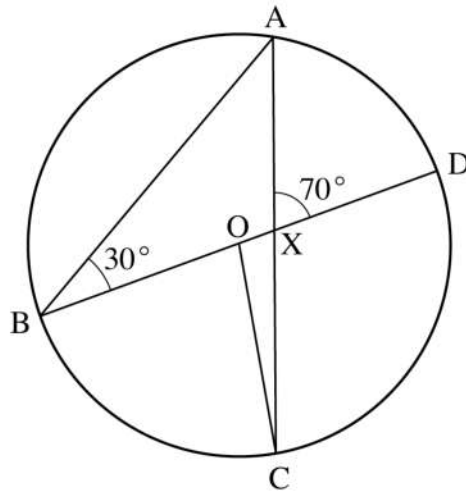


3.3.2 Mathematics Alt. A Paper 2 (121/2)

SECTION I (50 marks)

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

- 1 The lengths of two similar iron bars were given as 12.5 m and 9.23 m. Calculate the maximum possible difference in length between the two bars. (3 marks)
- 2 The first term of an arithmetic sequence is  $-7$  and the common difference is 3.
- (a) List the first six terms of the sequence; (1 mark)
- (b) Determine the sum of the first 50 terms of the sequence. (2 marks)
- 3 In the figure below, BOD is the diameter of the circle centre O. Angle ABD =  $30^\circ$  and angle AXD =  $70^\circ$ .



Determine the size of:

- (a) reflex angle BOC; (2 marks)
- (b) angle ACO. (1 mark)
- 4 Three quantities L, M and N are such that L varies directly as M and inversely as the square of N. Given that  $L = 2$  when  $M = 12$  and  $N = 6$ , determine the equation connecting the three quantities. (3 marks)

- 5 The table below shows the frequency distribution of marks scored by students in a test.

Marks	Frequency
1 – 10	2
11 – 20	4
21 – 30	11
31 – 40	5
41 – 50	3

Determine the median mark correct to 2 s.f. (4 marks)

- 6 Determine the amplitude and period of the function,  $y = 2 \cos (3x - 45)^\circ$ . (2 marks)

- 7 In a transformation, an object with an area of  $5 \text{ cm}^2$  is mapped onto an image whose area is  $30 \text{ cm}^2$ . Given that the matrix of the transformation is  $\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix}$ , find the value of  $x$ . (3 marks)

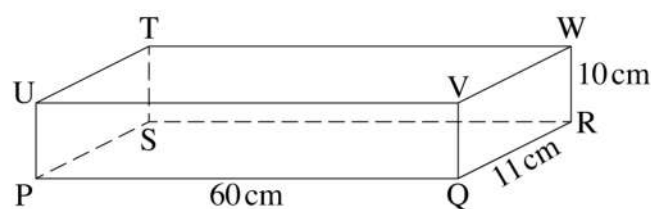
- 8 Expand  $(3 - x)^7$  up to the term containing  $x^4$ . Hence find the approximate value of  $(2.8)^7$ . (3 marks)

- 9 Solve the equation;

$$2 \log 15 - \log x = \log 5 + \log (x - 4). \quad (4 \text{ marks})$$

- 10 The figure below represents a cuboid PQRSTU VW.

PQ = 60 cm, QR = 11 cm and RW = 10 cm.



Calculate the angle between line PW and plane PQRS, correct to 2 decimal places. (3 marks)

