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MATHEMATICS **0580/22**

Paper 2 Non-calculator (Extended) **February/March 2025**

2 hours

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.
- You may use tracing paper.
- You must show all necessary working clearly.

INFORMATION

- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages.

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Calculators must **not** be used in this paper.

1 Oranges cost 220 rupees per kilogram.

Work out the cost of 9 kg of these oranges.

$220 \times 9 = 1980$

..........1980.......... rupees [1]

2 Aryan goes on a journey.
He leaves home at 11 40 and arrives at 14 18.

Find how many hours and minutes the journey took.

$11:40 \xrightarrow{2h} 13:40 \xrightarrow{20'} 14:00 \xrightarrow{18'} 14:18$

+ +

..........2.... h ......38.......... min [1]

3 A quadrilateral has one line of symmetry.
The diagonals of the quadrilateral cross at right angles.

Write down the mathematical name of the quadrilateral.

..........kite.......... [1]

4 $V = 4mp^2$

(a) Find V when $m = 10$ and $p = -3$.

$V = 4 \times 10 \times (-3)^2 = 360$

$V =$ ......360...... [2]

(b) Find the positive value of p when $V = 3200$ and $m = 2$.

$3200 = 4 \times 2p^2$

$p^2 = 400$

$p = 20$ (because $p > 0$)

$p =$ ......20...... [2]

5 Write these lengths in order of size, starting with the smallest.

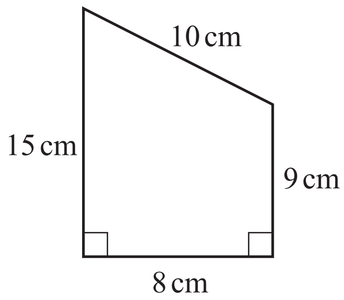
0.03 m   2.9 cm   32 mm   0.000 02 km

3cm   3.2 cm   2cm

......0.00002 km...... , ...2.9 cm...... , ...0.03 m...... , ...32 mm...... [2]

smallest

6



NOT TO SCALE

Work out the area of the trapezium.

$\frac{(9 + 15)8}{2} = 96$

......96...... cm^2 [2]

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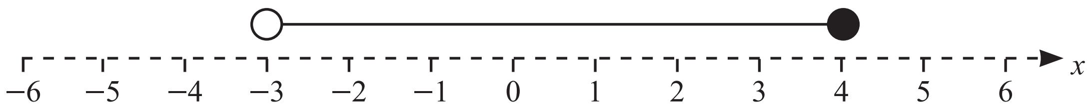
7



Write down the inequality for x represented on the number line.

$-3 < x \leqslant 4$ .... [2]

8 Pryanka plays a game in which she can win, lose or draw.
The table shows the probability of her winning or losing a game.

Result of game	win	lose	draw
Probability	0.3	0.25	0.45

(a) Complete the table. [2]

$1 - 0.3 - 0.25 = 0.45$

(b) Pryanka plays this game 120 times.

Work out the expected number of games she wins.

$120 \times 0.3 = 36$

.... 36 .... [1]

9

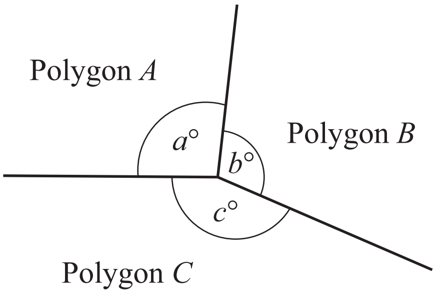
$$D = \sqrt{\frac{1.95 \times 9.92^2}{8.07}}$$

By writing each number correct to 1 significant figure, work out an estimate for D.

$$D \approx \sqrt{\frac{2 \times 10^2}{8}} = \frac{10\sqrt{2}}{2\sqrt{2}} = 5$$

$D =$ .... 5 .... [3]

10



NOT TO SCALE

Three regular polygons A, B and C meet at a point.
The interior angles of the polygons are in the ratio $a : b : c = 3 : 4 : 5$.

