frustum. (3 marks)

## SECTION II (50 marks)

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

- 17 A solid consists of a cone and a hemisphere. The common diameter of the cone and the hemisphere is 12 cm and the slanting height of the cone is 10 cm.
- (a) Calculate correct to two decimal places:
- (i) the surface area of the solid; (3 marks)
- (ii) the volume of the solid. (4 marks)
- (b) If the density of the material used to make the solid is  $1.3 \text{ g/cm}^3$ , calculate its mass in kilograms. (3 marks)

- 18** Makau made a journey of 700 km partly by train and partly by bus. He started his journey at 8.00 a.m. by train which travelled at 50 km/h. After alighting from the train, he took a lunch break of 30 minutes. He then continued his journey by bus which travelled at 75 km/h. The whole journey took  $11\frac{1}{2}$  hours.
- (a) Determine:
- the distance travelled by bus; (4 marks)
  - the time Makau started travelling by bus. (3 marks)
- (b) The bus developed a puncture after travelling  $187\frac{1}{2}$  km. It took 15 minutes to replace the wheel.  
Find the time taken to complete the remaining part of the journey. (3 marks)
- 19** (a) The product of the matrices  $\begin{pmatrix} 0 & 1 \\ 2 & p \end{pmatrix}$  and  $\begin{pmatrix} -1.5 & -0.5 \\ p & p-2 \end{pmatrix}$  is a singular matrix.  
Find the value of  $p$ . (3 marks)
- (b) A saleswoman earned a fixed salary of Ksh  $x$  and a commission of Ksh  $y$  for each item sold. In a certain month she sold 30 items and earned a total of Ksh 50 000. The following month she sold 40 items and earned a total of Ksh 56 000.
- Form two equations in  $x$  and  $y$ . (2 marks)
  - Solve the equations in (i) above using matrix method. (3 marks)
  - In the third month she earned Ksh 68 000. Find the number of items sold. (2 marks)
- 20** In a triangle ABC,  $BC = 8$  cm,  $AC = 12$  cm and angle  $ABC = 120^\circ$ .
- (a) Calculate the length of AB, correct to one decimal place. (4 marks)
- (b) If BC is the base of the triangle, calculate, correct to one decimal place:
- the perpendicular height of the triangle; (2 marks)
  - the area of the triangle; (2 marks)
  - the size of angle ACB. (2 marks)
- 21** (a) Using the trapezium rule with seven ordinates, estimate the area of the region bounded by the curve  $y = -x^2 + 6x + 1$ , the lines  $x = 0$ ,  $y = 0$  and  $x = 6$ . (5 marks)
- (b) Calculate:
- the area of the region in (a) above by integration; (3 marks)
  - the percentage error of the estimated area to the actual area of the region, correct to two decimal places. (2 marks)

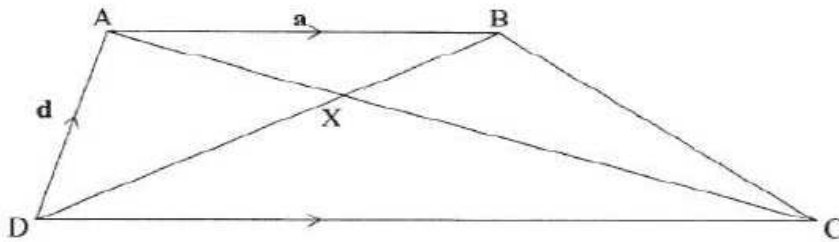


- 22 The displacement,  $s$  metres, of a moving particle after  $t$  seconds is given by,  
 $s = 2t^3 - 5t^2 + 4t + 2$ .

Determine:

- (a) the velocity of the particle when  $t = 3$  seconds; (3 marks)  
 (b) the value of  $t$  when the particle is momentarily at rest; (3 marks)  
 (c) the displacement when the particle is momentarily at rest; (2 marks)  
 (d) the acceleration of the particle when  $t = 3$  seconds. (2 marks)

- 23 In the figure below, ABCD is a trapezium. AB is parallel to DC, diagonals AC and DB intersect at X and  $DC = 2AB$ .  $\mathbf{AB} = \mathbf{a}$ ,  $\mathbf{DA} = \mathbf{d}$ ,  $\mathbf{AX} = k\mathbf{AC}$  and  $\mathbf{DX} = h\mathbf{DB}$ , where  $h$  and  $k$  are constants.



