

# SECTION I (50 marks)

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

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

$$\frac{6.373 \log 4.948}{\sqrt{0.004636}}$$

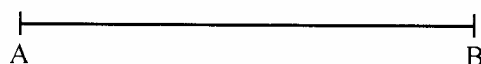
(3 marks)

- 2 Make  $h$  the subject of the formula

$$q = \frac{1+rh}{1-hr}$$

(2 marks)

- 3 Line AB given below is one side of triangle ABC. Using a ruler and a pair of compasses only:



- (i) Complete the triangle ABC such that  $BC = 5$  cm and  $\angle ABC = 45^\circ$ . (1 mark)  
(ii) On the same diagram construct a circle touching sides AC, BA produced and BC produced. (2 marks)

- 4 The position vectors of points A and B are  $\begin{pmatrix} 3 \\ -1 \\ -4 \end{pmatrix}$  and  $\begin{pmatrix} 8 \\ -6 \\ 6 \end{pmatrix}$  respectively. A point P divides AB in the ratio 2:3.

Find the position vector of point P.

(3 marks)

- 5 The top of a table is a regular hexagon. Each side of the hexagon measures 50.0 cm. Find the maximum percentage error in calculating the perimeter of the top of the table. (3 marks)

- 6 A student at a certain college has a 60% chance of passing an examination at the first attempt. Each time a student fails and repeats the examination, his chances of passing are increased by 15%.

Calculate the probability that a student in the college passes an examination at the second or at the third attempt. (3 marks)

- 7 An aeroplane flies at an average speed of 500 knots due East from a point P( $53.4^\circ\text{N}$ ,  $40^\circ\text{E}$ ) to another point Q. It takes  $2\frac{1}{4}$  hours to reach point Q.

Calculate:

- (i) the distance in nautical miles it travelled; (1 mark)  
(ii) the longitude of point Q to 2 decimal places. (2 marks)

- 8 (a) Expand and simplify the expression

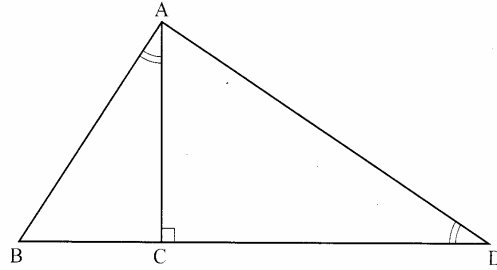
$$\left(10 + \frac{2}{x}\right)^5.$$

(2 marks)

- (b) Use the expansion in (a) above to find the value of  $14^5$ .

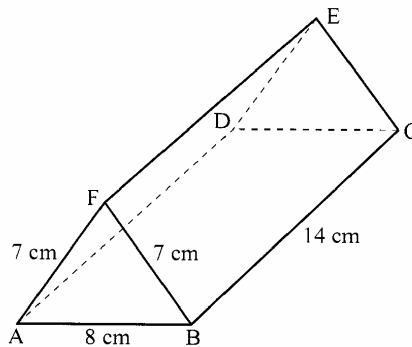
(2 marks)

- 9 In the figure below, angles BAC and ADC are equal. Angle ACD is a right angle. The ratio of the sides AC : BC = 4 : 3.



Given that the area of triangle ABC is  $24 \text{ cm}^2$ , find the area of triangle ACD. (3 marks)

- 10 Points A(2,2) and B(4,3) are mapped onto A'(2,8) and B'(4,15) respectively by a transformation T. Find the matrix of T. (4 marks)
- 11 The equation of a circle is given by  $4x^2 + 4y^2 - 8x + 20y - 7 = 0$ . Determine the coordinates of the centre of the circle. (3 marks)
- 12 Solve for y in the equation  $\log_{10}(3y + 2) - 1 = \log_{10}(y - 4)$ . (3 marks)
- 13 Without using a calculator or mathematical tables, express  $\frac{\sqrt{3}}{1 - \cos 30^\circ}$  in surd form and simplify. (3 marks)
- 14 The figure below represents a triangular prism. The faces ABCD, ADEF and CBFE are rectangles. AB = 8 cm, BC = 14 cm, BF = 7 cm and AF = 7 cm.



Calculate the angle between faces BCEF and ABCD. (3 marks)

- 15 A particle moves in a straight line from a fixed point. Its velocity  $V \text{ ms}^{-1}$  after  $t$  seconds is given by  $V = 9t^2 - 4t + 1$ . Calculate the distance travelled by the particle during the third second. (3 marks)
- 16 Find in radians, the values of  $x$  in the interval  $0^\circ \leq x \leq 2\pi^\circ$  for which  $2 \cos^2 x - \sin x = 1$ . (Leave the answers in terms of  $\pi$ ) (4 marks)

