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MATHEMATICS **0580/43**

Paper 4 Calculator (Extended) **May/June 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.
- You should use a scientific calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

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. Any blank pages are indicated.

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1 Find the median of these numbers.

5 11 11 13 17 21

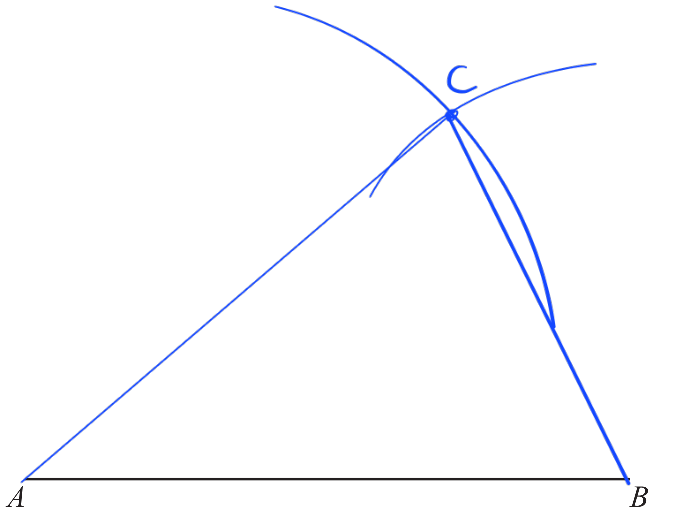
$\frac{11+13}{2}$

........................12........................ [1]

2 In triangle ABC, $AC = 21$ m and $BC = 15.9$ m.

Using a ruler and compasses only, complete the scale drawing of the triangle.
Use a scale of 1 cm to represent 3 m.
The side AB is drawn for you.

AC = 7 cm BC = 5.3 cm



Scale : 1 cm to 3 m

[3]

3

$\frac{2}{5}$	$\sqrt{15}$	23	$\sqrt{144}$	-2	0.8

From this list, write down

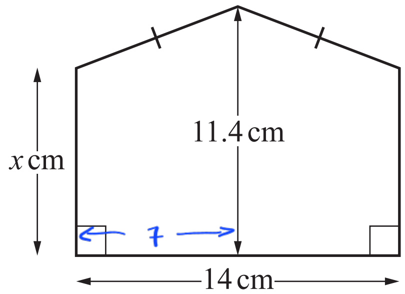
(a) a natural number

........................23........................ [1]

(b) an irrational number.

........................$\sqrt{15}$........................ [1]

4 The diagram shows a pentagon made from two congruent trapeziums.



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The area of the pentagon is $130.2\ \text{cm}^2$.

Calculate the value of x.

$$\frac{(x + 11.4)7}{2} \times 2 = 130.2$$

$$x + 11.4 = 18.6$$

$$x = 7.2$$

$x =$ ....7.2.................... [3]

5 **(a)** Convert $780\ \text{cm}^2$ into m^2.

$780 \div 100^2$

....0.078.......... m^2 [1]

(b) Convert $0.037\ \text{m}^3$ into cm^3.

0.037×100^3

....37 000.......... cm^3 [1]

6 One titanium atom has a mass of 7.95×10^{-23} grams.

Calculate the number of titanium atoms in 1 kg of titanium.
Give your answer in standard form.

1000 g

$$\frac{1000}{7.95 \times 10^{-23}}$$

....1.26×10^{25}.................... [2]

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7 $\mathscr{E} = \{x : x \text{ is an integer and } 1 \leqslant x \leqslant 12\}$
$E = \{\text{even numbers}\}$
$M = \{\text{multiples of } 3\}$

$E = \{2, 4, 6, 8, 10, 12\}$

(a) Find $n(M)$.

$M = \{3, 6, 9, 12\}$

4 .... [1]

(b) Write down the set $E \cap M$.

{ .... 6, 12 .... } [1]

(c) $y \in (E \cup M)'$

Write down a possible value of y.