- (a) Find in terms of  $\mathbf{a}$  and  $\mathbf{d}$ :
- (i)  $\mathbf{BC}$ ; (2 marks)  
 (ii)  $\mathbf{AX}$ ; (2 marks)  
 (iii)  $\mathbf{DX}$ . (1 mark)
- (b) Determine the values of  $h$  and  $k$ . (5 marks)
- 24 The frequency table below shows the daily wages paid to casual workers by a certain company.

Wages in shillings	100-150	150-200	200-300	300-400	400-600
No. of workers	160	120	380	240	100

- (a) Draw a histogram to represent the above information. (5 marks)
- (b) (i) State the class in which the median wage lies. (1 mark)  
 (ii) Draw a vertical line, in the histogram, showing where the median wage lies. (1 mark)
- (c) Using the histogram, determine the number of workers who earn sh 450 or less per day. (3 marks)

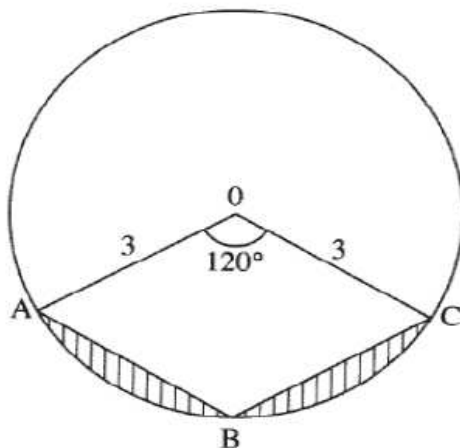
1.3.3 Mathematics Alt.B Paper 1 (122/1)

SECTION I (50 marks)

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

- 1 Evaluate  $\frac{-3 \times +6 + -2}{-4 + +5 - -3}$  (3 marks)
- 2 Find the common prime factors of 1890 and 1008. (2 marks)
- 3 On a certain day a journalist started travelling at 0850 hours to attend a meeting. He travelled for  $6\frac{1}{2}$  hours and then rested for 1 hour 45 minutes. He attended the meeting for  $3\frac{1}{4}$  hours and travelled for 35 minutes to a hotel.  
Determine the time, in 12-hour clock system, the journalist arrived at the hotel. (3 marks)
- 4 Use cube tables to calculate, to 4 significant figures, the volume of a cube whose side is 0.4321 m. (3 marks)
- 5 A cylindrical container of height 45 cm has a capacity of 25 litres. Find the radius of the container to the nearest millimetre. (3 marks)
- 6 Find the integral values of  $x$  which satisfy the inequality  $3x \leq 2x + 3 < 4x + 5$  (3 marks)
- 7 Three metal rods of lengths 234 cm, 270 cm and 324 cm were cut into shorter pieces, all of the same length, to make window grills.  
Calculate the length of the longest piece that can be cut from each of the rods and hence the total number of pieces that can be obtained from the rods. (4 marks)
- 8 Simplify  $\frac{1\frac{1}{5} - \frac{3}{8} \div \frac{2}{3}}{\frac{6}{7} \text{ of } 1\frac{1}{2} - \frac{3}{8}}$  (3 marks)
- 9 A support cable of length 6.5 m is fixed on a vertical pole at a distance of 0.9 m from the top. The cable is anchored on the ground at a distance of 2.5 m from the foot of the pole.  
Determine the height of the pole. (3 marks)
- 10 Use logarithm tables to evaluate (3 marks)
- $$\sqrt{\frac{2.5 \times 0.064}{8.1}}$$
- 11 Using a ruler and a pair of compasses only, construct triangle ABC such that AB = 4.5 cm, BC = 8.1 cm and angle CBA =  $60^\circ$ .  
Measure angle CAB. (3 marks)
- 12 The areas of the lids of two similar cylinders are  $16 \text{ cm}^2$  and  $25 \text{ cm}^2$ . If the volume of the bigger cylinder is  $800 \text{ cm}^3$ , find the volume of the smaller cylinder. (4 marks)
- 13 Use factorisation to solve the equation: (3 marks)
- $$\frac{1}{8}x^2 + x = 48$$

