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MATHEMATICS **0580/02**

Paper 2 Non-calculator (Extended) **For examination from 2025**

Practice Test 3 **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.
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- You may use tracing paper.
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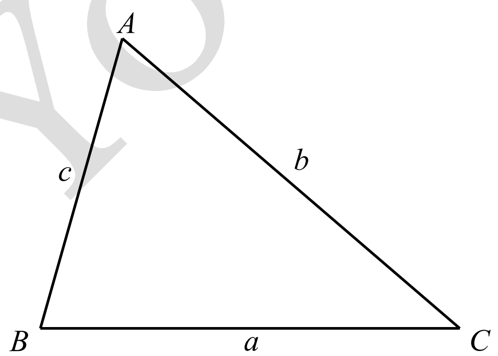
INFORMATION

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

List of formulas

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle of radius r.	$A = \pi r^2$
Circumference, C, of circle of radius r.	$C = 2\pi r$
Curved surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Curved surface area, A, of cone of radius r, sloping edge l.	$A = \pi rl$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of pyramid, base area A, height h.	$V = \frac{1}{3}Ah$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of cone of radius r, height h.	$V = \frac{1}{3}\pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$
For the equation $ax^2 + bx + c = 0$, where $a \neq 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For the triangle shown,



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

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

1 **(a)** Write down the number of lines of symmetry of a kite.

one .... [1]

(b) Write down the order of rotational symmetry of a parallelogram.

two .... [1]

2 Work out.

(a) $-8 \times 2 + 3$

-13 .... [1]

(b) 0.03×0.05

0.0015 .... [1]

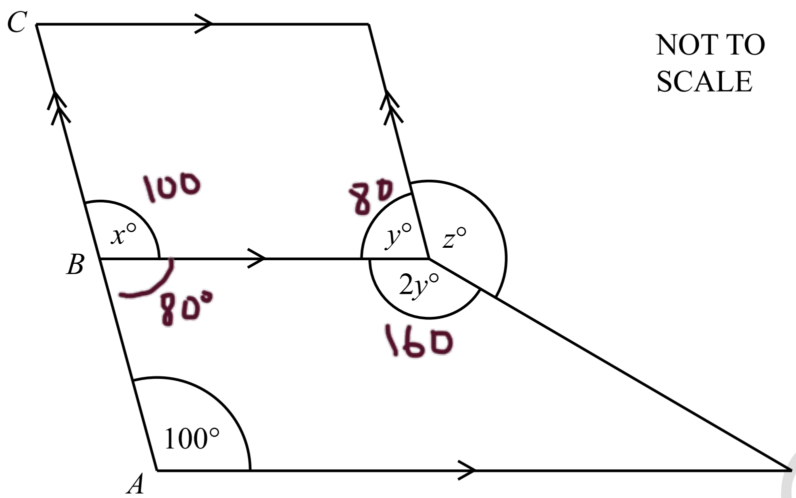
3 Here is some information about five positive integers.

- The median is 7.
- The mode is 13.
- The range is 10.
- They add up to 40.

Find the five integers.

3 , 4 , 7 , 13 , 13 [3]

4



The diagram shows a parallelogram and a trapezium.
The parallelogram and the trapezium are joined along a common side.
ABC is a straight line.

(a) Find the value of x.
Give a geometrical reason for your answer.

x = 100 because corresponding angles are equal. [2]

(b) Find the value of y.
Give a geometrical reason for your answer.

co-interior

y = 80° because allied angles add up to 180° [2]

(c) Find the value of z.

160 + 80 = 240

360 − 240 = 120

z = 120° [2]

5 **(a)** Convert 600 g into kg.

0.6 .... kg [1]

(b) Convert 5.7 litres into cm^3.

$1l = 1000 cm^3$

$5.7 = x$

5700 .... cm^3 [1]

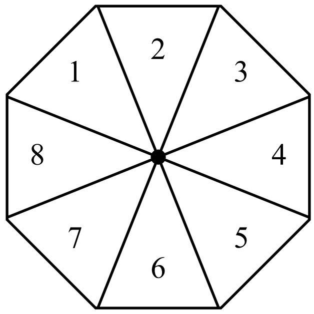
6 Write these numbers in order, starting with the smallest.

$\frac{3}{20}$ 0.143 $\frac{1}{6}$ 16%

0.143 , $\frac{3}{20}$, 16% , $\frac{1}{6}$ [2]

smallest

7 Jude has a fair 8-sided spinner numbered 1 to 8.



Jude spins the spinner once.

Find the probability that the spinner lands on

(a) a number greater than 6

$\frac{2}{8}$

$\frac{1}{4}$ .... [1]

(b) an odd number or a multiple of 3.

$\frac{4}{8} + \frac{2}{8}$

$= \frac{6}{8}$ × $\frac{5}{8}$

$\frac{3}{4}$ .... [1]

8 Write the ratio 80 : 200 : 360 in its simplest form.

8 : 20 : 36

2 : 5 : 9

2 : 5 : 9 [2]

9 The time that Rafiq works is divided into meetings, planning and working on a computer.

One day, Rafiq is

- in meetings for $\frac{3}{4}$ of the time
- planning for $\frac{1}{5}$ of the time
- working on a computer for the remaining 25 minutes of the time.

Work out the total time that Rafiq works this day.
Give your answer in hours and minutes.

$\frac{3}{4}x + \frac{1}{5}x + 25 = x$

$\frac{15}{20}x + \frac{4}{20}x + 25 = x$

$\frac{19}{20}x + 25 = x$

$25 = x - \frac{19}{20}x$

$25 = \frac{1}{20}x$

$\frac{25}{\frac{1}{20}} = x$

$x = 25 \times 20$
$= 500$ minutes

$\frac{500}{60} = 8.33$

0.33×60

........8........ hours ....20........ minutes [5]

10 These are the first five terms of a sequence.

9 13 17 21 25

(a) Find an expression for the nth term of this sequence.

........$4n + 5$........ [2]

(b) The kth term of this sequence is 89.

Find the value of k.

$4n + 5 = 89$

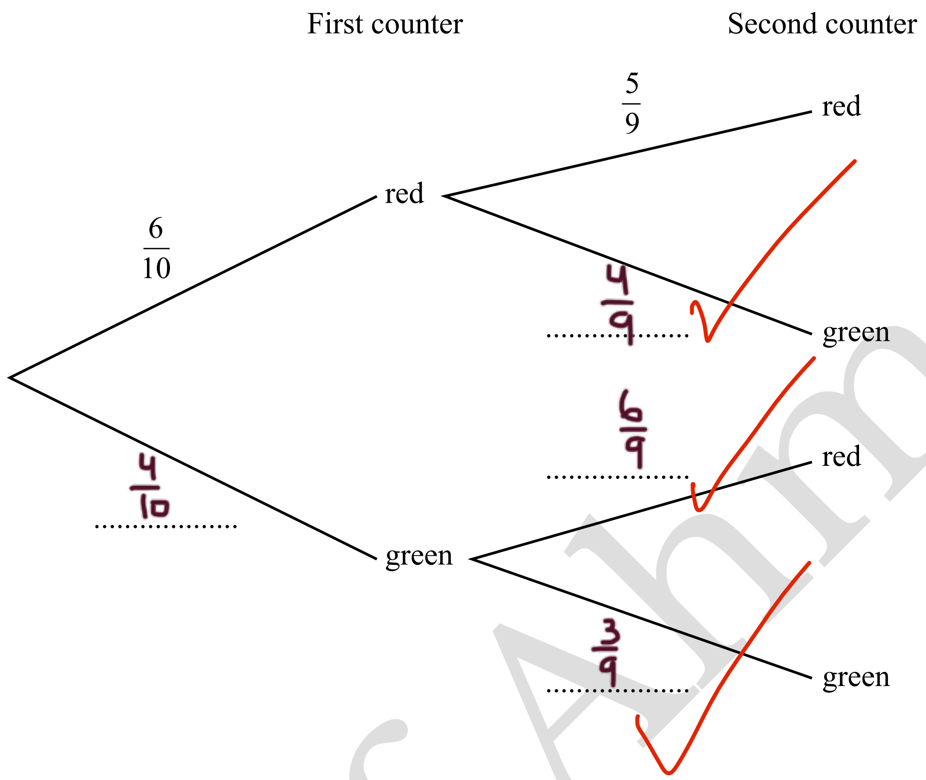
$4n = 84$

$n = \frac{84}{4}$

$k =$ ....21........ [2]

11 Asha has a bag containing 6 red counters and 4 green counters.
She takes two counters from the bag at random without replacement.

