

# KCSE MATHEMATICS PAPER 121/1 2009

## SECTION 1 (50 Marks)

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

1. Without using mathematical tables or calculators, evaluate

$$\frac{\sqrt{5184}}{6 \times 8 \div 9 + (5^{-3})} \quad (3 \text{ marks})$$

2. Without using a calculator, evaluate,  $\frac{2\frac{1}{4} + \frac{3}{5} \div \frac{5}{6} \text{ of } 2\frac{2}{5}}{1\frac{7}{10}}$ , leaving the answer as a fraction in its simplest form. (3 marks)

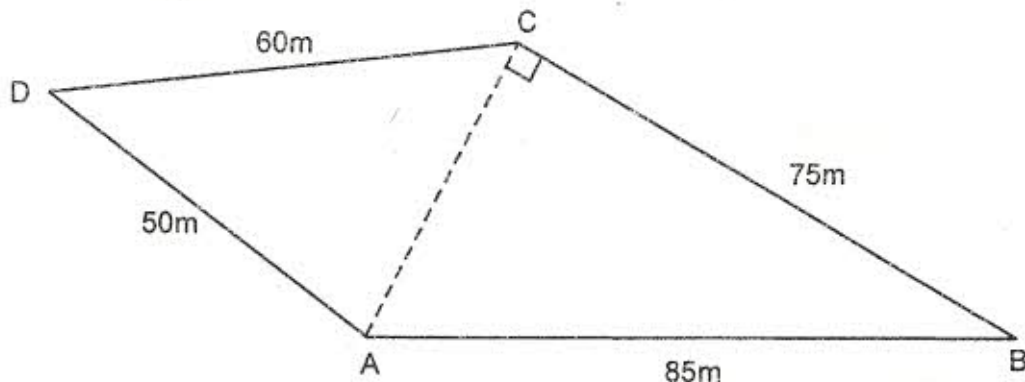
3. Given that the ratio  $x : y = 2 : 3$ , find the ratio  $(5x - 2y) : (x + y)$  (3 marks)

4. A bus travelling at an average speed of 63km/h left a station at 8.15 a.m. A car later left the same station at 9.00 a.m. and caught up with the bus at 10.45 a.m. Find the average speed of the car. (3 marks)

5. Without using logarithm tables or calculators, evaluate

$$\frac{64^{\frac{1}{2}} \times 27000^{\frac{2}{3}}}{2^{-4} \times 3^{\circ} \times 5^2} \quad (4 \text{ marks})$$

6. The figure below represents a plot of land ABCD such that AB= 85m, BC= 75m, CD= 60m, DA= 50m and angle ACB = 90°.



Determine the area of the plot in hectares correct to two decimal places. (4 marks)

7. A watch which loses a half-minute every hour was set to read the correct time at 05 45h on Monday. Determine the time, in the 12-hour system, the watch will show on the following Friday at 19 45h. (3 marks)

8. Simplify the expression

$$\frac{12x^2 + ax - 6a^2}{9x^2 - 4a^2}$$

(3 marks)

9. A line which joins the points A(3, k) and B(-2,5) is parallel to another line whose equation is  $5y + 2x = 10$ .  
Find the value of k. (3 marks)

10. The size of an interior angle of a regular polygon is  $6\frac{1}{2}$  times that of its exterior angle. Determine the number of sides of the polygon. (3 marks)

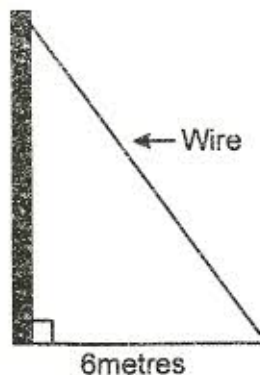
11. Line AB shown below is a side of a trapezium ABCD in which angle  $ABC = 105^\circ$ ,  $BC = 4\text{cm}$ ,  $CD = 5\text{cm}$  and CD is parallel to AB.



Using a ruler and a pair of compasses only:

- (a) Complete the trapezium; (3 marks)  
(b) Locate point T on line AB such that angle  $ATD = 90^\circ$ . (1 mark)

12. An electric pole is supported to stand vertically on a level ground by a tight wire. The wire is pegged at a distance of 6 metres from the foot of the pole as shown.