Show that polygon C has twice the number of sides as polygon B.

$$b = \frac{360°}{3+4+5} \times 4 = 120°$$

$$c = \frac{360°}{3+4+5} \times 5 = 150°$$

$$(n_b - 2)\,180° = 120° n_b$$

$$180° n_b - 360° = 120° n_b$$

$$60° n_b = 360°$$

$$\Rightarrow n_b = 6$$

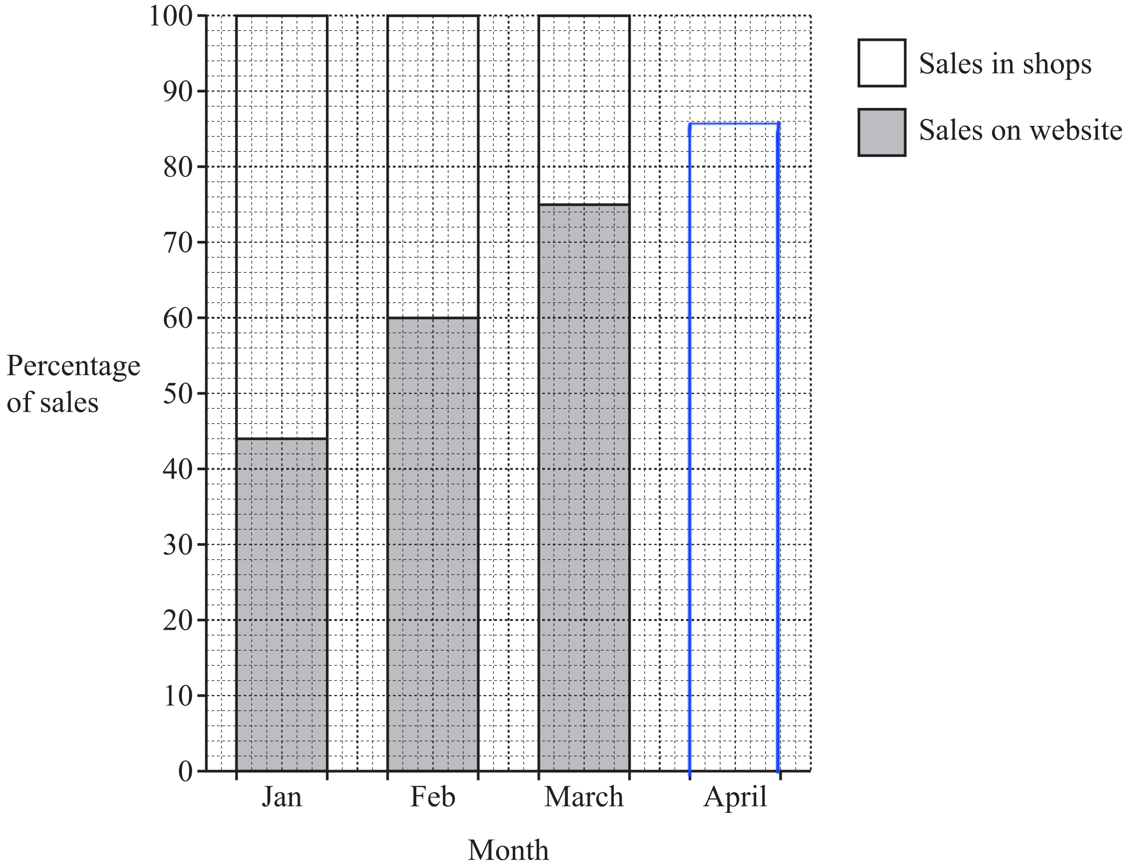
$$(n_c - 2)\,180° = 150° n_c$$

$$n_c = 12$$

$n_c = 2 n_b \Rightarrow$ polygon C has twice the number of sides as polygon B

[5]

11 A company sells items either on a website or in shops.
The composite bar chart shows the percentage of sales on the website and in shops for January, February and March.



(a) In April, $\frac{17}{20}$ of the company's sales were on the website.

On the grid, draw the bar for April. [2]

(b) In February, the company had sales of \$3.5 million.

Work out the value of sales **in shops** in February.

3.5 x 40 % = 1.4

\$ ....1.4........ million [3]

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(c) In May, the company had sales of \$6 million.
In June, the company had sales of \$7.5 million.

Find the percentage increase in sales from May to June.

$\frac{7.5 - 6}{6} = \frac{1.5}{6} = 0.25 = 25\%$

........25........ % [3]

(d) In 2024, the company had total sales of \$52 million.
This was an increase of 30% on the total sales for 2023.
x

<== This should be rewritten as "This was the total sales after an increase of 30% ...."

Work out the total sales in 2023.

$x + 30\% \, x = 52$

$1.3x = 52$

$x = 40$

\$ ....40........ million [2]

12 (a) Write as a single fraction in its simplest form.

$$\frac{x}{4} + \frac{3x}{8} - \frac{x+2}{12}$$

$\frac{6x}{24} + \frac{9x}{24} - \frac{2(x+2)}{24}$

$= \frac{6x + 9x - 2x - 4}{24}$

$= \frac{13x - 4}{24}$

.... $\frac{13x-4}{24}$ .... [3]

(b) Factorise.