(a) Complete the tree diagram.



[2]

(b) Work out the probability that Asha takes two green counters.

$\left(\frac{4}{10} \times \frac{3}{9}\right)$

$= \frac{12}{90}$

$= \frac{4}{30}$

$\frac{2}{15}$ [2]

12 **(a)** Expand.

$$2x(3x^2 - 8x)$$

$6x^3 - 16x^2$ .... [2]

(b) **(i)** Factorise.

$$x^2 - 19^2$$

$(x+19)(x-19)$ .... [1]

(ii) Work out.

$$81^2 - 19^2$$

$(81+19)(81-19)$

$(100)(62)$

6200 .... [2]

13 A force of 196 newtons is applied to a square surface of side 4.9 cm.

By writing each number correct to 1 significant figure, work out an estimate of the pressure applied to the square surface.

[Pressure = force ÷ area]
[Pressure is measured in newtons / cm^2]

$4.9 \simeq 5$

$196 \simeq 200$

$A = 5 \times 5$

$= 25$

$P = \frac{200}{25}$

$= \frac{40}{5}$

8 .... newtons / cm^2 [3]

14 Freya records how many minutes she takes to complete a crossword each day.

On Tuesday, she takes 10% less time than on Monday.
On Wednesday, she takes 50% less time than on Tuesday.
On Wednesday, she takes 9 minutes to complete the crossword.

Find the number of minutes Freya takes to complete the crossword on Monday.

$N.V = M \times O.V$

$9 = 0.5 \times x$

$\frac{9}{0.5} = x$

$x = 18$

Tuesday = 18mins

Wed = 9mins

$18 = 0.9 \times x$

$\frac{18}{0.9} = x$

$18 \times \frac{10}{9}$

$= \frac{180}{9}$

$= 20$mins

........20........ minutes [3]

15 Write $0.3\dot{1}\dot{2}$ as a fraction.
Give your answer in its simplest form.

$x = 0.31212$

$10x = 3.1212$

$100x = 31.212$

$1000x = 312.12$

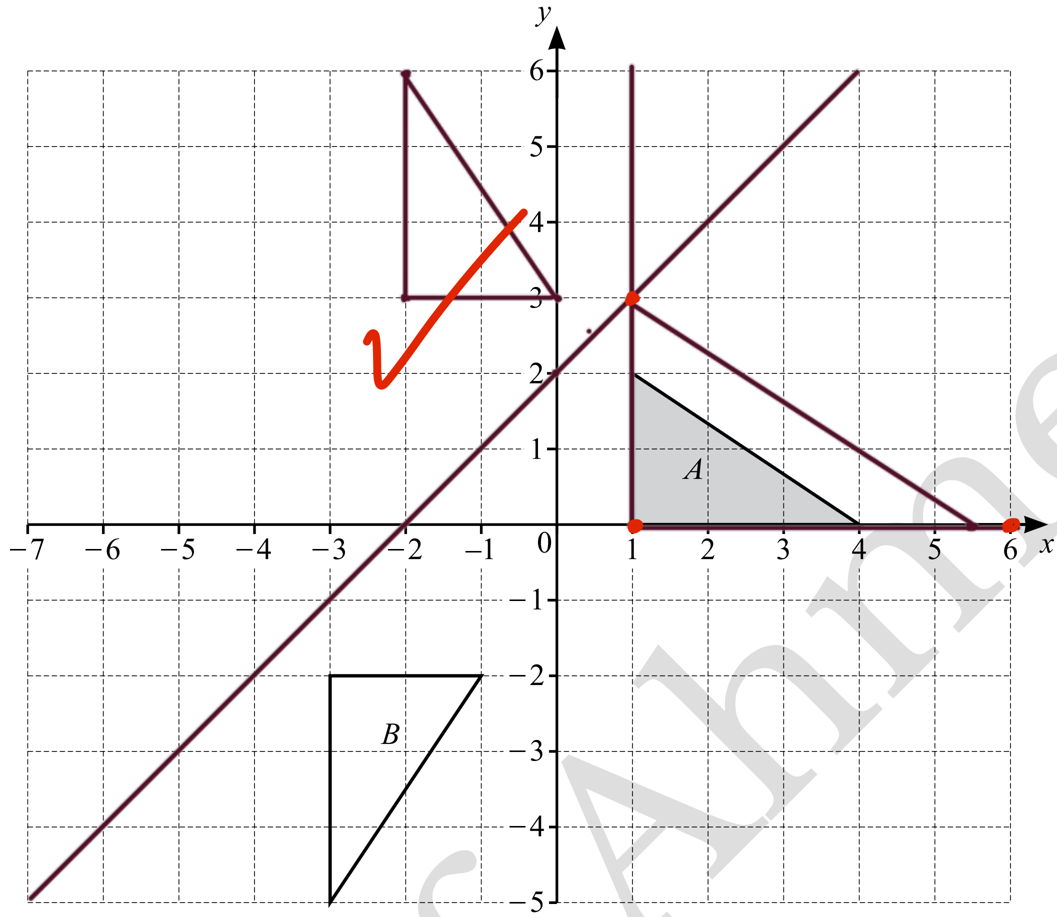
$$\begin{array}{rl} 1000x = & 312.1212 \\ - \quad 10x = & 3.1212 \\ \hline 990x = & 309 \end{array}$$

$x = \frac{309}{990}$

$= \frac{103}{330}$

$\frac{103}{330}$ .... [3]

16



(a) On the grid, draw the image of

(i) triangle A after a reflection in the line $y = x + 2$ [3]

(−2,3) & (0,3) & (−2,6)

x	0	1
y	2	3

(ii) triangle A after an enlargement by scale factor $\frac{3}{2}$ with centre (1, 0). [2]

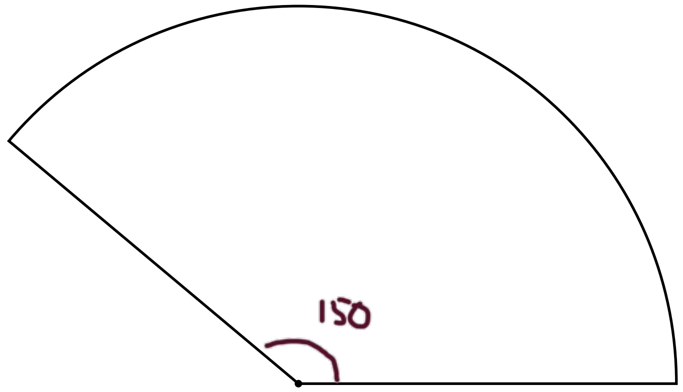
(1,0) & (1,3) & (6,0)

(b) Describe fully the **single** transformation that maps triangle A onto triangle B.

Rotation 90° clockwise centre (−2, 1)

[3]

17



NOT TO SCALE

The diagram shows a sector of a circle with radius 6 cm.
The area of the sector is $15\pi\,\text{cm}^2$.