- 14 The sum of interior angles of a regular polygon is  $1620^\circ$ . Calculate the number of sides of the polygon. (2 marks)
- 15 Solve the simultaneous equations:  
 $p - q = 3$   
 $p^2 - q^2 = 21$  (4 marks)
- 16 In the figure below, OABC is a rhombus drawn in a circle, centre O, of radius 3 cm. Angle  $AOC = 120^\circ$



Determine the total area of the shaded regions to 2 decimal places. (4 marks)

**SECTION II (50 marks)**

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

- 17 A salesman was paid a basic salary of Ksh 48 000 per month plus a commission of 3% for sales of goods worth above Ksh 500 000.
- (a) In January he sold goods worth Ksh 800 000, calculate his total earnings that month. (3 marks)
- (b) In February his total earnings were Ksh 78 000. Find the value of goods sold that month. (4 marks)
- (c) In the month of March, his original rate of commission was reduced by 60%. If he sold goods worth Ksh 2 500 000, calculate his total earnings that month. (3 marks)

18 Three straight lines  $L_1$ ,  $L_2$  and  $L_3$  are such that:

$L_1$  cuts the  $y$ -axis at  $y = 5$  and has a gradient of 2;

$L_2$  is perpendicular to  $L_1$  at the point where  $L_1$  cuts the  $x$ -axis;

$L_3$  is parallel to  $L_2$  and passes through point  $(1, 2)$ .

(a) Find the equations, in the form  $y = mx + c$ , of:

(i)  $L_1$ ; (2 marks)

(ii)  $L_2$ ; (3 marks)

(iii)  $L_3$ ; (2 marks)

(b) Determine the coordinates of the point at which  $L_3$  is perpendicular to  $L_1$ . (3 marks)

19 Three partners, Amani, Furaha and Nehema, contributed a total capital of Ksh 750 000 to start a business. Amani contributed  $\frac{1}{3}$  of the money, Furaha contributed  $\frac{2}{5}$  of the money and Nehema contributed the rest.

After some time the business realised a profit of 36% of the capital. The profit was taxed at the rate of 5%.

After taxation, each of the partners received Ksh 20 000 of the profit. The remainder of the profit was shared among the three partners in the ratio of their contributions.

Calculate:

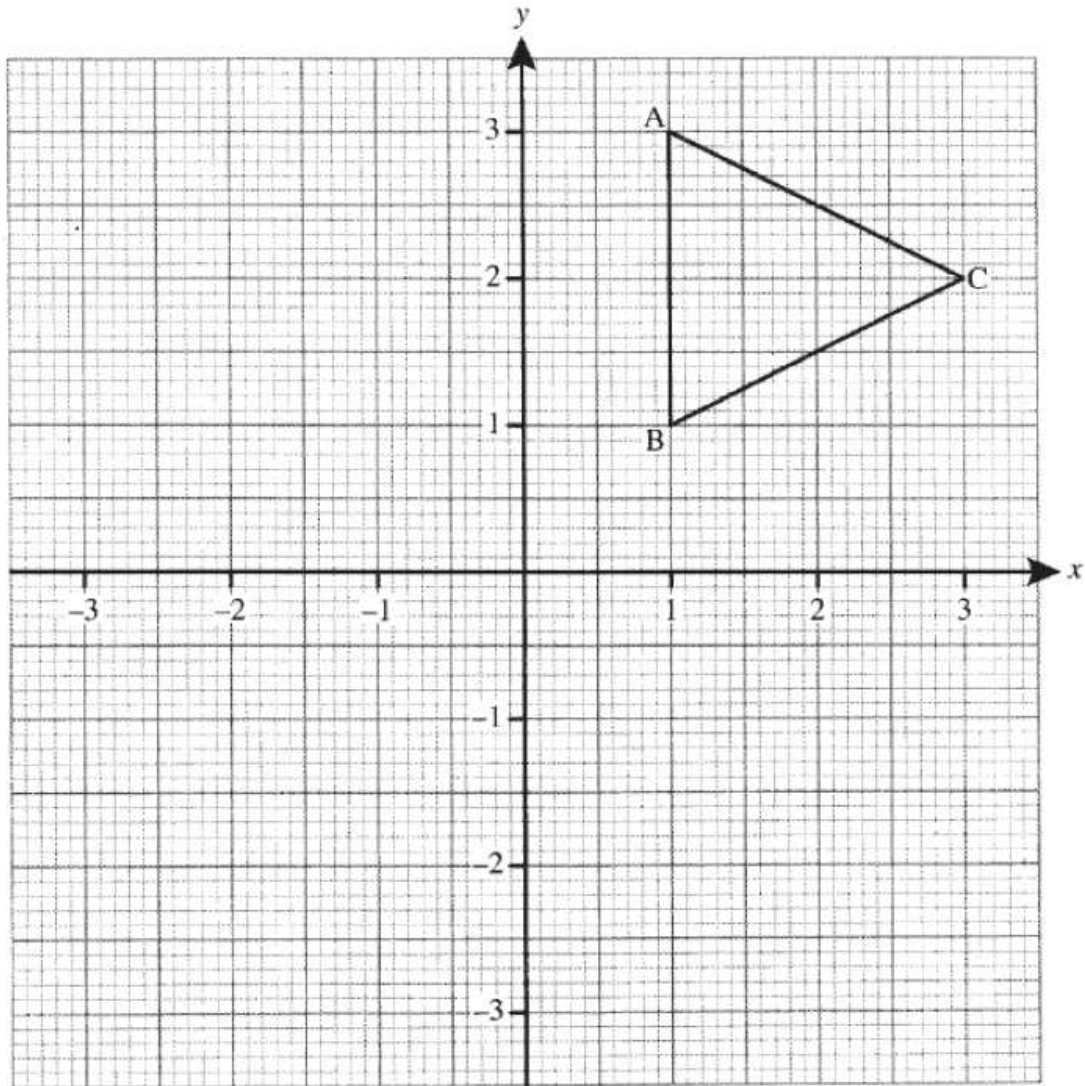
(a) the amount of money contributed by Nehema; (3 marks)

