### 29.3.4 Mathematics Alt. B Paper 2 (122/2)

SECTION I (50 marks)

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

1   Use a calculator to evaluate $\dfrac{(0.52)^3 \times \sqrt{4.17}}{3.58911}$ and give the answer correct
to 5 significant figures. (2 marks)

2   Given that $P = \begin{pmatrix} 2 & 4 \\ -3 & -7 \end{pmatrix}$, $Q = \begin{pmatrix} -1 & 2 \\ 0 & -3 \end{pmatrix}$ and $R = P - 2Q$ find:

   (a)   **R**; (2 marks)

   (b)   **PR.** (2 marks)

3   Solve by factorisation, the quadratic equation:
     $2x^2 - 3x - 5 = 0$ (3 marks)

4   Make n the subject of the formula. (3 marks)

   $$b = \sqrt{\dfrac{en}{n+p}}$$

5   The figure below shows a circle centre O and external point X.
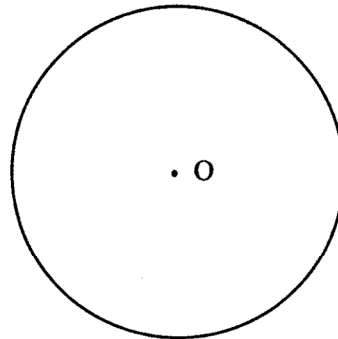
   (a)   Construct a tangent from X to touch the circle at a point P. (2 marks)

   (b)   Measure the length of XP. (1 mark)

6   Given that $OA = 6p - 4q$, $OB = 2p - 14q$ and $AB = m(2p + 5q)$, find the value of m. (4 marks)

7   An inlet pipe fills an empty water tank in 8 hours while an outlet pipe empties the full
tank in 5 hours. When the tank is full, the inlet and outlet pipes are opened at the same
time. Calculate:

   (a)   the fraction of the tank that is emptied in 1 hour; (2 marks)

   (b)   the time it takes for the tank to be completely emptied. (1 mark)

8 The pie-chart below represents the expenditure of a family in a certain month on maize, meat, vegetables, fruits and milk.
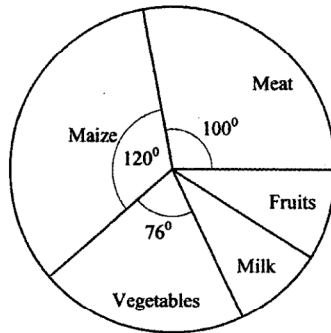

During that month, the family spent equal amounts of money on milk and fruits.

(a) Calculate the size of the angle of the sector representing expenditure on milk.

(2 marks)

(b) If the cost of milk was Ksh 528, calculate the total expenditure on all the items.

(2 marks)

9 The area of each small square of the grid below is 64 mm².
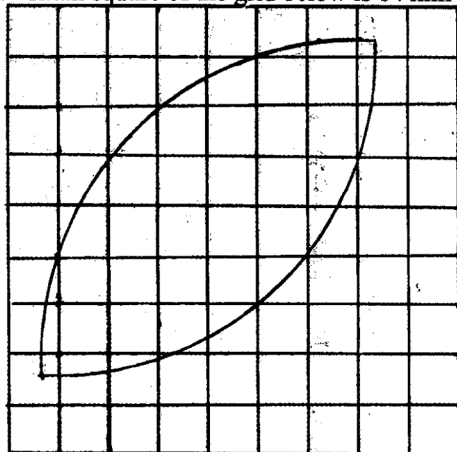
Estimate in mm², the area of the figure drawn on the grid. (3 marks)

10 (a) Find the determinant of the matrix $\begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$. (1 mark)

(b) A rectangle whose area is 15 cm² is transformed by the matrix $\begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$.
Determine the area of its image under the matrix of the transformation. (2 marks)

11 The second term of a geometric sequence is 24 and the fifth term is 192. Find the first term of the sequence. (3 marks)