(a) Work out the perimeter of the sector.
Give your answer in the form $a + b\pi$, where a and b are integers.

$\frac{\theta}{360} \times \pi \times 6^2 = 15\pi$

$\frac{36\pi\theta}{360} = 15\pi$

$36\pi\theta = 5400\pi$

$\theta = \frac{5400\pi}{36\pi}$

$\theta = 150°$

$\frac{150}{360} \times 2\pi \times 6 + 12$

$= \frac{1800\pi}{360} + 12$

$12 + 5\pi$ .... cm [4]

(b) The sector is the cross-section of a prism of length 10 cm.

Work out, giving your answer in terms of π,

(i) the volume of the prism

150π .... cm^3 [1]

(ii) the total surface area of the prism.

A of rect:

$6 \times 10 = 60 \times 2$

$= 120$

$2 \times 15\pi = 30\pi$

$120 + 30\pi$

$5\pi \times 10 = 50\pi$

$120 + 30\pi + 50\pi$

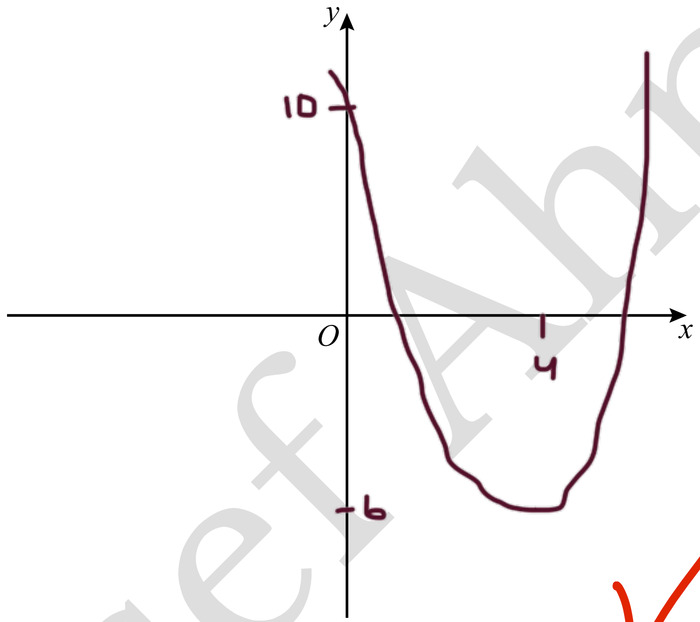
$120 + 80\pi$ .... cm^2 [3]

18 **(a)** Write $x^2 - 8x + 10$ in the form $(x-p)^2 - q$.

$(x-4)^2 - 16 + 10$

$(x-4)^2 - 6$ .... [2]

(b) Sketch the graph of $y = x^2 - 8x + 10$.
On the sketch, label the coordinates of the turning point and the y-intercept.



y int = 10

Tp = (4, 6)

[3]

19 Rationalise the denominator and simplify.

$$\frac{8}{1-\sqrt{5}}$$

$\dfrac{8}{1-\sqrt{5}} \times \dfrac{1+\sqrt{5}}{1+\sqrt{5}}$

$\dfrac{8+8\sqrt{5}}{(1-\sqrt{5})(1+\sqrt{5})}$

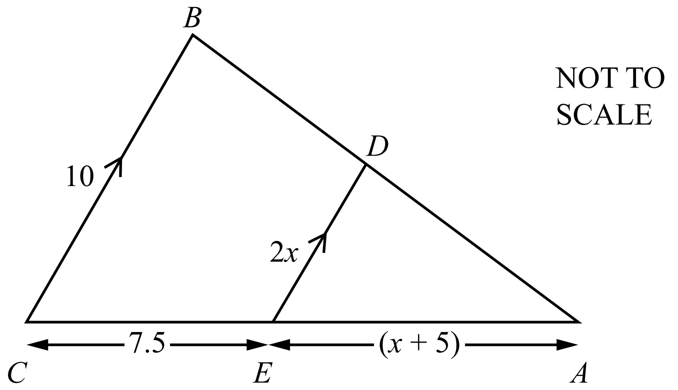
$\dfrac{8+8\sqrt{5}}{1-5}$

$\dfrac{8+8\sqrt{5}}{-4}$

$\dfrac{-8-8\sqrt{5}}{4}$

$-2-2\sqrt{5}$ .... [3]

20 In this question all lengths are given in centimetres.



NOT TO SCALE

Triangle *ABC* is mathematically similar to triangle *ADE*.

(a) **(i)** Show that $2x^2 + 15x - 50 = 0$.

$$\frac{2x}{x+5} = \frac{10}{7.5+x+5}$$

$$\frac{2x}{x+5} = \frac{10}{12.5+x}$$

$$2x(12.5+x) = 10(x+5)$$

$$25x + 2x^2 = 10x + 50$$

$$2x^2 + 25x - 10x - 50 = 0$$

$$2x^2 + 15x - 50 = 0$$

[3]

(ii) Solve by factorising $2x^2 + 15x - 50 = 0$.

$S = 15 \quad P = -100 < \begin{matrix} 20 \\ -5 \end{matrix}$

$$2x^2 + 20x - 5x - 50 = 0$$

$$2x(x+10) - 5(x+10) = 0$$

$$(2x-5)(x+10)$$

$x =$ ....$\frac{5}{2}$.... or $x =$ ....-10.... [3]

(iii) Find the length *AC*.

$$7.5 + 2.5 + 5$$

AC = ...15.... cm [1]

(b) The area of triangle ABC is $k\,\text{cm}^2$.

Find an expression for the area of the quadrilateral $BCED$.
Give your answer in terms of k.

$\left(\frac{l_1}{l_2}\right)^2 = \frac{A_1}{A_2}$ A of AED $= \frac{1}{4}k$

$\left(\frac{5}{10}\right)^2 = \frac{A}{k}$ A BCED:

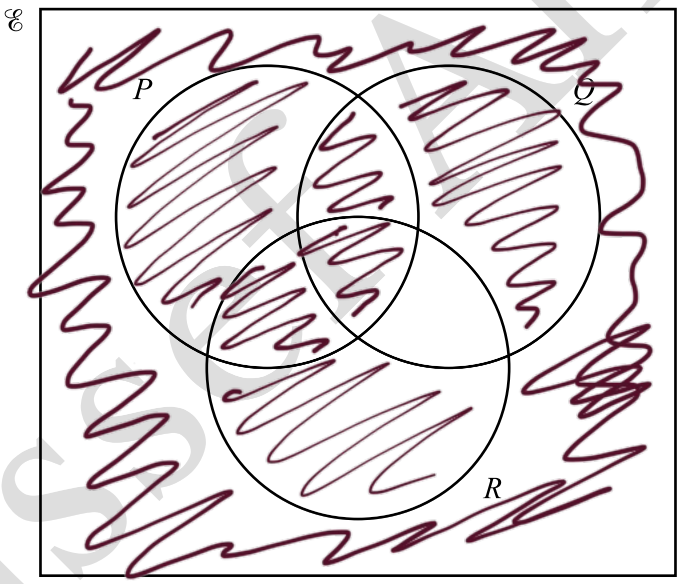
$k - \frac{1}{4}k$

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

$\frac{1}{4} = \frac{A}{k}$

$\frac{3}{4}k$ .... cm^2 [2]

21



In the Venn diagram, shade the region $P \cup Q' \cup R'$. [1]

22 Expand and simplify.

$$(2x - 3)(x + 1)(2 - 3x)$$

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

$(2x-3)[2x - 3x^2 + 2 - 3x]$

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

$-6x^3 - 2x^2 + 4x + 9x^2 + 3x - 6$

$-6x^3 + 7x^2 + 7x - 6$ .... [3]

23 Rearrange the formula to make p the subject.

$$d = \frac{2p+3}{2-py}$$

$d(2-py) = 2p+3$

$2d - dpy = 2p+3$

$2d - 3 = 2p + dpy$

$2d - 3 = p(2+dy)$

$\frac{2d-3}{2+dy} = p$

$p = \frac{2d-3}{2+dy}$ .... [4]

24 **(a)** Simplify.