1 .... [1]

8 Factorise.

(a) $28xy - 12x$

$4x(7y - 3)$ .... [2]

(b) $y - 6x + 2xy - 3$

$y - 3 - 2x(3 - y)$
$y - 3 + 2x(y - 3)$

$(y - 3)(2x + 1)$ .... [2]

9 **(a)** Simplify.

$$5x^5y \times 7x^3y^2$$

$35x^8y^3$ .... [2]

(b) $7^n = \sqrt[5]{7}$

Find the value of n.

$7^n = 7^{\frac{1}{5}}$

$n =$ $\frac{1}{5}$ .... [1]

10 Expand and simplify.

(a) $2x - x(5 - x^2)$

$2x - 5x + x^3$

$x^3 - 3x$ .... [2]

(b) $(x+4)(x-5)(x+3)$

$(x^2 + 4x - 5x - 20)(x+3)$

$(x^2 - x - 20)(x+3)$

$x^3 - x^2 - 20x + 3x^2 - 3x - 60$

$x^3 + 2x^2 - 23x - 60$ .... [3]

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11 The table shows three sequences.

	1st term	2nd term	3rd term	4th term	5th term	6th term	nth term
Sequence A	28	22	16	10	4	-2	$-6n + 34$
Sequence B	$\frac{1}{6}$	$\frac{2}{7}$	$\frac{3}{8}$	$\frac{4}{9}$	$\frac{1}{2} = \frac{5}{10}$	$\frac{6}{11}$	$\frac{n}{n+5}$
Sequence C	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8	$\frac{1}{4} \times 2^{n-1}$

Complete the table.

[8]

12

$$\sqrt{\frac{10^{400}}{10^{220} \times 10^{80}}} = 10^k$$

Find the value of k.

$$\sqrt{\frac{10^{400}}{10^{300}}} = 10^k$$

$$\left(10^{100}\right)^{\frac{1}{2}} = 10^k$$

$$10^{50} = 10^k$$

$k =$ ....50.................................... [3]

13 Line L has the equation $y = 2(x - 5)$.

(a) Find the coordinates of the point where line L intersects the y-axis.

(......0...... , ...-10......) [1]

(b) Find the x-coordinate of the point where line L intersects the line $y = 19$.

$2(x-5) = 19$

$2x - 10 = 19$

$2x = 29$

$x = 14.5$

$x =$ ......14.5...... [2]

(c) Line P is perpendicular to line L.
Line P passes through the point $(2, 3)$.

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

$m_L = 2$

$m_P = -1 \div 2 = -0.5$

Equation of line P: $y - 3 = -0.5(x - 2)$

$y - 3 = -0.5x + 1$

$y = -0.5x + 4$

$y =$ ......$-0.5x + 4$...... [3]

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14 Jess invests \$1400 in an account.
The account pays compound interest at a rate of r% per year.
At the end of 4 years the value of her investment is \$1523.15 .

Find the value of r.

$$1523.15 = 1400\left(1 + \frac{r}{100}\right)^4$$

$$1 + \frac{r}{100} = \sqrt[4]{\frac{1523.15}{1400}} \approx 1.0213$$

$$\frac{r}{100} = 0.0213$$

$$r = 2.13$$

$r =$ ....2.13........ [3]

15 m is inversely proportional to the square root of $(t+2)$.
$m = 0.5$ when $t = 23$.

Find m when $t = 98$.

$$m = \frac{k}{\sqrt{t+2}}$$

$$0.5 = \frac{k}{\sqrt{23+2}}$$

$$k = 0.5\sqrt{25} = 2.5$$

$$\Rightarrow m = \frac{2.5}{\sqrt{t+2}}$$

When $t = 98$: $m = \dfrac{2.5}{\sqrt{98+2}} = 0.25$

$m =$ ....0.25........ [3]

