## 29.3.2 Mathematics Alt. A Paper 2 (121/2)

SECTION I (50 marks)

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

1. The length and width of a rectangle measured to the nearest millimetre are 7.5 cm and 5.2 cm respectively.

   Find, to four significant figures, the percentage error in the area of the rectangle. (3 marks)

2. Simplify $\dfrac{4}{\sqrt{5}+\sqrt{2}} - \dfrac{3}{\sqrt{5}-\sqrt{2}}$. (3 marks)

3. In the figure below, O is the centre of the circle which passes through the points T, C and D. Line TC is parallel to OD and line ATB is a tangent to the circle at T. Angle DOC = 36°.
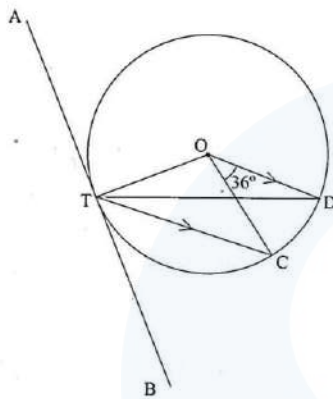
   Calculate the size of angle CTB. (3 marks)

4. A tea dealer mixes two brands of tea, *x* and *y*, to obtain 35 kg of the mixture worth Ksh 62 per kg. If brand *x* is valued at Ksh 68 per kg and brand *y* at Ksh 53 per kg, calculate the ratio, in its simplest form, in which the brands *x* and *y* are mixed. (2 marks)

5. The length of a flower garden is 2 m less than twice its width. The area of the garden is 60 m². Calculate its length. (3 marks)

6. Five people can build 3 huts in 21 days. Find the number of people, working at the same rate that will build 6 similar huts in 15 days. (2 marks)

7. When Ksh 40 000 was invested in a certain bank for 5 years it earned a simple interest of Ksh 3 800.

   Find the amount that must have been invested in the same bank at the same rate for $7\frac{1}{2}$ years to earn a simple interest of Ksh 3 420. (3 marks)

8. The heights, in centimetres, of 100 tree seedlings are shown in the table below.

Height (cm)	10–19	20–29	30–39	40–49	50–59	60–69
Number of Seedlings	9	16	19	26	20	10

   Find the quartile deviation of the heights. (4 marks)

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9 A bag contains 2 white balls and 3 black balls. A second bag contains 3 white balls and 2 black balls. The balls are identical except for the colours.

Two balls are drawn at random, one after the other from the first bag and placed in the second bag. Calculate the probability that the 2 balls are both white. (2 marks)

10 The points O, A and B have the coordinates (0,0), (4,0) and (3,2) respectively. Under a shear represented by the matrix $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$, triangle OAB maps onto triangle OAB′.

(a) Determine in terms of k, the x coordinate of point B′. (2 marks)

(b) If OAB′ is a right angled triangle in which angle OB′A is acute, find two possible values of k. (2 marks)

11 A particle starts from O and moves in a straight line so that its velocity V ms⁻¹ after time t seconds is given by $V = 3t - t^2$. The distance of the particle from O at time t seconds is s metres.

(a) Express s in terms of t and c where c is a constant. (1 mark)

(b) Calculate the time taken before the particle returns to O. (3 marks)

12 (a) Expand and simplify $(2 - x)^5$. (2 marks)

(b) Use the first 4 terms of the expansion in part (a) above to find the approximate value of $(1.8)^5$ to 2 decimal places. (2 marks)

13 (a) Using line AB given below, construct the locus of a point P such that $\angle APB = 90°$. (1 mark)

A   B

(b) On the same diagram locate **two** possible positions of point C such that point C is on the locus of P and is equidistant from A and B. (2 marks)
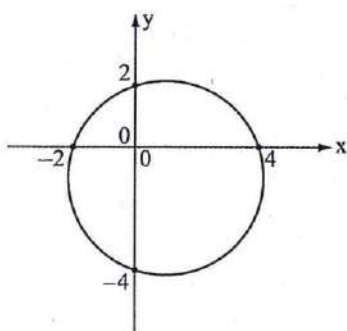
14 Make x the subject of the equation:

$$3y = y + \frac{p}{q + \frac{1}{x}}$$ (3 marks)

15 Find the value of x given that

$$\log(15 - 5x) - 1 = \log(3x - 2)$$ (3 marks)

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16. The circle shown below cuts the x-axis at (–2,0) and (4,0). It also cuts y-axis at (0,2) and (0,–4).