(b) the profit realised after taxation; (3 marks)

(c) the amount of money Furaha got more than Nehema. (4 marks)

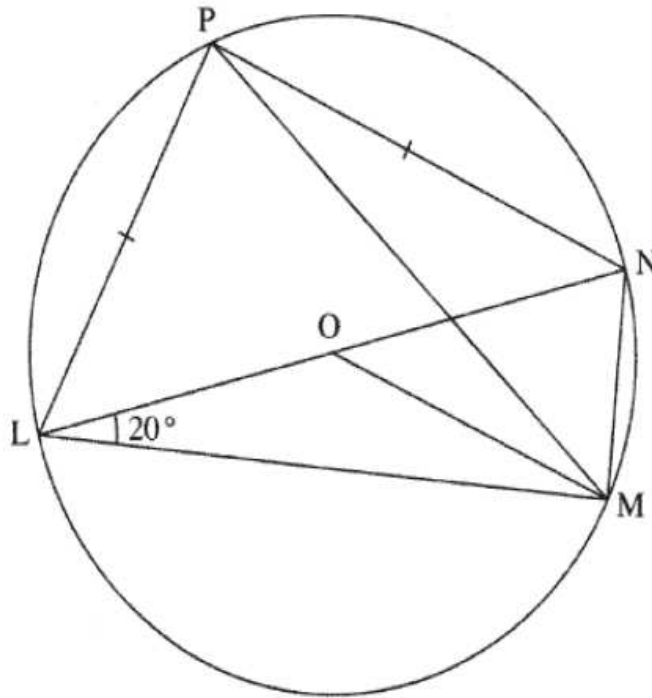


- 20 The figure below shows triangle ABC with co-ordinates A (1, 3), B (1, 1) and C (3, 2).