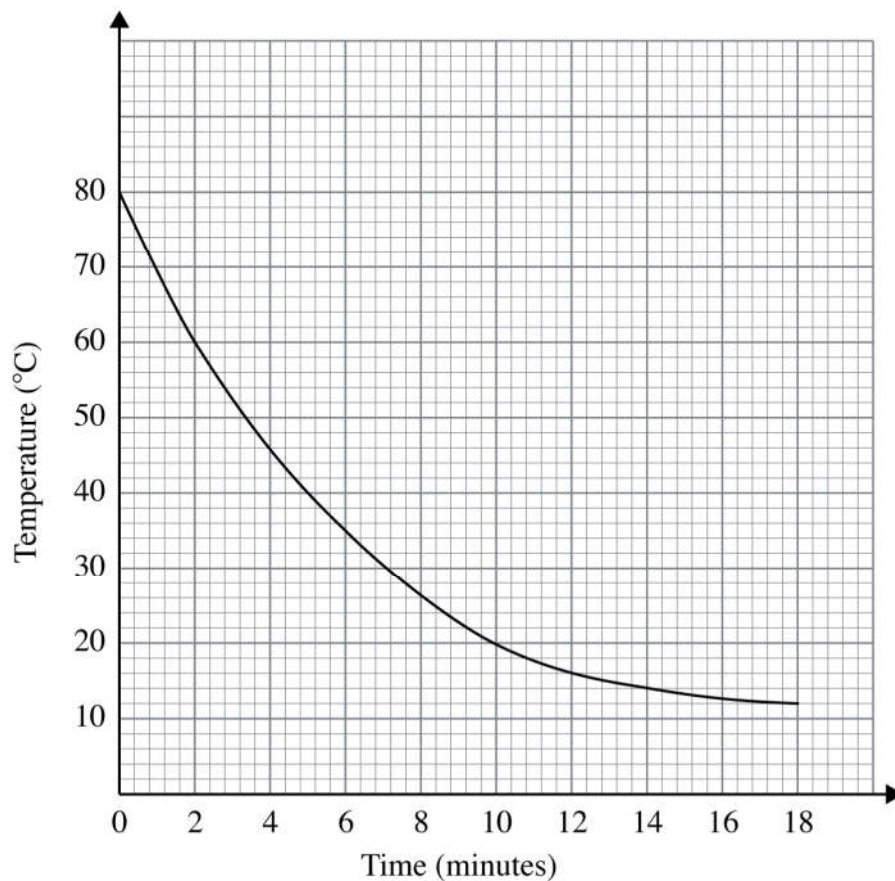
- 11 Solve the simultaneous equations;

$$3x - y = 9$$

$$x^2 - xy = 4$$

(4 marks)

- 12 Muga bought a plot of land for Ksh 280 000. After 4 years, the value of the plot was Ksh 495 000. Determine the rate of appreciation, per annum, correct to one decimal place. (3 marks)
- 13 The shortest distance between two points A ( $40^\circ\text{N}$ ,  $20^\circ\text{W}$ ) and B ( $\theta^\circ\text{S}$ ,  $20^\circ\text{W}$ ) on the surface of the earth is 8008 km. Given that the radius of the earth is 6370 km, determine the position of B. (Take  $\pi = \frac{22}{7}$ ). (3 marks)
- 14 Vectors  $\mathbf{r}$  and  $\mathbf{s}$  are such that  $\mathbf{r} = 7\mathbf{i} + 2\mathbf{j} - \mathbf{k}$  and  $\mathbf{s} = -\mathbf{i} + \mathbf{j} - \mathbf{k}$ . Find  $|\mathbf{r} + \mathbf{s}|$ . (3 marks)
- 15 The gradient of a curve is given by  $\frac{dy}{dx} = x^2 - 4x + 3$ . The curve passes through the point (1,0). Find the equation of the curve. (3 marks)
- 16 The graph below shows the rate of cooling of a liquid with respect to time.



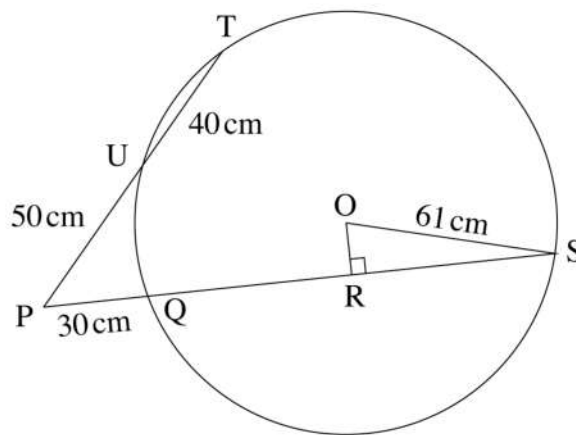
Determine the average rate of cooling of the liquid between the second and the eleventh minutes. (3 marks)

**SECTION II (50 marks)**

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

- 17** A paint dealer mixes three types of paint A, B and C, in the ratios  $A:B = 3:4$  and  $B:C = 1:2$ . The mixture is to contain 168 litres of C.
- (a) Find the ratio  $A:B:C$ . (2 marks)
- (b) Find the required number of litres of B. (2 marks)
- (c) The cost per litre of type A is Ksh 160, type B is Ksh 205 and type C is Ksh 100.
- (i) Calculate the cost per litre of the mixture. (2 marks)
- (ii) Find the percentage profit if the selling price of the mixture is Ksh 182 per litre. (2 marks)
- (iii) Find the selling price of a litre of the mixture if the dealer makes a 25% profit. (2 marks)

- 18** In the figure below OS is the radius of the circle centre O. Chords SQ and TU are extended to meet at P and OR is perpendicular to QS at R.  $OS = 61$  cm,  $PU = 50$  cm,  $UT = 40$  cm and  $PQ = 30$  cm.