12 In the figure below, PRQS is a circle of radius 17cm. Line PQ is a diameter of the circle and is perpendicular to chord RS at T.
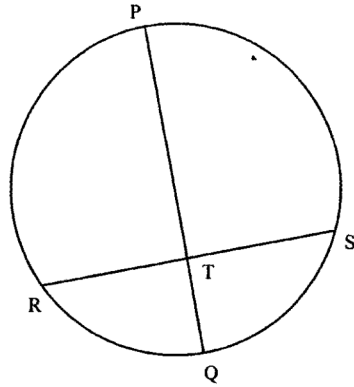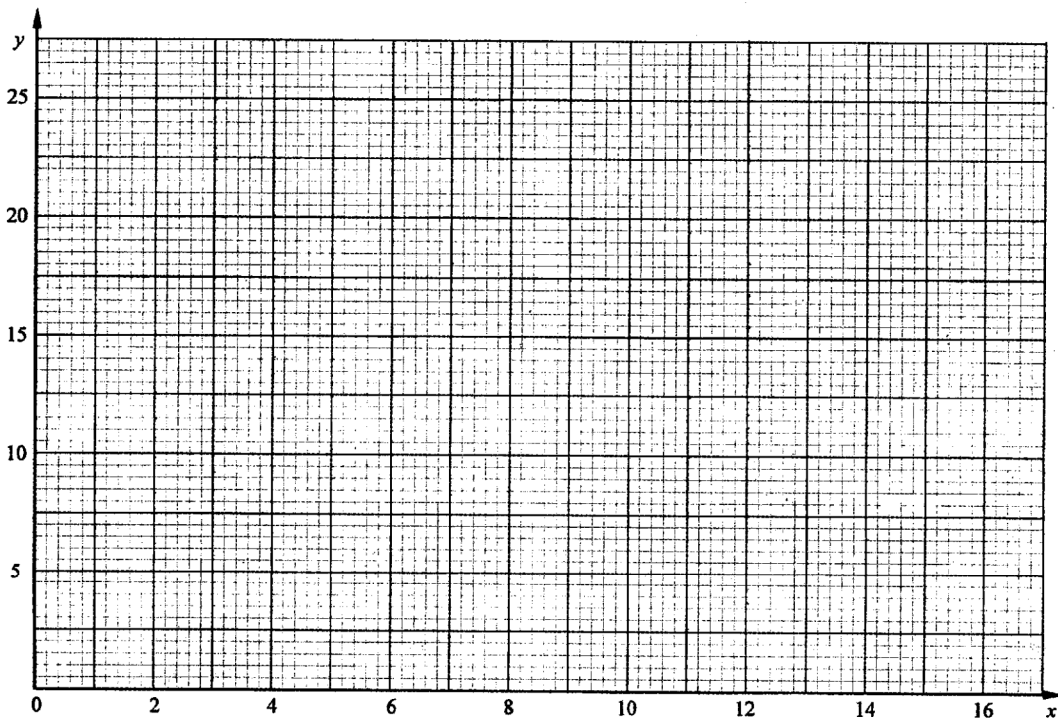
Given that PT = 25 cm, calculate the length of :

(a)　　TQ;　　　　　　　　　　　　　　　　　(1 mark)

(b)　　RS.　　　　　　　　　　　　　　　　　(2 marks)

13　　The table below gives values of two variables x and y obtained from an experiment.

x	4	8	10	11	13	16
y	24	17.5	14	12	9	4

(a)　　On the grid provided below, plot the values of y against x and draw the line of best fit.　　　　　　　　　　　　　　　　　(2 marks)

(b)　　Use the graph to estimate the value of y when x = 7.　　(1 mark)

14　　The positions of two points A and B on the surface of the earth are A(32.8°N, 26°E) and B(21.2°S, 26°E).
Calculate in kilometres the shortest distance between A and B.
(Take the radius of the earth to be 6370 km and $\pi = \frac{22}{7}$)　　(3 marks)

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15 A building was valued at Ksh 720 000 on 1st January 2007. The value of the building appreciated at 2% per annum in the first year. The value of the building then depreciated at the rate of 5% for the next 2 years. Calculate the value of the building at the end of year 2009. (3 marks)