(i) $(2xy)^0$

1 .... [1]

(ii) $\left(\dfrac{81m^8}{3m^2}\right)^{\frac{2}{3}}$

$3\overline{)81}$ 27

$(27m^6)^{\frac{2}{3}}$

$(\sqrt[3]{27})^2 = 9$

$6 \times \frac{2}{3} = \frac{12}{3} = 4$

$9m^4$ .... [3]

(b) Find the value of x.

$$32^x \times 2^{x+3} = \frac{1}{4}$$

$2^{5x} \times 2^{x+3} = 2^{-2}$

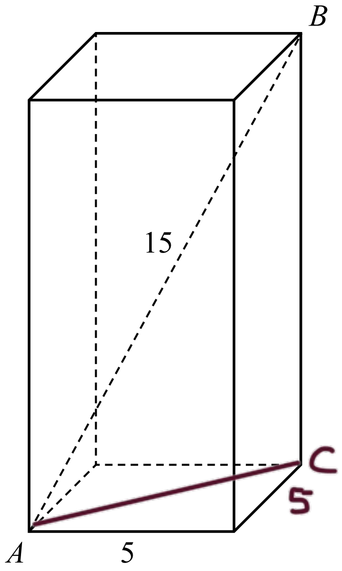
$5x + x + 3 = -2$

$6x + 3 = -2$

$6x = -5$

$x =$ $-\frac{5}{6}$ .... [3]

25



NOT TO SCALE

The diagram shows a cuboid with a square base.
The length of the edge of the base is 5 cm.
The length of the diagonal *AB* is 15 cm.

Work out the height of the cuboid.
Give your answer as a surd in its simplest form.

AC:

$c^2 = a^2 + b^2$

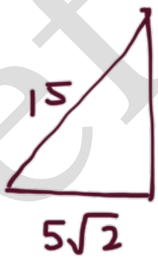
$= \sqrt{5^2 + 5^2}$

$= \sqrt{25 + 25}$

$= \sqrt{50}$

$= \sqrt{25 \times 2}$

$AC = 5\sqrt{2}$



CB:

$b = \sqrt{15^2 - (5\sqrt{2})^2}$

$= \sqrt{225 - 50}$

$= \sqrt{175}$

$= \sqrt{25 \times 7}$

$= 5\sqrt{7}$

$5\sqrt{7}$ .... cm [4]

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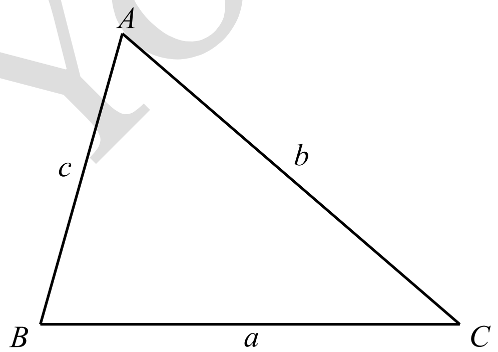


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

1 Christa had a music lesson every week for one year.
Each of the 52 lessons lasted for 45 minutes.

Work out the total time that Christa spent in music lessons.
Give your time in hours.

$$\begin{array}{r} 52 \\ \times\ 45 \\ \hline 260 \\ +2080 \\ \hline 2340 \end{array}$$

$\frac{234\cancel{0}}{6\cancel{0}}$

$\frac{234}{6} = 39$

...........39........... h [2]

2 Show that $\left(\frac{1}{10}\right)^2 + \left(\frac{2}{5}\right)^2 = 0.17$.

Write down all the steps in your work.

Answer

$\frac{1}{100} + \left(\frac{4}{25}\right) \begin{matrix} \times 4 \\ \times 4 \end{matrix}$

$\frac{1}{100} + \frac{16}{100} = \frac{17}{100} = 0.17$

[2]

3 Factor completely.

$15p^2 + 24pt$

$3p(5p + 8t)$

...........$3p(5p+8t)$........... [2]

4 Work out $1.1 \times 10^{13} - 2 \times 10^{12}$.
Give your answer in scientific notation.

$\xleftarrow{+}$ $\xrightarrow{-}$

$(1.1 \times 10^{13}) - (0.2 \times 10^{13})$

0.9×10^{13}

...........9×10^{12}........... [2]

5 $1 = 0.619 pounds (£).

The cost of a ticket to fly from New York to London is $300.

Work out the cost of this ticket in pounds.
Give your answer to the nearest pound.

$1 : 0.619 \qquad x = 300 \times 0.619$

$300 : x \qquad = 185.7$

.................186................. [2]

6 Show that $\left(\frac{49}{16}\right)^{-\frac{3}{2}} = \frac{64}{343}$.

Write down all the steps in your work.

Answer

$\left(\frac{16}{49}\right)^{\frac{3}{2}}$

$\left(\sqrt{16}\right)^{3} = (4)^{3} = 64 \qquad = \frac{64}{343}$

$\left(\sqrt{49}\right)^{3} = (7)^{3} = 343$

[3]

7 $(2x + 1)^2 + 7x - 3 = 4x^2 + ax + b$

Find the values of *a* and *b*.

$(2x)^2 + 2(2x)(1) + (1)^2$

$= 4x^2 + 4x + 1 + 7x - 3$

$= 4x^2 + \underline{11}x \underline{-2}$

$a =$ ....11.................

$b =$ ....−2................. [2]

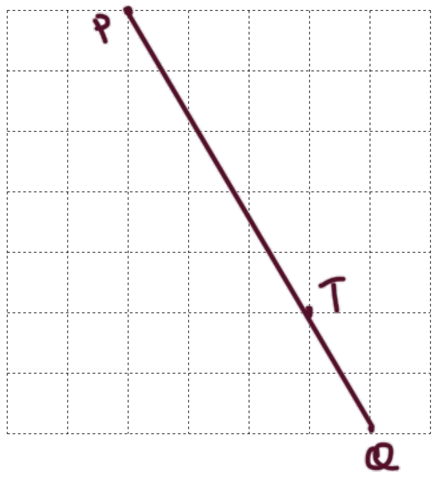
8 P is the point (1, 4) and Q is the point (4, – 2).
T is the point on PQ so that $PT : TQ = 2 : 1$.

Find the co-ordinates of T.
You may use the grid below to help you.

$4-1=3$
$-2-4=-6$

$\frac{2}{3} \times 3 = 2 + 1$
$= 3$

$\frac{2}{3} \times (-6) = -4 + 4$
$= 0$



(3 , 0) [2]

9 Solve the equation.

$$2\sqrt{y} - 1 = 9$$

$2\sqrt{y} = 10$

$\sqrt{y} = 5$

$y = 5^2$

$y =$ 25 [2]

10 Leon scores the following marks in 5 tests.

8 4 8 y 9

His mean mark is 7.2.

Calculate the value of y.