- (a) Draw triangle A'B'C', the image of  $\Delta ABC$  under reflection in the  $y$ -axis. (2 marks)
- (b) (i) Draw line  $y = x$ . (1 mark)
- (ii) Draw triangle A''B''C'', the image of  $\Delta A'B'C'$  under reflection in the line  $y = x$ . (2 marks)
- (c) Determine the matrix of transformation that maps  $\Delta ABC$  onto  $\Delta A''B''C''$ . (3 marks)
- (d) Describe fully a single transformation that maps  $\Delta ABC$  onto  $\Delta A''B''C''$ . (2 marks)

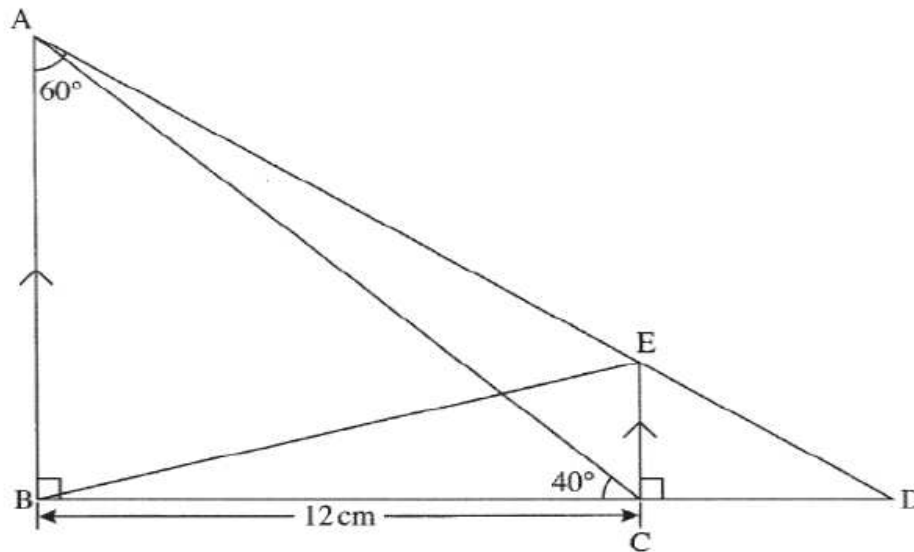
- 21 In the figure below, points L, M, N and P are on the circumference of a circle centre O. Line LON is a diameter of the circle.  $PL = PN$  and angle  $NLM = 20^\circ$ .



Find, giving a reason in each case, the size of each of the following angles.

- |     |                |           |
|-----|----------------|-----------|
| (a) | $\angle MPN$ ; | (2 marks) |
| (b) | $\angle PLN$ ; | (2 marks) |
| (c) | $\angle LPM$ ; | (2 marks) |
| (d) | $\angle MNP$ ; | (2 marks) |
| (e) | $\angle PMO$ . | (2 marks) |

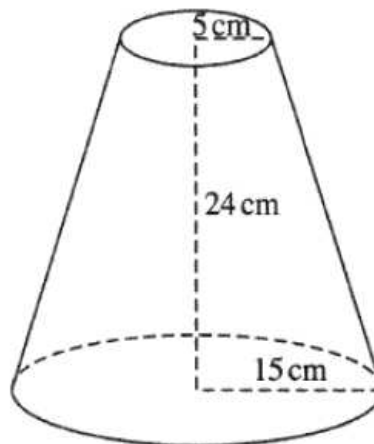
- 22 In the figure below,  $BC = 12$  cm,  $\angle ACB = 40^\circ$ ,  $\angle BAD = 60^\circ$ ,  $BCD$  is a straight line and  $CE$  is parallel to  $BA$ .



Calculate:

- (a) the length of:
- (i)  $AB$ ; (2 marks)
- (ii)  $CD$ . (4 marks)
- (b) the size of angle  $CBE$ . (4 marks)
- 23 A piece of land is in the shape of a quadrilateral  $ABCD$ . Point  $B$  is 450 m east of  $A$ . Point  $D$  is 500 m from  $A$  on a bearing of  $310^\circ$ . Point  $C$  is 700 m from  $D$  on a bearing of  $080^\circ$ .
- (a) Using 1 cm to represent 100 m, make a scale drawing of the piece of land. (4 marks)
- (b) Find:
- (i) the perimeter of the piece of land; (3 marks)
- (ii) the length of  $AC$ ; (1 mark)
- (iii) the bearing of  $A$  from  $C$ . (2 marks)

- 24 The figure below represents a frustum of a cone with dimensions as shown.



Taking  $\pi = 3.142$ , calculate:

- (a) the area of the circular surfaces, correct to 4 significant figures; (3 marks)
- (b) the height of the small cone that was cut off to make the frustum; (2 marks)
- (c) the area of the curved surface of the frustum, correct to 4 significant figures. (5 marks)