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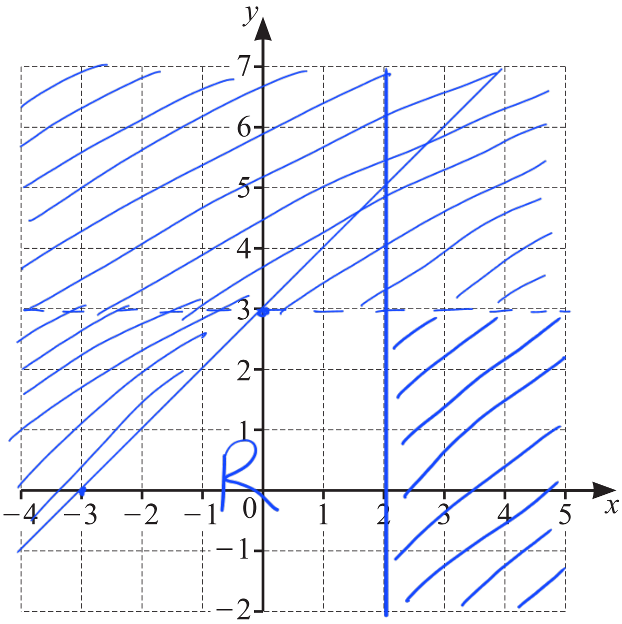
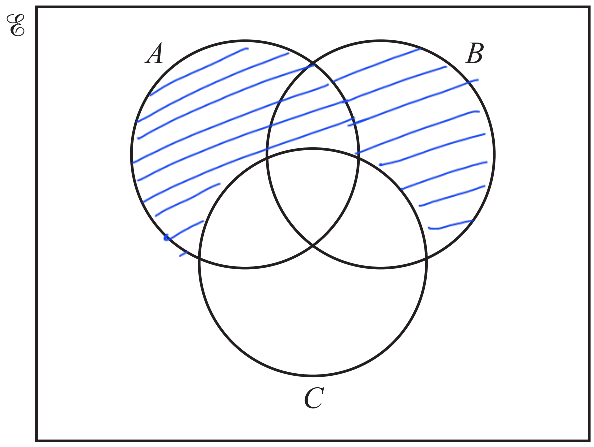


By shading the **unwanted** regions of the grid, draw and label the region R which satisfies these three inequalities.

$y < 3$ $\qquad$ $x \leqslant 2$ $\qquad$ $y < x + 3$

[5]

17 In the Venn diagram, shade the region $(A \cup B) \cap C'$.



[1]

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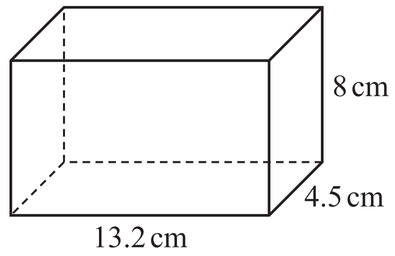
18



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The diagram shows a solid cuboid with sides of length 4.5 cm, 8 cm and 13.2 cm.

(a) Calculate the volume of the cuboid.

$4.5 \times 8 \times 13.2$

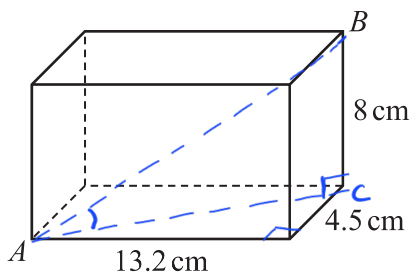
.......475.2....... cm^3 [1]

(b) Calculate the total surface area of the cuboid.

$(13.2 \times 4.5 + 4.5 \times 8 + 13.2 \times 8) \times 2$

.......402....... cm^2 [3]

(c)



NOT TO SCALE

Calculate the angle between AB and the horizontal base of the cuboid.