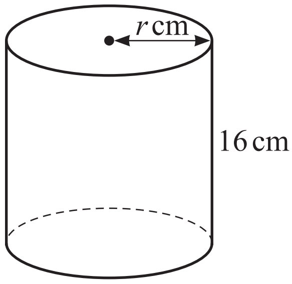
$$3x(a+4y) - ay - 4y^2$$

$3x(a+4y) - y(a+4y)$

$(3x - y)(a + 4y)$

.... $(3x-y)(a+4y)$ .... [1]

13



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The diagram shows a cylinder with radius r cm and height 16 cm.
A sphere has radius 3 cm.
The volume of the cylinder is equal to the volume of the sphere.

Find the value of r.

$$16\pi r^2 = \frac{4}{3}\pi \times 3^3$$

$$16r^2 = 36$$

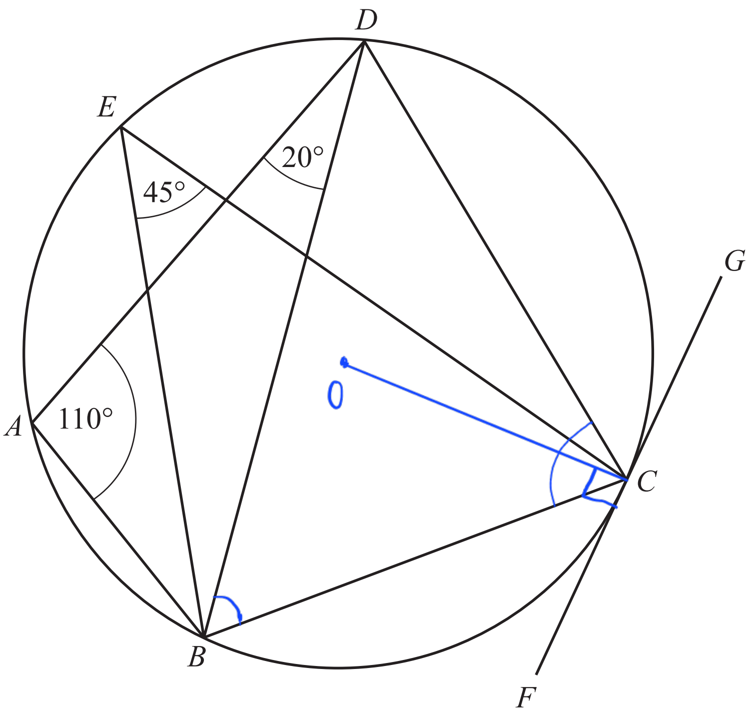
$$r^2 = \frac{36}{16} = \frac{9}{4}$$

$$r = \pm\frac{3}{2}$$

Because $r > 0$ so $r = \frac{3}{2}$

$r = \frac{3}{2}$ [4]

14



A, B, C, D and E lie on a circle.
FG is a tangent to the circle at C.
Angle $BAD = 110°$, angle $ADB = 20°$ and angle $BEC = 45°$.

(a) Find angle BCD.
Give a geometrical reason for your answer.

Angle BCD = 70° because the sum of 2 opposite angles in a cyclic quadrilateral is 180° [2]

(b) **(i)** Find angle DBC.

$\widehat{BDC} = \widehat{BEC} = 45°$
$\widehat{DBC} = 180° - 45° - 70°$

Angle DBC = 65° [2]

(ii) Find angle DCG.

$\widehat{DCG} = \widehat{DBC} = 65°$

Angle DCG = 65° [1]

15 Point A has coordinates $(-4, 1)$ and $\overrightarrow{BA} = \begin{pmatrix} -5 \\ -12 \end{pmatrix}$.

(a) Find the coordinates of point B.

$$\begin{pmatrix} -4 - x_B \\ 1 - y_B \end{pmatrix} = \begin{pmatrix} -5 \\ -12 \end{pmatrix}$$

$x_B = -4 + 5 = 1$

$y_B = 1 + 12 = 13$

(....1.... , ...13....) [2]

(b) Point C has coordinates $(5, -2)$.

Find the vector $\overrightarrow{CA}$.

$$\begin{pmatrix} -4 - 5 \\ 1 - (-2) \end{pmatrix}$$

$\overrightarrow{CA} = \begin{pmatrix} -9 \\ 3 \end{pmatrix}$ [2]

(c) $\overrightarrow{EF} = 3\overrightarrow{BA}$

Find $|\overrightarrow{EF}|$.

$$|\overrightarrow{EF}| = 3|\overrightarrow{BA}| = 3\sqrt{(-5)^2 + (-12)^2}$$
$$= 3\sqrt{25 + 144}$$
$$= 3\sqrt{169}$$
$$= 3 \times 13$$
$$= 39$$

....39.... [3]

16 The stem-and-leaf diagram shows the mass of each of 13 packets.

3	1 2 8
4	0 1 2 3 3 8
5	1 2 3 4

Key: 3 | 1 represents 31 g

(a) Work out the interquartile range.