16 Below is a travel timetable for a bus travelling from town P to town S via towns Q and R.

Town	Arrival Time	Departure Time
P		11.30a.m
Q	12.15p.m	12.25p.m
R	1.05p.m	1.25p.m
S	2.15p.m	

If the distance between town P and town S is 220km, calculate the average speed at which the bus travels. (3 marks)

SECTION II (50 marks)

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

17 A shop sells a certain type of fridge at a cash price of Ksh 80 000. If the fridge is bought on Hire Purchase (H.P), a deposit of Ksh 24 000 is paid. A customer is also charged 15% per annum simple interest on the balance of the cash price after deposit is paid.
Khamala bought one such fridge on H.P. He paid the balance plus the interest in 5 equal monthly instalments.

(a) Calculate:

(i) the total simple interest charged over the 5 months; (3 marks)

(ii) his monthly instalment. (2 marks)

(b) Fatuma bought the same type of fridge as Khamala from the same shop. She was offered a 4% discount on the cash price. Calculate how much more Khamala paid for the fridge than Fatuma. (5 marks)

18 The terms of an Arithmetic sequence are 2,5,8,11, ...

(a) Find:

(i) the common difference of the sequence; (1 mark)

(ii) the next two terms of the sequence; (2 marks)

(iii) the 30th term of the sequence. (2 marks)

(b) The sum of the first n terms of the sequence is 5430. Given that the last term is 179, find n, the number of terms of the sequence. (2 marks)

(c) Calculate the sum of the first 50 terms of the sequence. (3 marks)

19 The table below represents the number of streams in 20 schools.

| No. of streams (x)	Frequency (f)
3	5
4	4
5	3
6	4
7	2
8	2

Calculate:

(a) the mean number of streams per school; (3 marks)

(b) the variance; (5 marks)

(c) the standard deviation correct to 2 decimal places. (2 marks)

20 A bag contains 5 yellow (Y) balls and 3 blue (B) balls. All the balls are identical except for the colour. A ball is drawn at random from the bag without replacement and its colour noted. A second ball is draw at random from the same bag and its colour also noted.

(a) Complete the tree diagram below to represent the situation above. (2 marks)
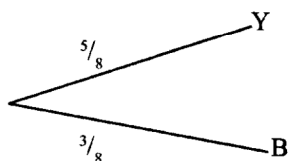
(b) Calculate the probability that:

    (i) both balls are yellow; (2 marks)

    (ii) both balls are of the same colour; (3 marks)

    (iii) the two balls are of different colours. (3 marks)

21 Triangle ABC is such that AB = 4 cm, BC = 7 cm and angle ABC = 100°.
Calculate to 2 decimal places:

(a) the area of triangle ABC; (2 marks)

(b) the perimeter of triangle ABC; (4 marks)

(c) the size of angle ACB. (4 marks)

22 A quadrant (a quarter of a circle) of radius 10 cm is drawn on the grid below. The quadrant is divided into 5 vertical strips.
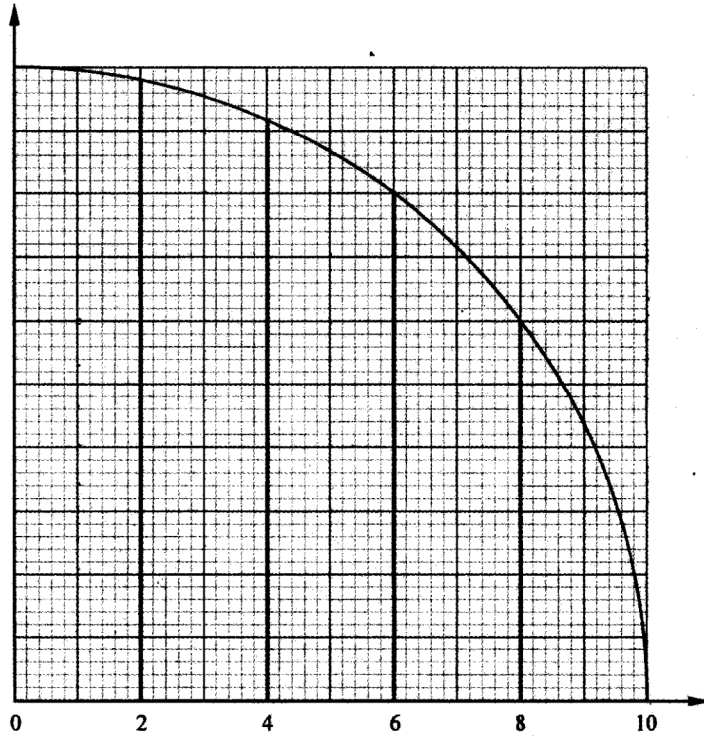
(a)   Determine the lengths of the vertical lines passing through 2, 4, 6 and 8.   (2 marks)