Determine the:

(a) (i) coordinates of the centre;   (1 mark)

    (ii) radius of the circle.   (1 mark)

(b) equation of the circle in the form $x^2 + y^2 + ax + by = c$ where a, b and c are constants.   (2 marks)

SECTION II (50 marks)

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

17. (a) Complete the table below, giving the values correct to 2 decimal places.   (2 marks)

$x°$	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
Cos $x°$	1.00	0.94	0.77	0.50		–0.17		–0.77		–1.00
Sin $x°$ – Cos $x°$	–1.00	–0.60		0.37	0.81		1.37		1.28	1.00

(b) On the grid provided and using the same axes draw the graphs of $y = \cos x°$ and $y = \sin x° - \cos x°$ for $0° \leq x \leq 180°$. Use the scale; 1 cm for 20° on the x-axis and 4 cm for 1 unit on the y-axis.   (5 marks)

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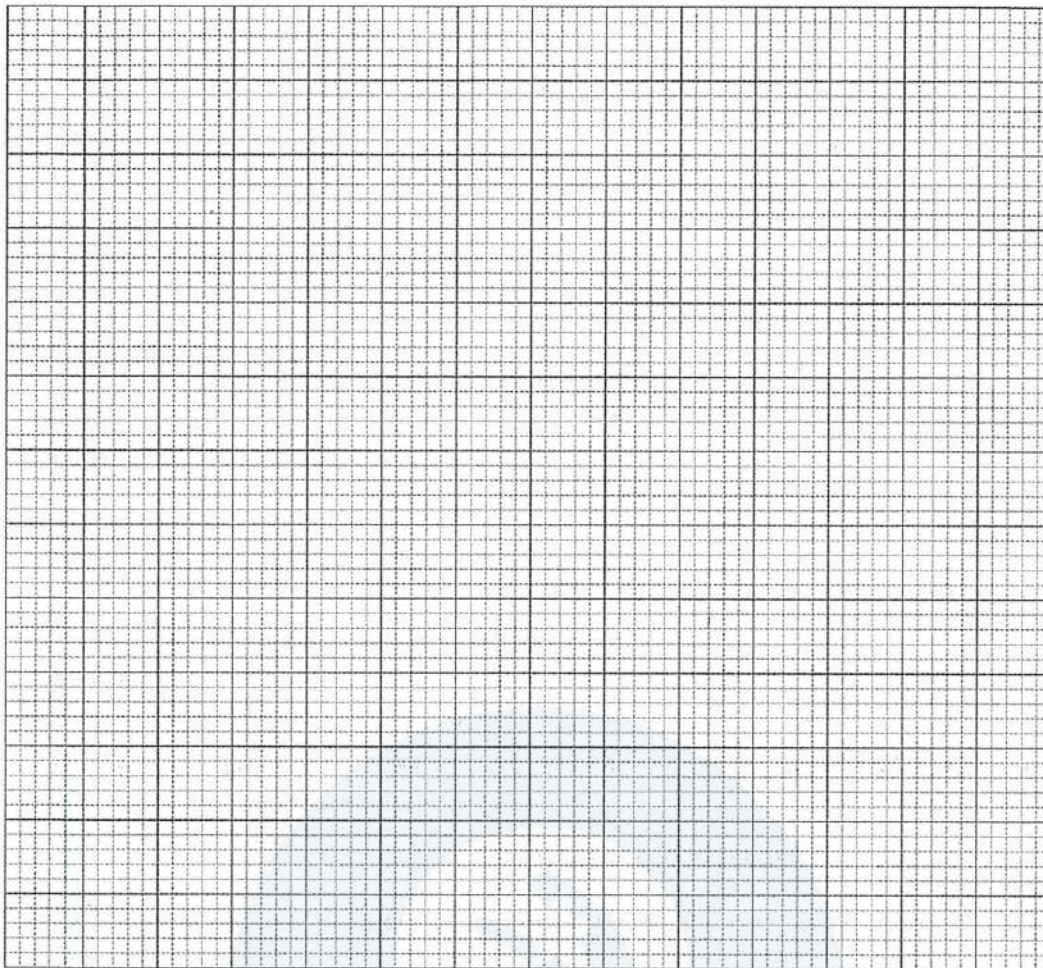
(c) Using the graph in part (b):
   (i) solve the equation $\sin x^\circ - \cos x^\circ = 1.2$;   (1 mark)