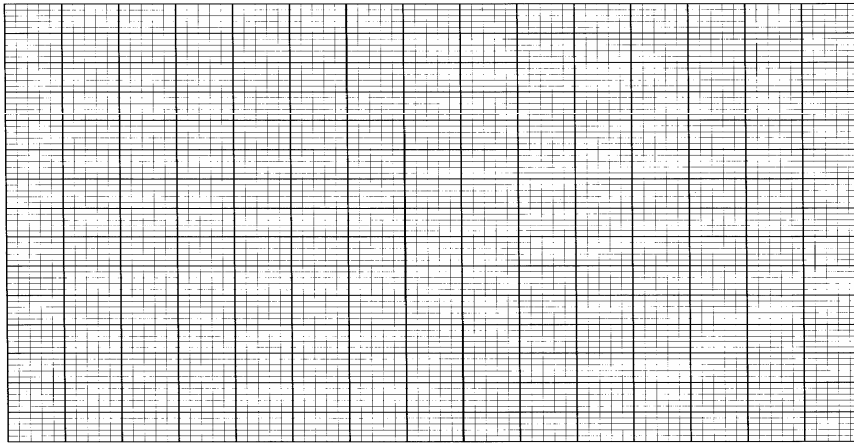
## SECTION II (50 marks)

*Answer **any** five questions in this section.*

- 17** 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) above. Calculate the ratio of type A rice to type B rice in this mixture. (2 marks)
- 18** Three variables  $p$ ,  $q$  and  $r$  are such that  $p$  varies directly as  $q$  and inversely as the square of  $r$ .
- (a) When  $p = 9$ ,  $q = 12$  and  $r = 2$ .  
Find  $p$  when  $q = 15$  and  $r = 5$ . (4 marks)
- (b) Express  $q$  in terms of  $p$  and  $r$ . (1 mark)
- (c) If  $p$  is increased by 20% and  $r$  is decreased by 10%, find:
- (i) a simplified expression for the change in  $q$  in terms of  $p$  and  $r$ ; (3 marks)
- (ii) the percentage change in  $q$ . (2 marks)
- 19** (a) Complete the table below, giving the values correct to 2 decimal places.

$x^\circ$	0	30	60	90	120	150	180	210	240	270	300	330	360
$\sin 2x$	0		0.87		-0.87		0	0.87	0.87				0
$3\cos x - 2$	1	0.60		-2	-3.5			-4.60			-0.5		1

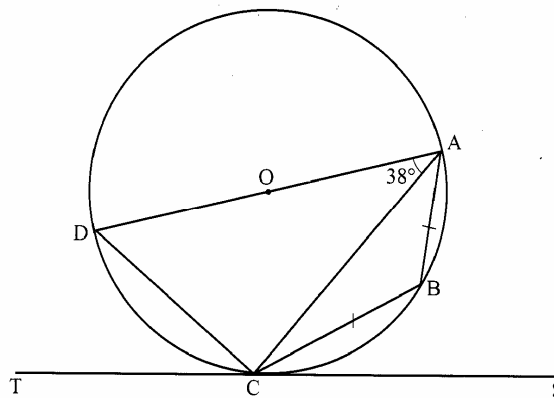
- (2 marks)
- (b) On the grid provided, draw the graphs of  $y = \sin 2x$  and  $y = 3\cos x - 2$  for  $0^\circ \leq x \leq 360^\circ$  on the same axes. Use a scale of 1 cm to represent  $30^\circ$  on the  $x$ -axis and 2 cm to represent 1 unit on the  $y$ -axis. (5 marks)



(c) Use the graph in (b) above to solve the equation  $3\cos x - \sin 2x = 2$ . (2 marks)

(d) State the amplitude of  $y = 3\cos x - 2$ . (1 mark)

- 20 In the figure below DA is a diameter of the circle ABCD centre O, radius 10 cm. TCS is a tangent to the circle at C,  $AB = BC$  and angle  $DAC = 38^\circ$ .



(a) Find the size of the angle:

(i) ACS; (2 marks)

(ii) BCA. (2 marks)

(b) Calculate the length of:

(i) AC; (2 marks)

(ii) AB. (4 marks)

- 21 Two policemen were together at a road junction. Each had a *walkie talkie*. The maximum distance at which one could communicate with the other was 2.5 km.

One of the policemen walked due East at 3.2 km/h while the other walked due North at 2.4 km/h.

The policeman who headed East travelled for  $x$  km while the one who headed North travelled for  $y$  km before they were unable to communicate.