$\frac{8+4+8+y+9}{5} = 7.2$

$\frac{29+y}{5} = 7.2$

$29 + y = 36$
$y = 36 - 29$

$y =$ 7 [2]

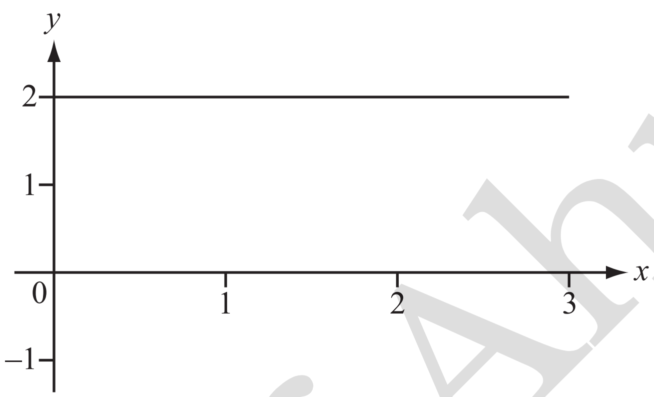
11 Find r when $(5)^{\frac{r}{3}} = 125$.

$5^{\frac{r}{3}} = 5^3$

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

$r =$ 9 [2]

12



Write down the domain and range of the function shown in the graph.

domain $0 \leqslant x \leqslant 3$

range $y = 2$ [2]

13 Simplify $1\frac{5}{6} + \frac{9}{10}$.

Give your answer as a mixed number in its simplest form.

$1\frac{5}{6} = \frac{11}{6}$

$\frac{11}{6} + \frac{9}{10}$

$\frac{110 + 54}{60} = \frac{164}{60} = \frac{82}{30} = \frac{41}{15}$

$2\frac{11}{15}$ [3]

14 An electrician repairs some machinery.
His total cost is a fixed amount of $40 plus $35 per hour.

(a) Calculate the total cost when he works for 5 hours.

$35 \times 5 = 175$

$175 + 40$

$ ....215........ [1]

(b) **(i)** Find an expression, in terms of h, for the total cost, in dollars, when he works for h hours.

........$40 + 35h$........ [1]

(ii) Find the value of h when the total cost is $390.

$40 + 35h = 390$

$35h = 350$

$h = \frac{350}{35} = \frac{70}{7}$

$h =$ ....10........ [1]

15 Solve the system of linear equations.

$$x + 7y = 19$$
$$3x + 5y = 9$$

$x = 19 - 7y$

$3(19 - 7y) + 5y = 9$

$57 - 21y + 5y = 9$

$-16y = -48$

$y = \frac{-48}{-16} = \frac{12}{4}$

$y = 3$

$x + 7(3) = 19$

$x + 21 = 19$

$x = 19 - 21$

$x =$ ....-2........

$y =$ ....3........ [3]

16 **(a)** Find the slope of the line between (0, 2) and (2, 1).

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-2}{2-0} = -\frac{1}{2}$

$-\frac{1}{2}$ .... [2]

(b) Write down the equation of the line passing through (0, 2) and (2, 1).

$y - y_1 = m(x - x_1)$

$y - 2 = -\frac{1}{2}(x - 0)$

$2y - 4 = -x$

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

17 y is **inversely** proportional to x^2.
When $x = 3$, $y = 2$.

Find y when $x = 5$.

$y = \frac{k}{x^2}$

$2 = \frac{k}{3^2}$

$k = 2 \times 9$

$k = 18$

$y = \frac{18}{x^2}$

$y = \frac{18}{5^2}$

$= \frac{18}{25}$

$y =$ $\frac{18}{25}$ .... [3]

18 A model of a boat is made to a scale of 1 : 200.
The surface area of the model is 900 cm^2.

Calculate the surface area of the boat, giving your answer in square meters.

1 m = 100 cm

1 m^2 = 10000 cm^2

$(1)^2 : (200)^2$

1 : 40000

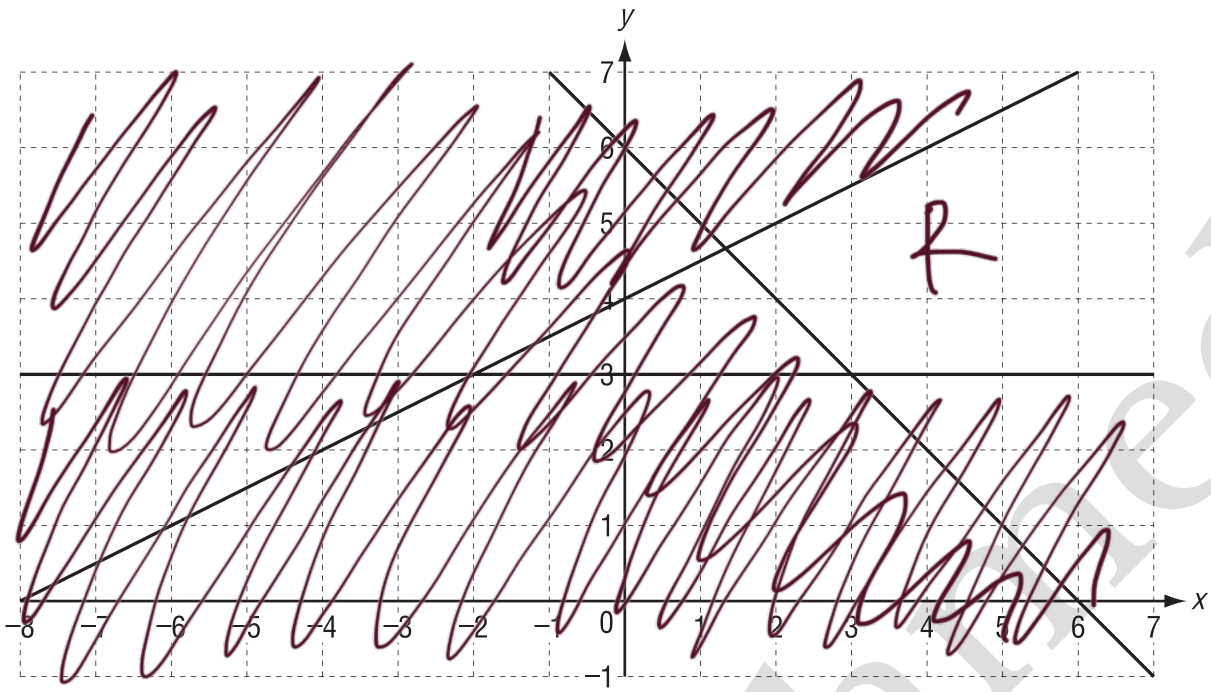
900 : x

= 36000000

$\frac{36000000}{10000}$

3600 .... m^2 [3]

19



The region ***R*** contains points which satisfy the inequalities

$$y \leqslant \frac{1}{2}x + 4, \qquad y \geqslant 3 \quad \text{and} \quad x + y \geqslant 6.$$

On the grid, label with the letter ***R*** the region which satisfies these inequalities.

You must shade the **unwanted** regions. [3]

20 Solve for w.

$$c = \frac{4 + w}{w + 3}$$

$c(w+3) = 4+w$

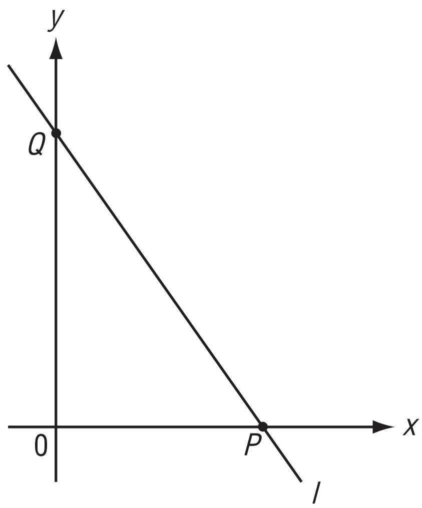
$cw + 3c = 4+w$

$cw - w = 4-3c$

$w(c-1) = 4-3c$

$w = \dfrac{4-3c}{c-1}$ [4]

21



The equation of the straight line, l, is $y = 12 - 4x$.