   (ii) solve the equation $\cos x^\circ = \frac{1}{2}\sin x^\circ$;   (1 mark)

   (iii) determine the value of $\cos x^\circ$ in part (c) (ii) above.   (1 mark)

18   In the figure below OJKL is a parallelogram in which **OJ** = 3**p** and **OL** = 2**r**.
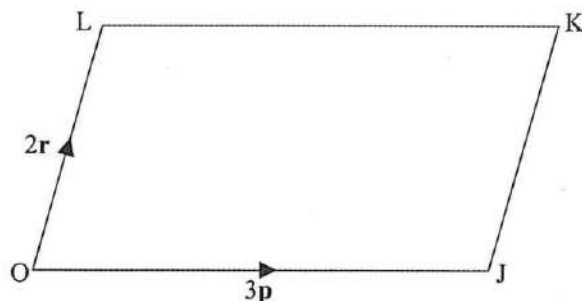
(a) If A is a point on LK such that LA = $\frac{1}{2}$AK and a point B divides the line JK externally in the ratio 3:1, express **OB** and **AJ** in terms of **p** and **r**.   (2 marks)

(b) Line OB intersects AJ at X such that **OX** = m**OB** and **AX** = n**AJ**.
   (i) Express **OX** in terms of **p**, **r** and m.   (1 mark)

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(ii) Express **OX** in terms of **p, r** and n. (1 mark)

(iii) Determine the values of m and n and hence the ratio in which point X divides line AJ. (6 marks)

19 The positions of three ports A, B and C are (34°N, 16°W), (34°N, 24°E) and (26°S, 16°W) respectively.

(a) Find the distance in nautical miles between:

    (i) Ports A and B to the nearest nautical miles; (3 marks)

    (ii) Ports A and C. (2 marks)

(b) A ship left Port A on Monday at 1330 h and sailed to Port B at 40 knots.

    Calculate:

    (i) the local time at Port B when the ship left Port A; (2 marks)

    (ii) the day and the time the ship arrived at port B. (3 marks)

20 A carpenter takes 4 hours to make a stool and 6 hours to make a chair. It takes the carpenter and at least 144 hours to make x stools and y chairs. The labour cost of making a stool is Ksh 100 and that of a chair is Ksh 200. The total labour cost should not exceed Ksh 4 800. The carpenter must make at least 16 stools and more than 10 chairs.

(a) Write down inequalities to represent the above information. (3 marks)

(b) Draw the inequalities in (a) above on the grid provided. (4 marks)

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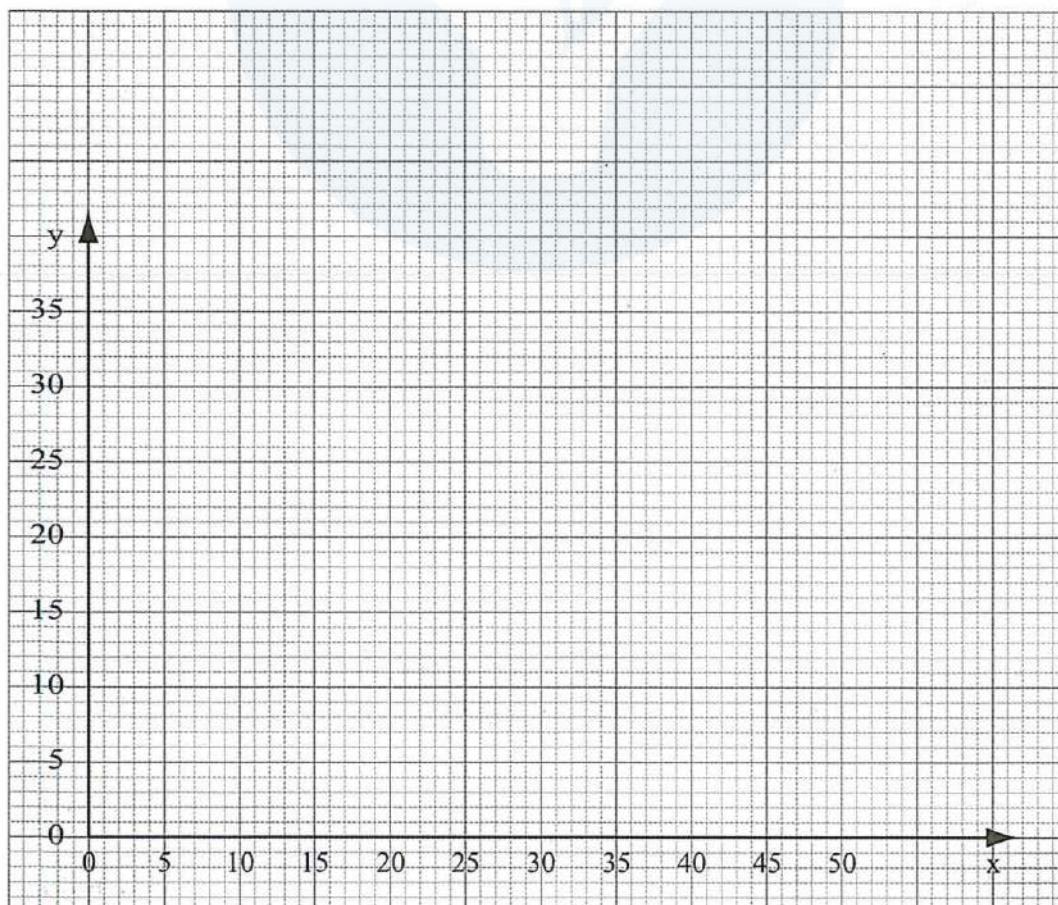
(c) The carpenter makes a profit of Ksh 40 on a stool and Ksh 100 on a chair.