- (a) Calculate the length of:
- (i) QS; (2 marks)
- (ii) OR. (3 marks)
- (b) Calculate, correct to 1 decimal place:
- (i) the size of angle ROS; (2 marks)
- (ii) the length of the minor arc QS. (3 marks)

19 The table below shows income tax rates for a certain year.

Monthly income in Kenya shillings (Ksh)	Tax rate in each shilling
0 – 10164	10%
10165 – 19740	15%
19741 – 29316	20%
29317 – 38892	25%
over 38892	30%

A tax relief of Ksh 1162 per month was allowed. In a certain month, of that year, an employee's taxable income in the fifth band was Ksh 2108.

(a) Calculate:

- (i) the employee's total taxable income in that month; (2 marks)
- (ii) the tax payable by the employee in that month. (5 marks)

(b) The employee's income included a house allowance of Ksh 15 000 per month. The employee contributed 5% of the basic salary to a co-operative society. Calculate the employees net pay for that month. (3 marks)

20 The dimensions of a rectangular floor of a proposed building are such that:

- the length is greater than the width but at most twice the width;
- the sum of the width and the length is, more than 8 metres but less than 20 metres. If  $x$  represents the width and  $y$  the length.

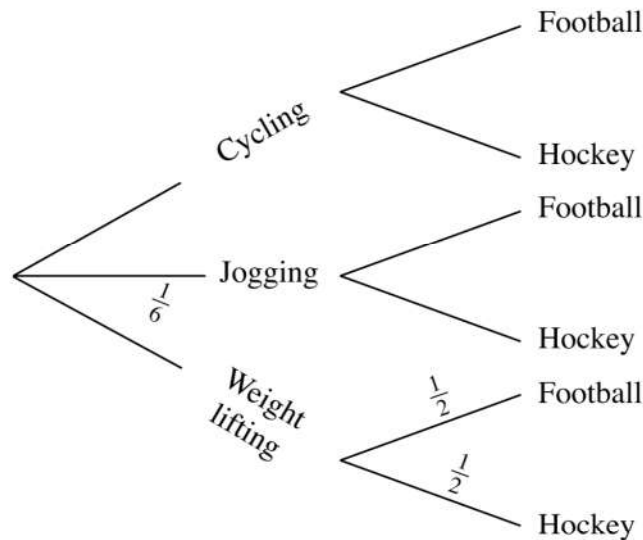
- (a) write inequalities to represent the above information. (4 marks)
- (b) (i) Represent the inequalities in part (a) above on the grid provided. (4 marks)
- (ii) Using the integral values of  $x$  and  $y$ , find the maximum possible area of the floor. (2 marks)



21 Each morning Gataro does one of the following exercises:  
 Cycling, jogging or weightlifting.  
 He chooses the exercise to do by rolling a fair die. The faces of the die are numbered  
 1, 1, 2, 3, 4 and 5.  
 If the score is 2, 3 or 5, he goes for cycling.  
 If the score is 1, he goes for jogging.  
 If the score is 4, he goes for weightlifting.

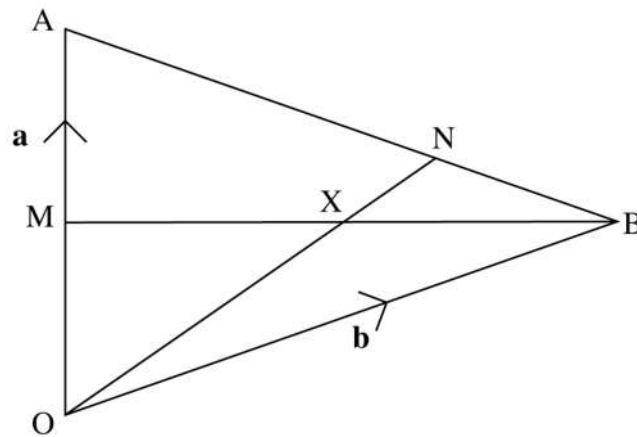
- (a) Find the probability that:
- (i) on a given morning, he goes for cycling or weightlifting; (2 marks)
  - (ii) on two consecutive mornings he goes for jogging. (2 marks)
- (b) In the afternoon, Gataro plays either football or hockey but never both games. The probability that Gataro plays hockey in the afternoon is:
- $\frac{1}{3}$  if he cycled;
  - $\frac{2}{5}$  if he jogged and
  - $\frac{1}{2}$  if he did weightlifting in the morning.