$AC = \sqrt{13.2^2 + 4.5^2} \approx 13.946$

$\tan \widehat{BAC} = \frac{8}{13.946}$

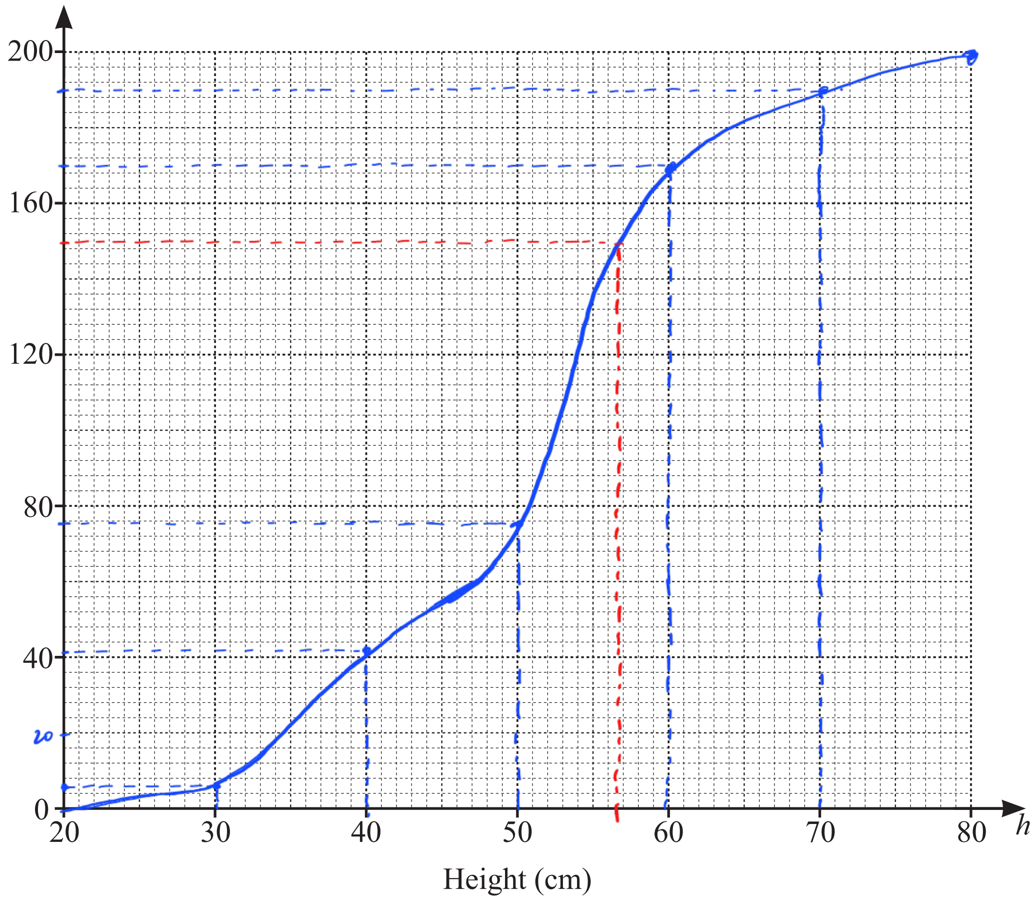
$\widehat{BAC} \approx 29.8^\circ$

.......29.8°....... [4]

19 The table shows some information about the heights of 200 plants.

Height (h cm)	Cumulative frequency
$h \leqslant 30$	6
$h \leqslant 40$	42
$h \leqslant 50$	76
$h \leqslant 60$	170
$h \leqslant 70$	190
$h \leqslant 80$	200

(a) Draw a cumulative frequency diagram to show this information.



[3]

(b) Find an estimate of the 75th percentile.

200 × 75% = 150

......56.5...... cm [1]

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20 Stephan has two bags, A and B, each containing red sweets and yellow sweets only.
He picks two sweets at random, one from bag A and the other from bag B.

The probability that Stephan picks a red sweet from bag A is $\frac{3}{5}$.

The probability that Stephan picks a red sweet from bag A and a red sweet from bag B is $\frac{2}{15}$.