$Q_1 = \frac{38+40}{2} = 39$

$Q_3 = \frac{51+52}{2} = \frac{103}{2} = 51.5$

$Q_3 - Q_1 = 51.5 - 39$
$= 12.5$

........12.5........ g [3]

(b) Two of these packets are chosen at random.

Find the probability that the one packet has a mass of more than 50 g and the other packet has a mass of less than 50 g.

$P(m > 50) = \frac{4}{13}$

$P(m < 50) = \frac{9}{13}$

$\frac{4}{13} \times \frac{9}{12} \times 2 = \frac{6}{13}$

.... $\frac{6}{13}$ .... [3]

17 Work out.

$$\frac{5}{9} + 0.2\dot{8}$$

Give your answer as a fraction in its simplest form.

$x = 0.2888\ldots$
$10x = 2.888\ldots$
$100x = 28.888\ldots$

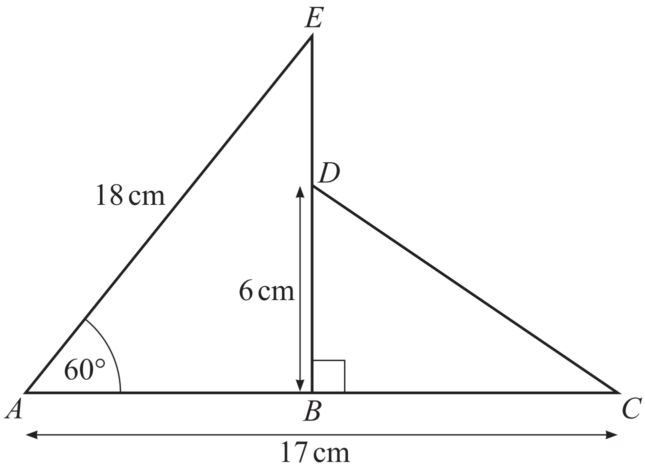
$100x - 10x = 28 - 2$
$90x = 26$
$x = \frac{26}{90}$

$\frac{5}{9} + \frac{26}{90} = \frac{50+26}{90} = \frac{76}{90} = \frac{38}{45}$

.... $\frac{38}{45}$ .... [4]

18

NOT TO SCALE



The quadrilateral $ACDE$ is formed by two right-angled triangles ABE and BCD.
$AC = 17$ cm, $AE = 18$ cm and $BD = 6$ cm.

(a) Show that $CD = 10$ cm.

$AB = AE \cos 60° = 18 \times \frac{1}{2} = 9$ cm

$BC = 17 - 9 = 8$ cm

$CD = \sqrt{BD^2 + BC^2} = \sqrt{6^2 + 8^2} = 10$ cm

[5]

(b) Find the perimeter of the quadrilateral $ACDE$.
Give your answer in the form $p + k\sqrt{q}$.

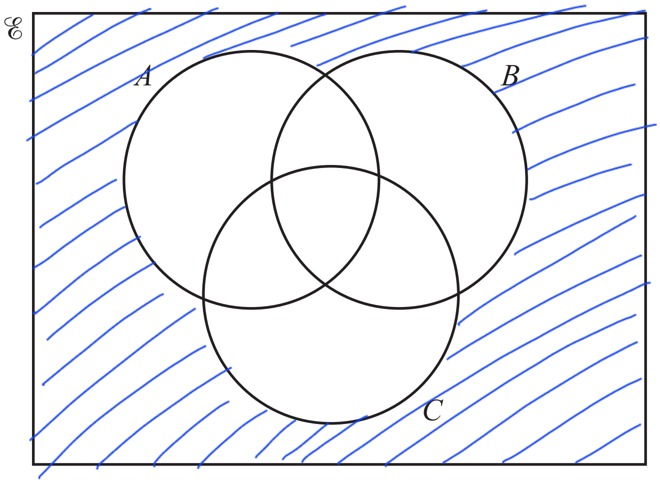
$BE = AE \sin 60° = 18 \times \frac{\sqrt{3}}{2} = 9\sqrt{3}$

$DE = BE - BD = 9\sqrt{3} - 6$

Perimeter of $ACDE = 18 + 17 + 10 + 9\sqrt{3} - 6$
$= 39 + 9\sqrt{3}$

.......$39 + 9\sqrt{3}$....... cm [4]