(a) Find the co-ordinates of P and Q.

$\rightarrow y = 0$

$12 - 4x = 0$

$12 = 4x$

$x = \frac{12}{4}$

$x = 3$

$\rightarrow x = 0$

$y = 12$

P (....3.... , ...0....)

Q (....0.... , ...12....) [2]

(b) Find the equation of the line which is perpendicular to the line l and passes through the origin.

m of $l = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 12}{3 - 0} = \frac{-12}{3} = -4$

$m_2 = \frac{1}{4}$

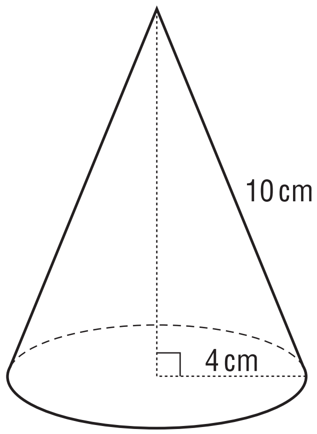
$y - y_1 = m(x - x_1)$

$y - 0 = \frac{1}{4}(x - 0)$

$4y = x$

....$y = \frac{1}{4}x$.... [2]

22 **(a)**



NOT TO SCALE

The cone in the diagram has radius 4 cm and sloping edge 10 cm.

Show that the lateral surface area of the cone is 40π cm^2.

Answer (a)

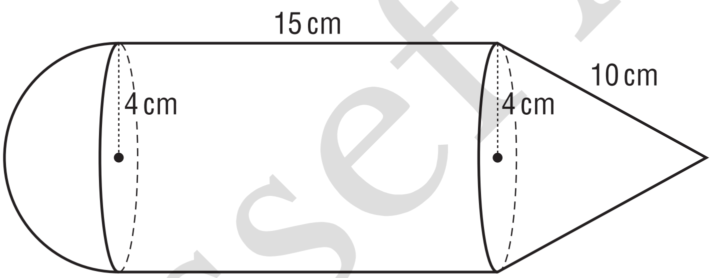
$SA = \pi r l$

$= \pi \times 4 \times 10$

$= 40\pi$ ✓

[2]

(b)



NOT TO SCALE

The solid in the diagram is made up of a hemisphere, a cylinder and a cone, all of radius 4 cm.
The length of the cylinder is 15 cm.
The sloping edge of the cone is 10 cm.
The total surface area of the solid is $k\pi$ cm^2.

Find the value of k.

SA of sphere $= \dfrac{4\pi r^2}{2}$

$= 2\pi r^2$

$= 2\pi \times (4)^2$

$= 2\pi \times 16$

$= 32\pi$

CSA of cylinder

$= 2\pi r h$

$= 2\pi \times 4 \times 15$

$= 120\pi$

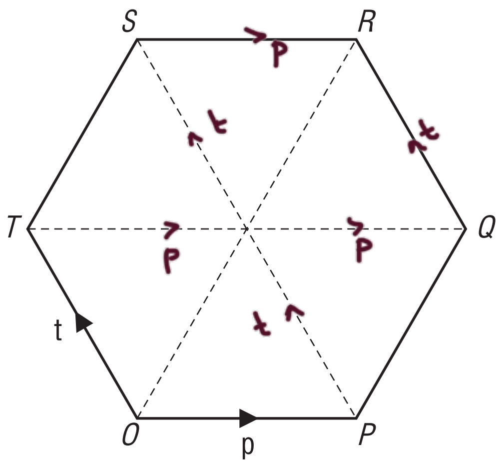
$120\pi + 32\pi + 40\pi$

$152\pi + 40\pi$

$k =$ .... 192π ✓ .... [3]

$K = 192$

23



O is the origin and $OPQRST$ is a regular hexagon.

$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OT} = \mathbf{t}$.

Find, in terms of $\mathbf{p}$ and $\mathbf{t}$, in their simplest forms,

(a) $\overrightarrow{PT}$,

$\overrightarrow{PT} = \overrightarrow{PO} + \overrightarrow{OT}$
$= -p + t$

$\overrightarrow{PT} =$ .... $t - p$ .... [1]

(b) $\overrightarrow{PR}$,

$\overrightarrow{TS} = p + t$
$\overrightarrow{TS} = \overrightarrow{PQ}$
$\overrightarrow{PR} = \overrightarrow{PQ} + \overrightarrow{QR}$
$= p + t + t$

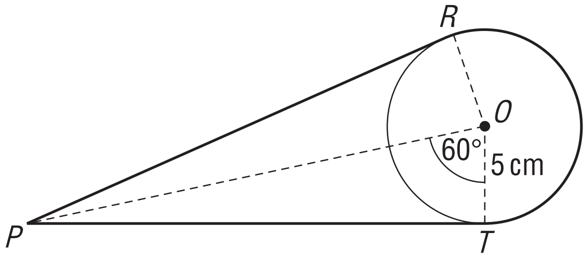
$\overrightarrow{PR} =$ .... $p + 2t$ .... [2]

(c) the position vector of R.

$2(p+t)$

.... $2p + 2t$ .... [2]

24

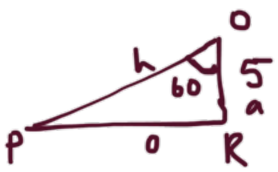


R and T are points on a circle, centre O, with radius 5 cm.
PR and PT are tangents to the circle and angle $POT = 60°$.

A thin rope of length l cm goes from P to R, around the major arc RT and then from T to P.

Explaining all your reasoning, show that $l = 10\sqrt{3} + \dfrac{20\pi}{3}$.

Answer



$\tan 60 = \dfrac{PR}{5}$

$PR = \tan 60 \times 5$

$\tan 60 = \sqrt{3}$

$PR = \sqrt{3} \times 5$

$PR = 5\sqrt{3}$

(length of PR)

$2 \times 5\sqrt{3}$

$= 10\sqrt{3}$

Arc length = (of RT)

$360 - (2 \times 60)$

$= \dfrac{240}{360} \times 2\pi \times 5$

$= \dfrac{240\cancel{0}\pi}{36\cancel{0}}$

$= \dfrac{240\pi}{36}$

$= \dfrac{40\pi}{6}$

$= \dfrac{20\pi}{3}$ ✓

so total length is:

$l = 10\sqrt{3} + \dfrac{20\pi}{3}$ ✓

[6]

25 Write each of these as a single fraction in its simplest form.

(a) $\dfrac{1}{x-1}+1$

$\dfrac{1+x-1}{x-1}$

$\dfrac{x}{x-1}$

.... [2]

(b) $\dfrac{x+2}{3}-\dfrac{2x-1}{4}+1$

$\dfrac{4(x+2)-3(2x-1)}{12}+1$

$\dfrac{4x+8-6x+3}{12}+1$

$\dfrac{11-2x+12}{12}$

$\dfrac{23-2x}{12}$

.... [3]

26 Simplify the following.

$$\frac{h^2-h-20}{h^2-25}$$

h^2-h-20

$S=-1 \quad P=-20 < \begin{matrix}-5\\4\end{matrix}$

$(h-5)(h+4)$

$(h)^2-(5)^2$

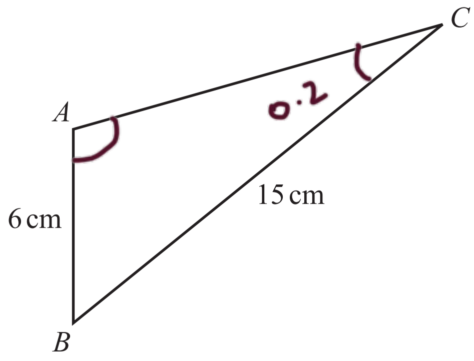
$(h-5)(h+5)$

$\dfrac{\cancel{(h-5)}(h+4)}{(h+5)\cancel{(h-5)}}$

$\dfrac{h+4}{h+5}$

.... [4]

27



NOT TO SCALE

(a) In triangle ABC, $AB = 6$ cm, $BC = 15$ cm and $\sin C = 0.2$.
Find the value of $\sin A$.

$$\frac{\sin C}{AB} = \frac{\sin A}{BC}$$

$$\sin A = \frac{3}{6}$$

$$\frac{0.2}{6} = \frac{\sin A}{15}$$

$$\sin A = \frac{0.2 \times 15}{6}$$

................0.5................ [2]

(b) Find angle BAC, which is obtuse.

$$\sin A = \frac{1}{2}$$

$$A = \sin^{-1}\left(\frac{1}{2}\right)$$

$$A = 30$$

$$180 - 30$$

Angle BAC = ...150................ [2]

28 $f(x) = 3x + 5$ $g(x) = 4x - 1$

(a) Find the value of g(g(3)).