(a) Find the probability that Stephan picks a red sweet from bag B.

$$\frac{2}{15} \div \frac{3}{5} = \frac{2}{9}$$

$\frac{2}{9}$ .... [2]

(b) Find the probability that Stephan picks a yellow sweet from bag A and a yellow sweet from bag B.

$$P(Y_A) \times P(Y_B)$$

$$= \frac{2}{5} \times \frac{7}{9}$$

$\frac{14}{45}$ .... [3]

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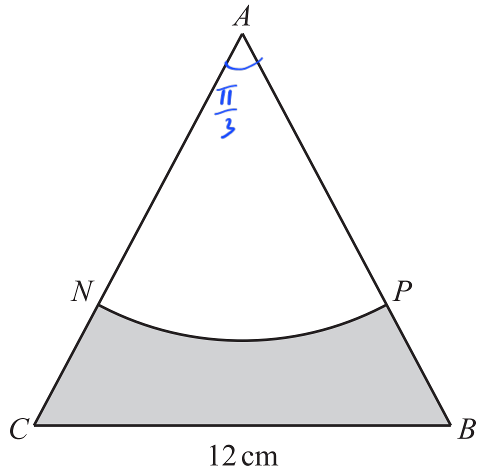

The diagram shows an equilateral triangle ABC with all sides of length 12 cm.
ANP is a sector of a circle, centre A.
N lies on AC such that $AN : NC = 2 : 1$.
P lies on AB such that $AP : PB = 2 : 1$.

Calculate the area of the shaded region.

ΔABC is equilateral

$\Rightarrow C\hat{A}B = \frac{\pi}{3}$ rad

$A_{\Delta ABC} = \frac{1}{2} . AB . AC \sin \frac{\pi}{3}$

$= \frac{1}{2} \times 12 \times 12 \times \frac{\sqrt{3}}{2} = 36\sqrt{3}$

$A_{\text{sector } ANP} = \frac{1}{2} AP^2 \frac{\pi}{3}$

$= \frac{1}{2} \left(\frac{2}{3} \times 12\right)^2 \frac{\pi}{3} = \frac{32\pi}{3}$

$A_{\text{shaded region}} = 36\sqrt{3} - \frac{32\pi}{3}$

..........28.8.......... cm^2 [4]

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22 A metal cube has mass 14.2 g, correct to 1 decimal place.

(a) Find the lower bound of the mass of the cube.

$14.2 - \frac{0.1}{2} = 14.15$

.........14.15......... g [1]

(b) The side length of the cube is 1.3 cm, correct to 1 decimal place.

Calculate the upper bound of the density of the metal.
[Density = mass ÷ volume]

$\text{Density (max)} = \frac{\text{mass}}{\text{volume}} = \frac{\text{mass (max)}}{(\text{side})^3 \text{ (min)}}$

$\text{Density} = \frac{14.2 + \frac{0.1}{2}}{\left(1.3 - \frac{0.1}{2}\right)^3} = 7.296$

.........7.296......... g/cm^3 [3]

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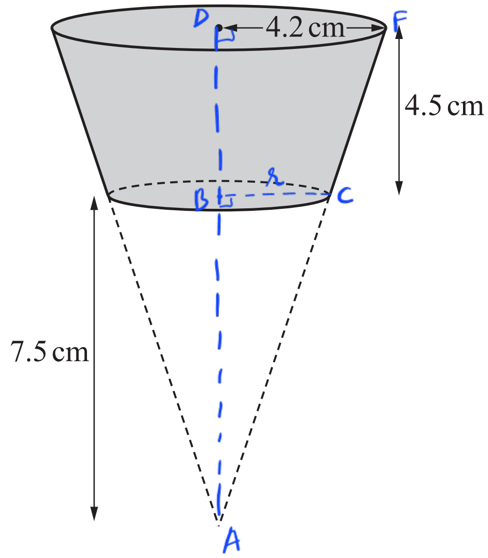

NOT TO SCALE

The diagram shows a frustum made by removing a small cone from a large cone.
The height of the small cone is 7.5 cm.
The height of the frustum is 4.5 cm.
The radius of the large cone is 4.2 cm.

Work out the volume of the frustum.