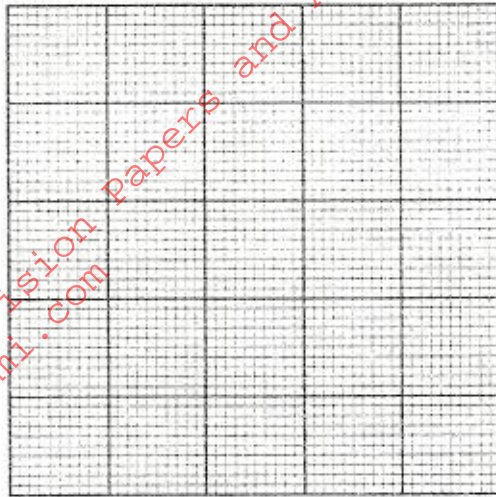
The angle which the wire makes the ground is three times the angle it makes with the pole. Calculate the length of wire to the nearest centimetre. (3 marks)

13. Solve the equation:  $\sin(3x + 30^\circ) = \frac{\sqrt{3}}{2}$ , for  $0^\circ \leq x \leq 90^\circ$ . (4 marks)

14. The diagonals of a rhombus PQRS intersect at T. Given that P(2,2), Q(3,6) R(-1,5):

(a) draw the rhombus PQRS on the grid provided;

(1 mark)



(b) state the coordinates of T.

(1 mark)

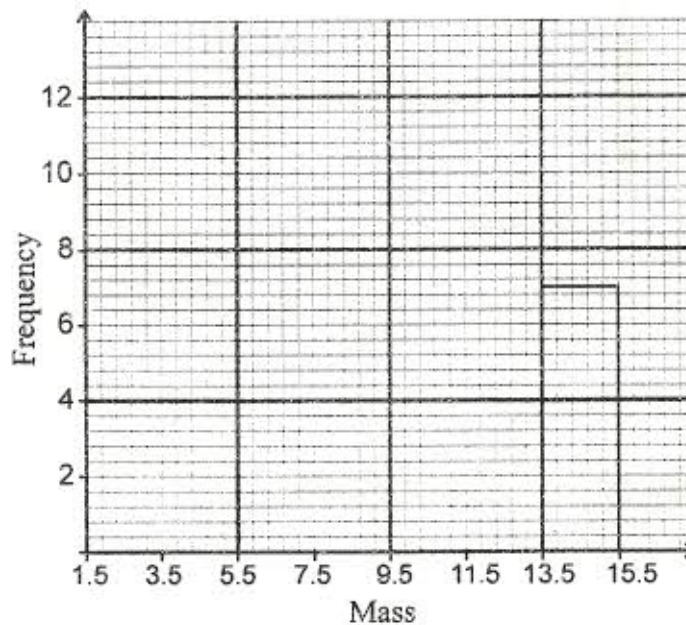
15. Abdi sold a radio costing Ksh 3800 at a profit of 20%. He earned a commission of 22½% on the profit. Find the amount he earned. (2 marks)

16. The following data was obtained for the masses of certain animals.

Mass ( $x$ kg)	Frequency
$1.5 \leq x < 5.5$	16
$5.5 \leq x < 7.5$	20
$7.5 \leq x < 13.5$	18
$13.5 \leq x < 15.5$	14

Complete the histogram on the grid provided below.

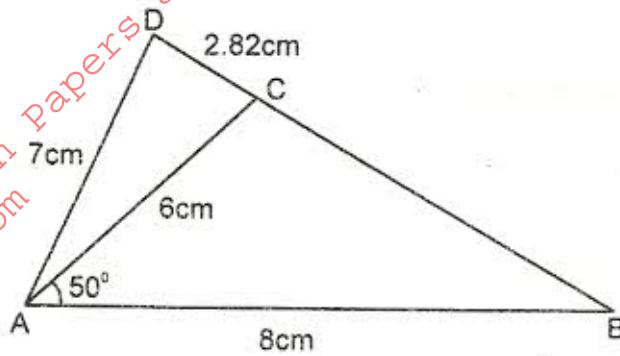
(3 marks)



**SECTION II (50 Marks)**

*Answer only five questions in this section*

17. 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  $BC$ ; (2 marks)
- (b) the size of angle  $ABC$ ; (3 marks)
- (c) the size of angle  $CAD$ ; (3 marks)
- (d) the area of triangle  $ACD$  (2 marks)

18. The marks scored by a group of pupils in a mathematics test were as recorded in the table below.

Marks	Frequency
0 - 9	1
10 - 19	2
20 - 29	4
30 - 39	7
40 - 49	10
50 - 59	16
60 - 69	20
70 - 79	6
80 - 89	3
90 - 99	1

- (a) (i) State the modal class (1 mark)
- (ii) Determine the class in which the median mark lies (2 marks)
- (b) Using an assumed mean of 54.4, calculate the mean mark. (7 marks)



19. A school planned to buy  $x$  calculators for a total cost of Ksh 16 200. The supplier agreed to offer a discount of Ksh 60 per calculator. The school was then able to get three extra calculators for the same amount of money.