Use the graph to determine the maximum profit the carpenter can make. (3 marks)

21 A hall can accommodate 600 chairs arranged in rows. Each row has the same number of chairs. The chairs are rearranged such that the number of rows are increased by 5 but the number of chairs per row is decreased by 6.

(a) Find the original number of rows of chairs in the hall. (6 marks)

(b) After the re-arrangement 450 people were seated in the hall leaving the same number of empty chairs in each row. Calculate the number of empty chairs per row. (4 marks)

22 The first term of an Arithmetic Progression (A.P.) with six terms is p and its common difference is c. Another A.P. with five terms has also its first term as p and a common difference of d. The last terms of the two Arithmetic Progressions are equal.

(a) Express d in terms of c. (3 marks)

(b) Given that the 4th term of the second A.P. exceeds the 4th term of the first one by $1\frac{1}{2}$, find the values of c and d. (3 marks)

(c) Calculate the value of p if the sum of the terms of the first A.P. is 10 more than the sum of the terms of the second A.P. (4 marks)

23 In a uniformly accelerated motion the distance, s metres, travelled in time t seconds varies partly as the time and partly as the square of the time. When the time is 2 seconds, the distance travelled is 80 metres and when the time is 3 seconds, the distance travelled is 135 metres.

(a) Express s in terms of t. (5 marks)

(b) Find:
    (i) the distance travelled in 5 seconds; (2 marks)

    (ii) the time taken to travel a distance of 560 metres. (3 marks)

24 In the figure below, P, Q, R and S are points on the circle centre O. PRT and USTV are straight lines. Line USTV is a tangent to the circle at S, $\angle RST = 50°$ and $\angle RTV = 150°$.
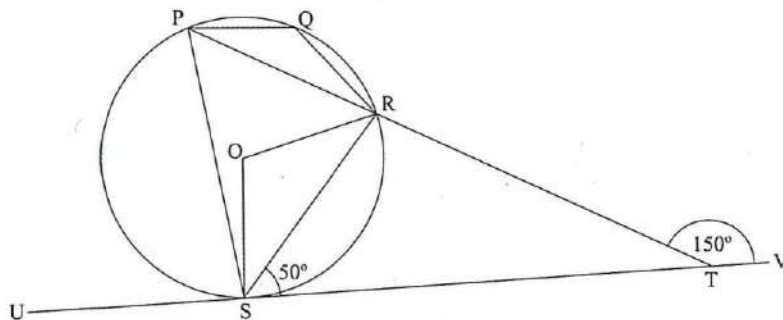
(a) Calculate the size of:
    (i) $\angle ORS$; (2 marks)

    (ii) $\angle USP$; (1 mark)

(iii) ∠PQR. (2 marks)

(b) Given that RT = 7 cm and ST = 9 cm, calculate to 3 significant figures:
   (i) the length of line PR; (2 marks)

   (ii) the radius of the circle. (3 marks)