$\Delta ABC \sim \Delta ADF$

$\frac{BC}{DF} = \frac{AB}{AD} \Rightarrow \frac{r}{4.2} = \frac{7.5}{7.5+4.5} \Rightarrow r = 2.625$

$V_{\text{frustum}} = V_{\text{large cone}} - V_{\text{small cone}}$

$= \frac{1}{3}\pi 4.2^2 \times 12 - \frac{1}{3}\pi 2.625^2 \times 7.5$

.... 168 .... cm^3 [4]

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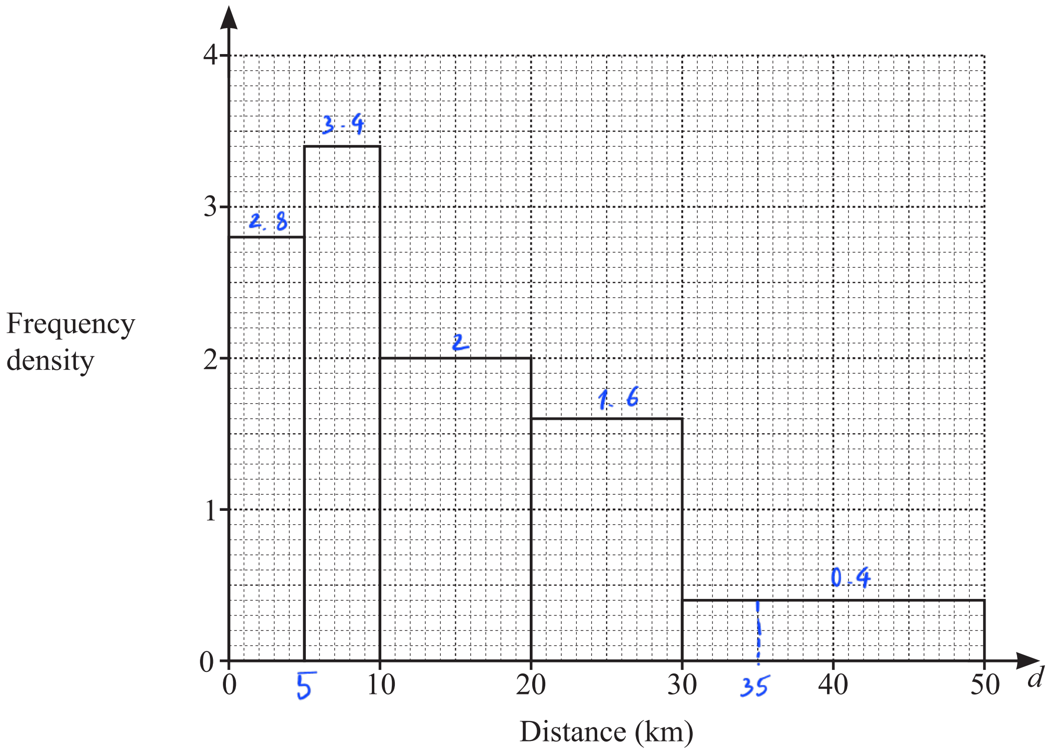
24 The histogram shows information about the distance some people travel to work.



(a) Use the histogram to complete the table.

Distance (d km)	Number of people
$0 < d \leqslant 5$	14
$5 < d \leqslant 20$	37
$20 < d \leqslant 50$	24

5×2.8

$5 \times 3.4 + 10 \times 2$

$10 \times 1.6 + 20 \times 0.4$

[3]