Complete the tree diagram below by writing the appropriate probability on each branch. (2 marks)



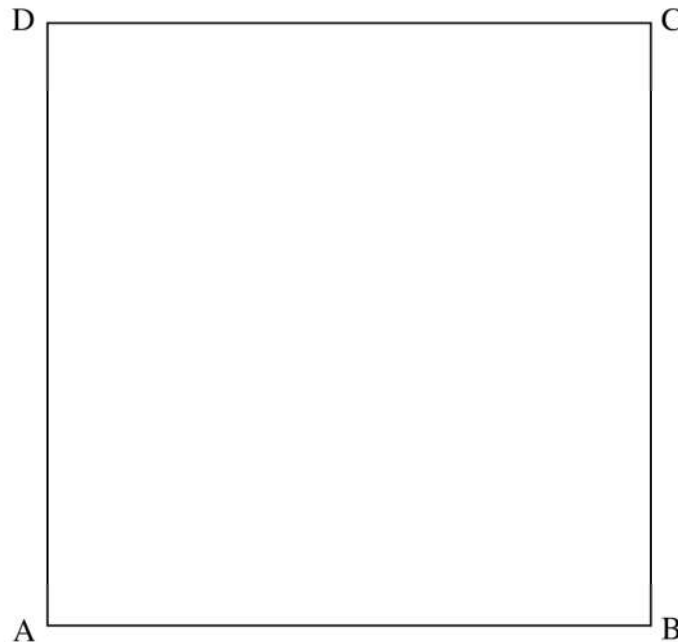
- (c) Find the probability that on any given day:
- (i) Gataro plays football; (2 marks)
  - (ii) Gataro neither jogs nor plays football. (2 marks)

- 22 In the figure below  $\mathbf{OA} = \mathbf{a}$  and  $\mathbf{OB} = \mathbf{b}$ . M is the mid-point of OA and  $AN:NB = 2:1$ .



- (a) Express in terms of  $\mathbf{a}$  and  $\mathbf{b}$ :
- (i)  $\mathbf{BA}$ ; (1 mark)
  - (ii)  $\mathbf{BN}$ ; (1 mark)
  - (iii)  $\mathbf{ON}$ . (2 marks)
- (b) Given that  $\mathbf{BX} = h\mathbf{BM}$  and  $\mathbf{OX} = k\mathbf{ON}$  determine the values of  $h$  and  $k$ . (6 marks)

- 23 Figure ABCD below is a scale drawing representing a square plot of side 80 metres.



- (a) On the drawing, construct:
- (i) the locus of a point P, such that it is equidistant from AD and BC. (2 marks)
  - (ii) the locus of a point Q such that  $\angle AQB = 60^\circ$ .

- (b) (i) Mark on the drawing the point  $Q_1$ , the intersection of the locus of Q and line AD. Determine the length of  $BQ_1$ , in metres. (1 mark)
- (ii) Calculate, correct to the nearest  $m^2$ , the area of the region bounded by the locus of P, the locus of Q and the line  $BQ_1$ . (4 marks)

24 In an experiment involving two variables  $t$  and  $r$ , the following results were obtained.

t	1.0	1.5	2.0	2.5	3.0	3.5
r	1.50	1.45	1.30	1.25	1.05	1.00

- (a) On the grid provided, draw the line of best fit for the data. (4 marks)
- (b) The variables  $r$  and  $t$  are connected by the equation  $r = at + k$  where  $a$  and  $k$  are constants.  
Determine:
- (i) the values of  $a$  and  $k$ ; (3 marks)
- (ii) the equation of the line of best fit. (1 mark)
- (iii) the value of  $t$  when  $r = 0$ . (2 marks)