19



In the Venn diagram, shade the region $(A \cup B \cup C)'$. [1]

20 **(a)** Simplify.

$$\sqrt{300} + \sqrt{48}$$

$10\sqrt{3} + 4\sqrt{3}$

$= 14\sqrt{3}$

$14\sqrt{3}$ [2]

(b) Rationalise the denominator and simplify.

$$\frac{9}{2+\sqrt{7}}$$

$\frac{9(2-\sqrt{7})}{(2+\sqrt{7})(2-\sqrt{7})} = \frac{18-9\sqrt{7}}{4-7} = \frac{9\sqrt{7}-18}{3} = 3\sqrt{7}-6$

$3\sqrt{7} - 6$ [3]

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21 **(a)** Write down the coordinates of the point where the graph of $y = 5x - 3$ crosses the y – axis.

(0 , −3) [1]

(b) A is the point $(1, 7)$ and B is the point $(5, 15)$.

Find the equation of the perpendicular bisector of the line AB.
Give your answer in the form $y = mx + c$.

Mid point of AB $= \left(\frac{1+5}{2}, \frac{7+15}{2} \right) = (3, 11)$

$m_{AB} = \frac{15-7}{5-1} = 2$

$m_{\text{perpendicular line}} = \frac{-1}{2}$

Equation of perpendicular bisector of AB:

$y - 11 = \frac{-1}{2}(x - 3)$

$y = -\frac{1}{2}x + \frac{3}{2} + 11$

$y = -\frac{1}{2}x + \frac{25}{2}$

$y =$ $\frac{-1}{2}x + \frac{25}{2}$ [5]

22 A curve has equation $y = x^3 + x^2 - x$.

The curve has a stationary point at $\left(\frac{1}{3}, -\frac{5}{27}\right)$.

(a) Find the coordinates of the other stationary point.

$\frac{dy}{dx} = 3x^2 + 2x - 1 = 0$

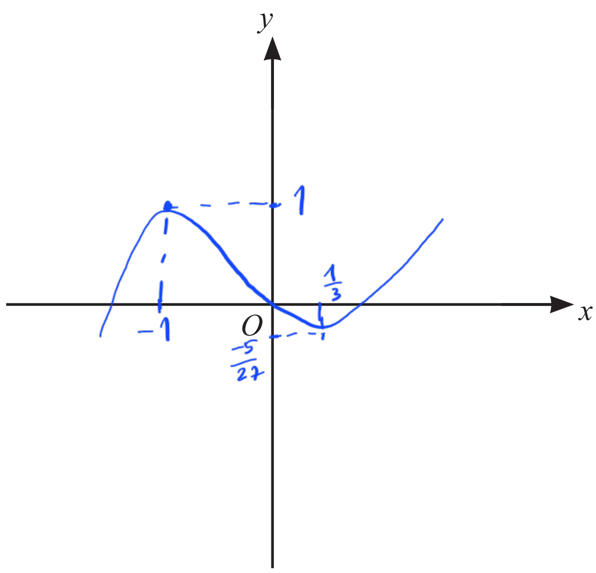
$(3x-1)(x+1) = 0$

$x = \frac{1}{3}$ or $x = -1$

when $x = -1$, $y = (-1)^3 + (-1)^2 - (-1) = 1$

(..........-1.......... , ...1..........) [5]

(b) By sketching the graph of $y = x^3 + x^2 - x$, determine whether the stationary point $\left(\frac{1}{3}, -\frac{5}{27}\right)$ is a maximum or a minimum.



$\left(\frac{1}{3}, -\frac{5}{27}\right)$ is a ....minimum.......... [2]

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(c) The equation $x^3 + x^2 - x = k$ has fewer than 3 solutions.

Find the range of possible values for k.

$k < -\frac{5}{27}$ or $k \geqslant 1$ .... [2]

23 (a) Simplify $\left(\frac{x^2}{4}\right)^{\frac{3}{2}}$.

$(x^2)^{\frac{3}{2}} = x^{2\times\frac{3}{2}} = x^3$

$4^{\frac{3}{2}} = (\sqrt{4})^3 = 2^3 = 8$

.... $\frac{x^3}{8}$ .... [2]

(b) $16^x \times \left(\frac{1}{2}\right)^x = 4^{x+3}$

Find the value of x.

$(4^2)^x \times (4^{-\frac{1}{2}})^x = 4^{x+3}$

$2x + \frac{-1}{2}x = x + 3$

$\frac{1}{2}x = 3$

$x = 6$

$x =$ .... 6 .... [4]

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