$g(3) = 4(3) - 1$
$= 11$
$gg(3) = 4(11) - 1$

43 [2]

(b) Find f(g(x)), giving your answer in its simplest form.

$3(4x-1) + 5$
$12x - 3 + 5$

f(g(x)) = $12x + 2$ [2]

(c) Solve the equation.

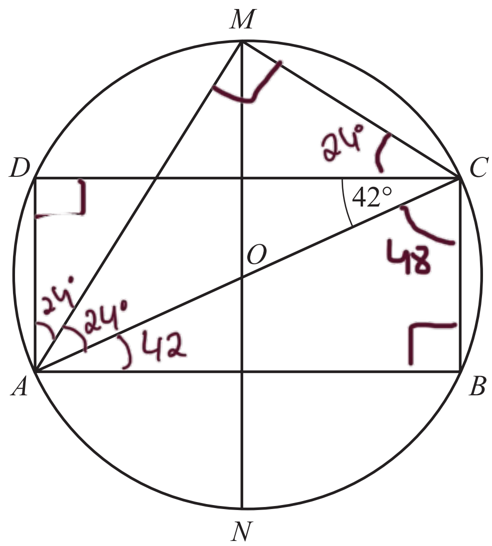
$$f^{-1}(x) = 11$$

$y = 3x + 5$
$y - 5 = 3x$
$x = \frac{x-5}{3}$

$\frac{x-5}{3} = 11$
$x - 5 = 33$
$x = 33 + 5$

$x =$ 38 [1]

30



NOT TO SCALE

The vertices of the rectangle *ABCD* lie on a circle center *O*.
MN is a line of symmetry of the rectangle.
AC is a diameter of the circle and angle *ACD* = 42°.

Calculate

(a) angle *CAM*,

DAB = 90°

CAD = 48°

Angle *CAM* = ...24°........ [2]

(b) angle *DCM*.

Angle *DCM* = ...24°........ [2]

31 In this question, give all your answers as fractions.

A box contains 3 red pencils, 2 blue pencils and 4 green pencils.
Raj chooses 2 pencils at random, without replacement.

Calculate the probability that

(a) they are both red,

$\frac{3}{9} \times \frac{2}{8}$

$= \frac{6}{72} = \frac{3}{36}$

$\frac{1}{12}$ .... [2]

(b) they are both the same color,

$P(RR) + P(GG) + P(BB)$

$\left(\frac{3}{9} \times \frac{2}{8}\right) + \left(\frac{4}{9} \times \frac{3}{8}\right) + \left(\frac{2}{9} \times \frac{1}{8}\right)$

$\frac{6}{72} + \frac{12}{72} + \frac{2}{72} = \frac{20}{72}$

$\frac{5}{18}$ .... [3]

(c) exactly one of the two pencils is green.

$P(G, B) + P(RG)$

$2\left(\frac{4}{9} \times \frac{2}{8}\right) + 2\left(\frac{3}{9} \times \frac{4}{8}\right)$

$\frac{16}{72} + \frac{24}{72}$

$\frac{5}{9}$ .... [3]

$\frac{40}{72} = \frac{20}{36}$

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MATHEMATICS **0580/02**

Paper 2 Non-calculator (Extended) **For examination from 2025**

Practice Test 5 **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

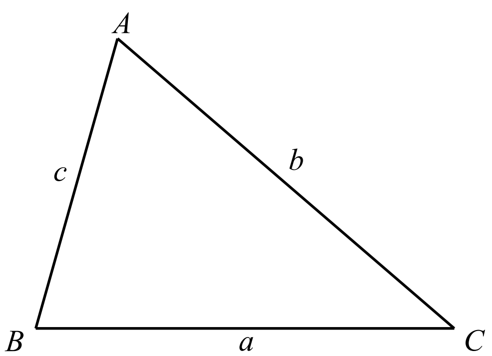
- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [ ].

This document consists of **17** printed pages and **1** blank page.

List of formulas

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle of radius r.	$A = \pi r^2$
Circumference, C, of circle of radius r.	$C = 2\pi r$
Curved surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Curved surface area, A, of cone of radius r, sloping edge l.	$A = \pi rl$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of pyramid, base area A, height h.	$V = \frac{1}{3}Ah$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of cone of radius r, height h.	$V = \frac{1}{3}\pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$
For the equation $ax^2 + bx + c = 0$, where $a \neq 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For the triangle shown,



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

1 **(a)** Write 230 000 in standard form.

2.3×10^5 .... [1]

(b) Write 4.8×10^{-4} as an ordinary number.

0.00048 .... [1]

2 Solve the following equations.

(a) $4(5x - 2) = 18x$

$20x - 8 = 18x$

$2x = 8$

$x = \frac{8}{2}$

$x =$ 4 .... [3]

(b) $x^2 + 2x - 3 = 0$

$S = 2 \quad P = -3 < \begin{matrix} 3 \\ -1 \end{matrix}$

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

$x =$ 1 .... or $x =$ −3 .... [3]

3 Factorise completely.

$6ab - 24bc$

$6b(a - 4c)$

$6b(a-4c)$ .... [2]

4 Robert says it is possible to draw a regular polygon with interior angles of 130°.

Explain why Robert is wrong.

Ext angle = 180 − 130 = 50   n of side = $\frac{360}{50}$ = 7.5 sides

Number of sides cant be decimal. (Result of 360 ÷ 50 is not an integer)

.... [2]

5 **(a)** Rearrange $s = ut + \frac{1}{2}at^2$ to make a the subject.

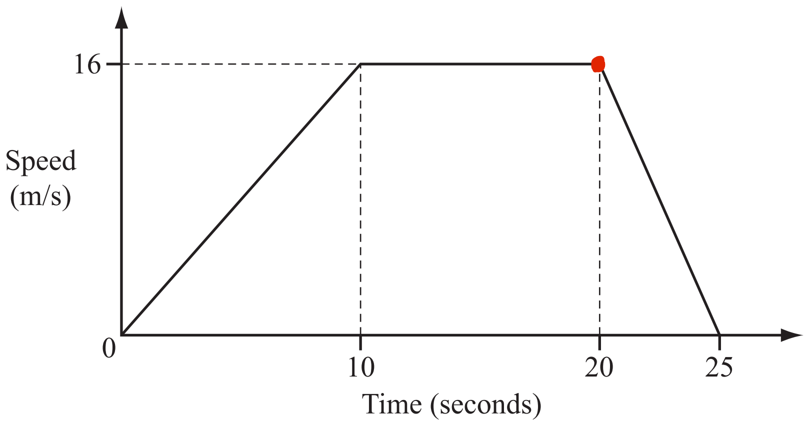
$$s - ut = \frac{1}{2}at^2$$

$$\frac{s - ut}{t^2} = \frac{1}{2}a$$

$$2\left(\frac{s-ut}{t^2}\right) = a$$

$a =$ $\frac{2(s-ut)}{t^2}$ [3]

(b) The diagram shows the speed-time graph for a car travelling between two sets of traffic lights.