(b)   Use the trapezium rule with the five strips to estimate the area of the quadrant.
                                                                                    (4 marks)

(c)   By taking $\pi = 3.142$, calculate to 4 significant figures, the exact area of the quadrant.
                                                                                    (2 marks)

(d)   Express the estimated area in part (b) as a percentage of the area calculated in part (c),
       giving the answer to the nearest whole number.   (2 marks)

23   The figure below shows a triangle OAC in which B is the mid-point of OC and D is the
      mid-point of AC.
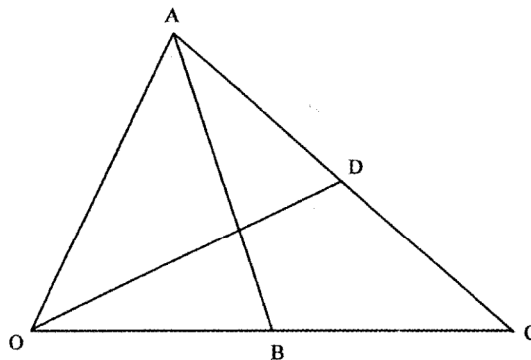
Given that **OA** = 2**i** + 5**j** and **OB** = 4**i** + **j**,

(a)   determine in terms of **i** and **j**:

       (i)   **AB**;   (2 marks)

       (ii)   **AC**.   (3 marks)

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(b)   Determine the magnitude of **OD**.   (5 marks)

24   Some water is heated in a beaker and then left to cool for 12 minutes. After the heating is stopped, the relationship between the water temperature C, in degrees centigrade and the time t, after heating is given as $C = 100 - \frac{1}{2} t^2$.

(a)   Use the relationship $C = 100 - \frac{1}{2} t^2$ to complete the table below.

Time t (minutes)	0	2	4	6	8	10	12
Temperature (°C)	100					50	

                                                                           (2 marks)

(b)   On the grid provided, draw the graph of temperature against time.
        Take the scale: 1 cm for 1 minute on x - axis and 1 cm for 10°C for y-axis. (4 marks)
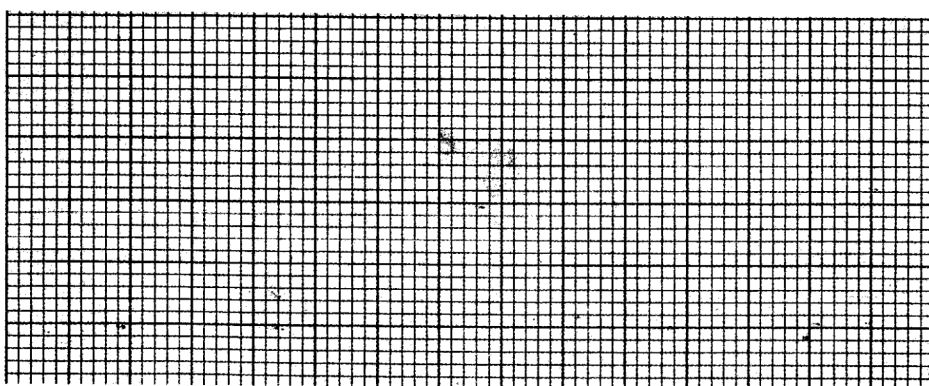
(c)   Use the graph to determine:

(i)   the average rate at which the water is cooling during the last five minutes;
                                                                           (2 marks)

(ii)   the rate at which the water is cooling when t = 3.   (2 marks)