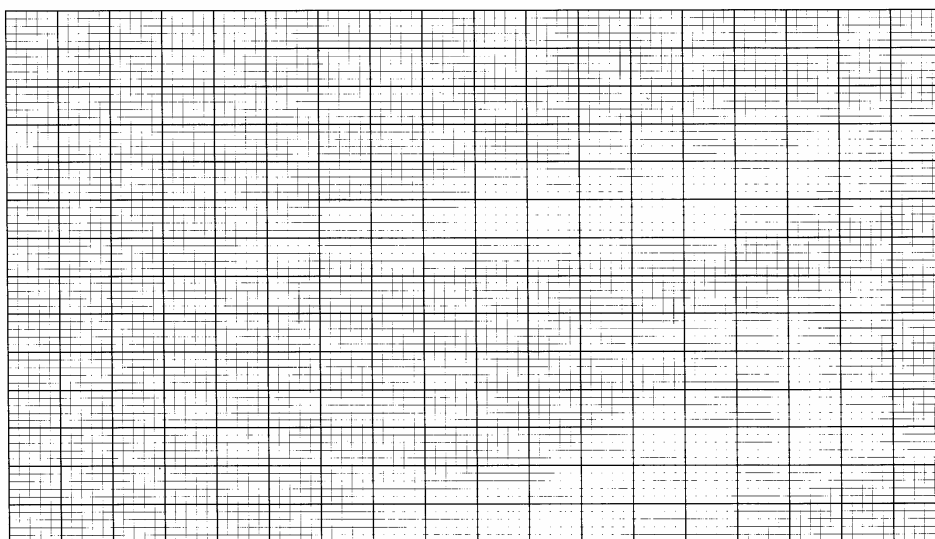
(a) Draw a sketch to represent the relative positions of the policemen. (1 mark)

- (b) (i) From the information above form two simultaneous equations in  $x$  and  $y$ . (2 marks)
- (ii) Find the values of  $x$  and  $y$ . (5 marks)
- (iii) Calculate the time taken before the policemen were unable to communicate. (2 marks)

**22** The table below shows the distribution of marks scored by 60 pupils in a test.

Marks	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90
Frequency	2	5	6	10	14	11	9	3

- (a) On the grid provided, draw an ogive that represents the above information. (4 marks)



- (b) Use the graph to estimate the interquartile range of this information. (3 marks)
- (c) In order to pass the test, a pupil had to score more than 48 marks. Calculate the percentage of pupils who passed the test. (3 marks)

**23** Halima deposited Ksh 109 375 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 shares as a percentage. (2 marks)

- 24 The table below shows values of  $x$  and some values of  $y$  for the curve  $y = x^3 + 3x^2 - 4x - 12$  in the range  $-4 \leq x \leq 2$ .

(a) Complete the table by filling in the missing values of  $y$ .

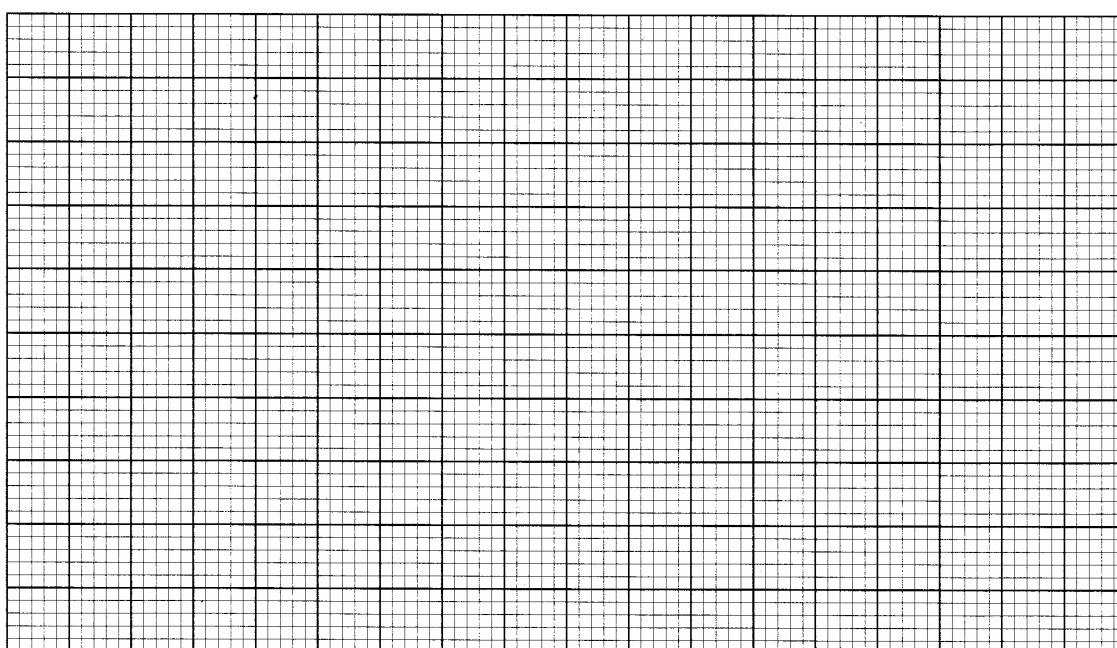
$x$	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2.0
$y$		-4.1		-1.1		-2.6		-9.4		-13.1		-7.9	

(2 marks)

- (b) On the grid provided, draw the graph  $y = x^3 + 3x^2 - 4x - 12$  for  $-4 \leq x \leq 2$ .

Use the scale: Horizontal axis 2 cm for 1 unit and vertical axis 2 cm for 5 units.

(3 marks)



- (c) By drawing a suitable straight line, on the same grid as (b) above, solve the equation:

$$x^3 + 3x^2 - 5x - 6 = 0.$$

(5 marks)