(a) Write an expression in terms of  $x$ , for the:

(i) original price of each calculator; (1 mark)

(ii) price of each calculator after the discount. (1 mark)

(b) Form an equation in  $x$  and hence determine the number of calculators the school bought. (5 marks)

(c) Calculate the discount offered to the school as a percentage. (3 marks)

20. The position vectors of points A and B with respect to the origin O, are  $\begin{pmatrix} -8 \\ 5 \end{pmatrix}$  and  $\begin{pmatrix} 12 \\ -5 \end{pmatrix}$  respectively. Point M is the midpoint of AB and N is the midpoint of OA.

(a) Find:

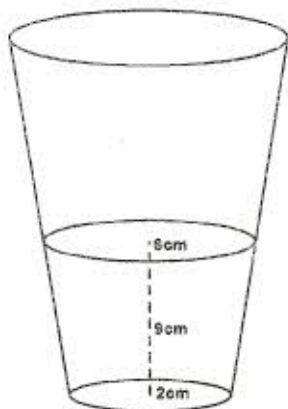
(i) the coordinates of N and M; (3 marks)

(ii) the magnitude of NM. (3 marks)

(b) Express vector  $\overline{NM}$  in terms of  $\overline{OB}$ . (1 mark)

(c) Point P maps onto P' by a translation  $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$ . Given that  $\overline{OP} = \overline{OM} + 2\overline{MN}$ , find the coordinates of P'. (3 marks)

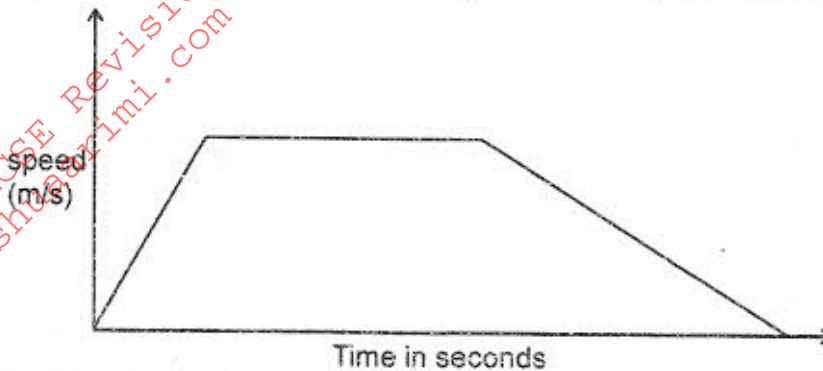
21. A glass, in the form of a frustum of a cone, is represented by the diagram below. The glass contains water to a height of 9cm. The bottom of the glass is a circle of radius 2 cm while the surface of the water is a circle of radius 6cm.



(a) Calculate the volume of the water in the glass. (3 marks)

- (b) When a spherical marble is submerged into the water in the glass, the water level rises by 1cm.  
Calculate:
- (i) the volume of the marble; (4 marks)
- (ii) the radius of the marble (3 marks)

22. The diagram below shows the speed-time graph for a train travelling between two stations. The train starts from rest and accelerates uniformly for 150 seconds. It then travels at a constant speed for 300 seconds and finally decelerates uniformly for 200 seconds.



Given that the distance between the two stations is 10 450m, calculate the:

- (a) maximum speed, in km/h, the train attained; (3 marks)
- (b) acceleration; (2 marks)
- (c) distance the train travelled during the last 100 seconds; (2 marks)
- (d) time the train takes to travel the first half of the journey. (3 marks)
23. Three points P, Q and R are on a level ground. Q is 240m from P on a bearing of  $230^\circ$ . R is 120m to the east of P.
- (a) Using a scale of 1cm to represent 40m, draw a diagram to show the positions of P, Q and R in the space provided below. (2 marks)
- (b) Determine
- (i) the distance of R from Q; (2 marks)
- (ii) the bearing of R from Q. (2 marks)
- (c) A vertical post stands at P and another one at Q. A bird takes 18 seconds to fly directly from the top of the post at Q to the top of the post at P.  
Given that the angle of depression of the top of the post at P from the top of post at Q is  $9^\circ$ , Calculate:
- (i) the distance, to the nearest metre, the bird covers; (2 marks)
- (ii) the speed of the bird in Km/h (2 marks)

24. (a) On the grid provided, draw a graph of the function

$$y = \frac{1}{2}x^2 - x + 3 \text{ for } 0 \leq x \leq 6.$$

(3 marks)



(b) Calculate the mid-ordinates for 5 strips between  $x = 1$  and  $x = 6$ , and hence use the mid-ordinate rule to approximate the area under the curve between  $x = 1$ ,  $x = 6$  and the  $x =$  axis. (3 marks)

(c) Assuming that the area determined by intergration to be the actual area, calculate the percentage error in using the mid-ordinate rule. (4 marks)