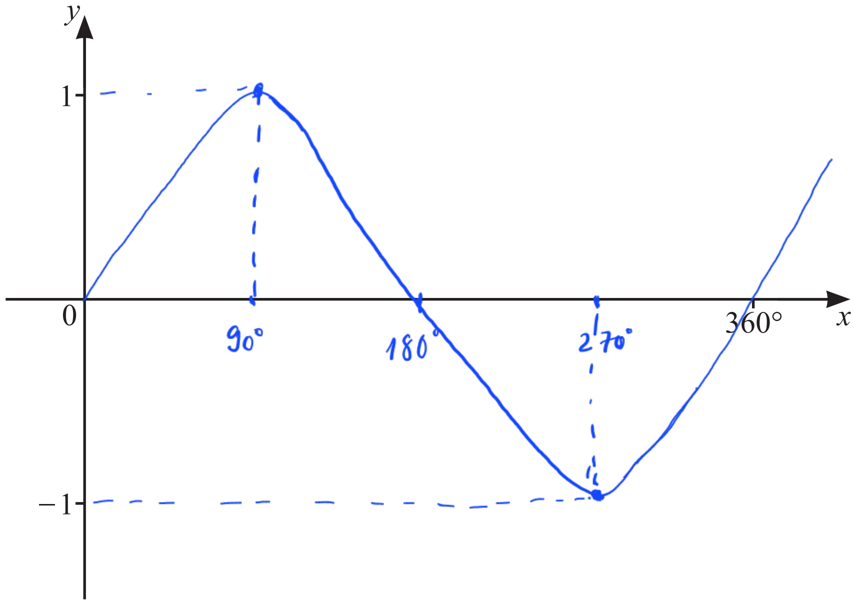
(b) The people who travel a distance greater than 35 km to work have a car allowance.

Calculate an estimate of the number of these people who have a car allowance.

$(50 - 35)\, 0.4 = 6$

........................6........................ [1]

25 **(a)** Sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Solve the equation $2 + 5\sin x = 1$ for $0° \leqslant x \leqslant 360°$.

$5 \sin x = -1$

$\sin x = \frac{-1}{5}$

$x = -11.5°$ or $x = 180° - (-11.5°) = 191.5°$

or $x = -11.5° + 360° = 348.5°$

$x =$ ....191.5°.... and $x =$ ....348.5°.... [3]

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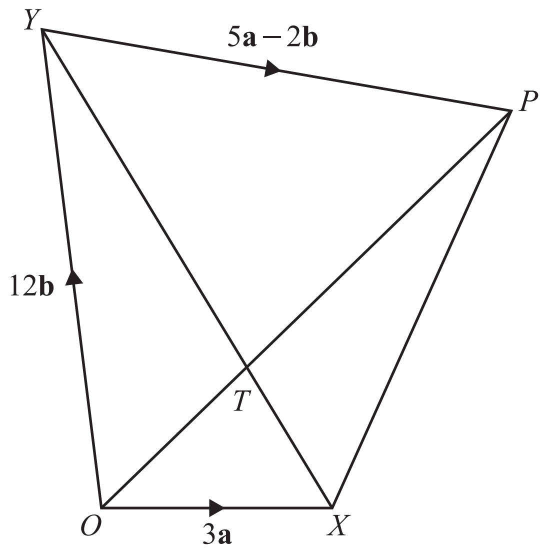

NOT TO SCALE

The diagram shows a quadrilateral *OXPY* with diagonals meeting at *T*.
$\overrightarrow{OX} = 3\mathbf{a}$ and $\overrightarrow{OY} = 12\mathbf{b}$.

(a) Find $\overrightarrow{XY}$ in terms of **a** and **b**.

$\overrightarrow{XY} = \overrightarrow{XO} + \overrightarrow{OY}$
$= -3a + 12b$

.......$-3a + 12b$....... [1]

(b) $XT : TY = 1 : 2$ and $\overrightarrow{YP} = 5\mathbf{a} - 2\mathbf{b}$.

Find the ratio $OT : TP$.

$\overrightarrow{OT} = \overrightarrow{OX} + \overrightarrow{XT} = 3a + \frac{1}{3}(-3a + 12b)$
$\overrightarrow{OT} = 2a + 4b = 2(a + 2b)$

$\overrightarrow{TP} = \overrightarrow{TY} + \overrightarrow{YP} = \frac{2}{3}(-3a + 12b) + 5a - 2b$
$\overrightarrow{TP} = 3a + 6b = 3(a + 2b)$

$\frac{OT}{TP} = \frac{\overrightarrow{OT}}{\overrightarrow{TP}} = \frac{2(a + 2b)}{3(a + 2b)} = \frac{2}{3}$

.......2....... : ....3....... [4]