(i) Calculate the deceleration of the car for the last 5 seconds of the journey.

$$a = \frac{\Delta v}{t}$$

$$= \frac{0 - 16}{5} = -\frac{16}{5} \Rightarrow \text{deceleration} = \frac{16}{5}$$

$\cancel{-\frac{16}{5}}$ $\frac{16}{5}$ m/s² [1]

(ii) Calculate the distance between the two sets of traffic lights.

$$A = \frac{1}{2}(a+b)h$$

$$= \frac{1}{2}(10+25) \times 16$$

$$= \frac{1}{2}(35 \times 16)$$

$$= \frac{1}{2}(560)$$

280 m [3]

6 **(a)** The line $x + y = 2$ intersects the circle $x^2 + y^2 = 34$ at the points A and B.
Find the co-ordinates of the points A and B.

$y = 2 - x$

$x^2 + (2-x)^2 = 34$

$x^2 + 4 - 4x + x^2 = 34$

$\frac{1}{2}(2x^2 - 4x - 30 = 0)$

$x^2 - 2x - 15 = 0$

$S = -2 \quad P = -15 < \begin{matrix} -5 \\ 3 \end{matrix}$

$(x-5)(x+3) = 0$

$x = 5 \quad x = -3$

for $x = 5$
$y = 2 - 5$
$= -3$

for $x = -3$
$y = 2 - (-3)$
$= 5$

(...5... , ...-3...)

(...-3... , ...5...) [6]

(b) Show that the length of the line AB is $8\sqrt{2}$ units.

$|AB| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(-3-5)^2 + (5+3)^2}$

$= \sqrt{64 + 64}$

$= \sqrt{128}$

$= \sqrt{64 \times 2}$

$= 8\sqrt{2}$

[2]

7 A curve has equation $y = x^3 - 6x^2 + 16$.

(a) Find the co-ordinates of the two turning points.

$\frac{dy}{dx} = 3x^2 - 12x$

$\frac{dy}{dx} = 0$

$3x^2 - 12x = 0$

$3x(x-4) = 0$

$x = 0 \quad x = 4$

for $x = 0$

$y = (0)^3 - 6(0)^2 + 16$

$= 16$

for $x = 4$

$y = (4)^3 - 6(4)^2 + 16$

(..0.. , ..16..) and (..4.. , ..−16..) [6]

(b) Determine whether each of the turning points is a maximum or a minimum.
Give reasons for your answers.

$\frac{d^2y}{dx^2} = 6x - 12$

$6(0) - 12$
$= -12$

$6(4) - 12$
$= 24 - 12 = 12$

(0, 16) is a maximum point

(4, −16) is a minimum point [3]

8 Lea uses the following method to estimate the value of $\sqrt{90005 \times 3.97^2}$

$\sqrt{100000 \times 4^2}$

$\sqrt{1600000}$

$= 4000$

She estimates each value to 1 significant figure and calculates it. The solution is not correct as $(4000)^2$ is equal to 16000000

Comment on her method and solution.

$\sqrt{90000 \times 4^2} = \sqrt{90000 \times 16}$

$= 1200$ [2]

9 **(a)** Convert 144 km/h into metres per second.

$\frac{km}{h} \times \frac{1000}{60 \times 60}$

$= \frac{100\cancel{0}}{360\cancel{0}} = \frac{5}{18}$

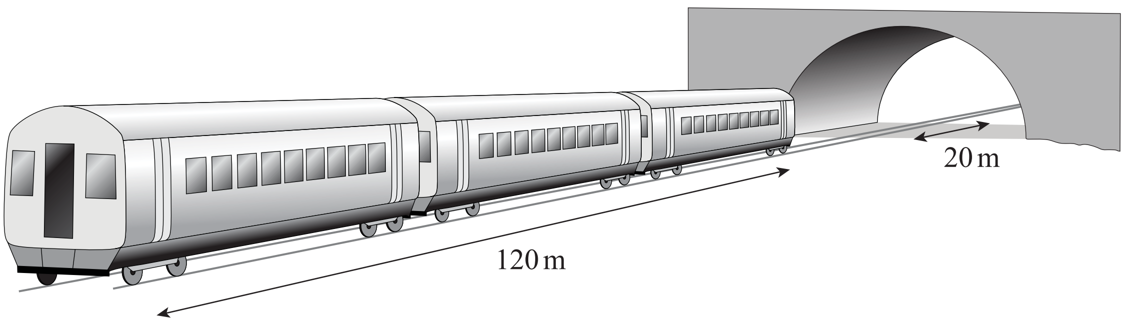
$\frac{144 \times 5}{18}$

$= \frac{720}{18}$

$18 \overline{)720}$ 040

40 .... m/s [2]

(b) A train of length 120 m is travelling at 144 km/h.
It passes through a tunnel 20 m long.



Find the time taken for the whole train to pass through the tunnel.
Give your answer in seconds.

$s = \frac{d}{t}$

$t = \frac{d}{s}$

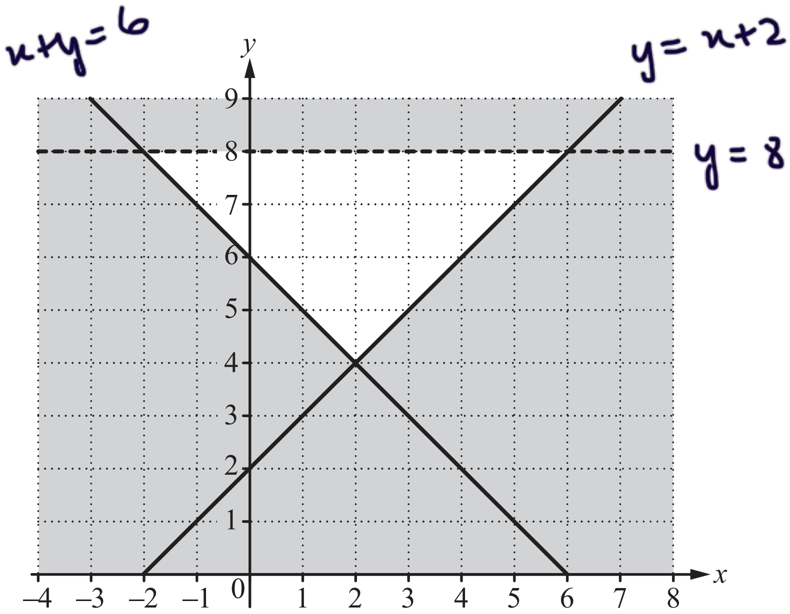
$t = \frac{120 + 20}{40}$

$= \frac{14\cancel{0}}{4\cancel{0}}$

$4 \overline{)14.{}^{2}0}$ 03.5

3.5 .... s [2]

10



Write down the 3 inequalities which define the unshaded region.

(0,2) (−2,0)

$m = \frac{0-2}{-2-0} = \frac{-2}{-2} = 1$

$y < 8$

$x + y \geq 6$

$y \geq x + 2$ [4]

11 Find the value of

(a) $64^{0.5} \times 5^{-2}$,

$64^{0.5} = 64^{\frac{1}{2}} = \sqrt{64} = 8$

$\begin{array}{r} {}^{2}64 \\ \times\ 5 \\ \hline 320 \end{array}$

$0.5 + -2$

$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

$\Rightarrow 8 \times \frac{1}{25} = \frac{8}{25}$

$320^{-1.5}$ [2]

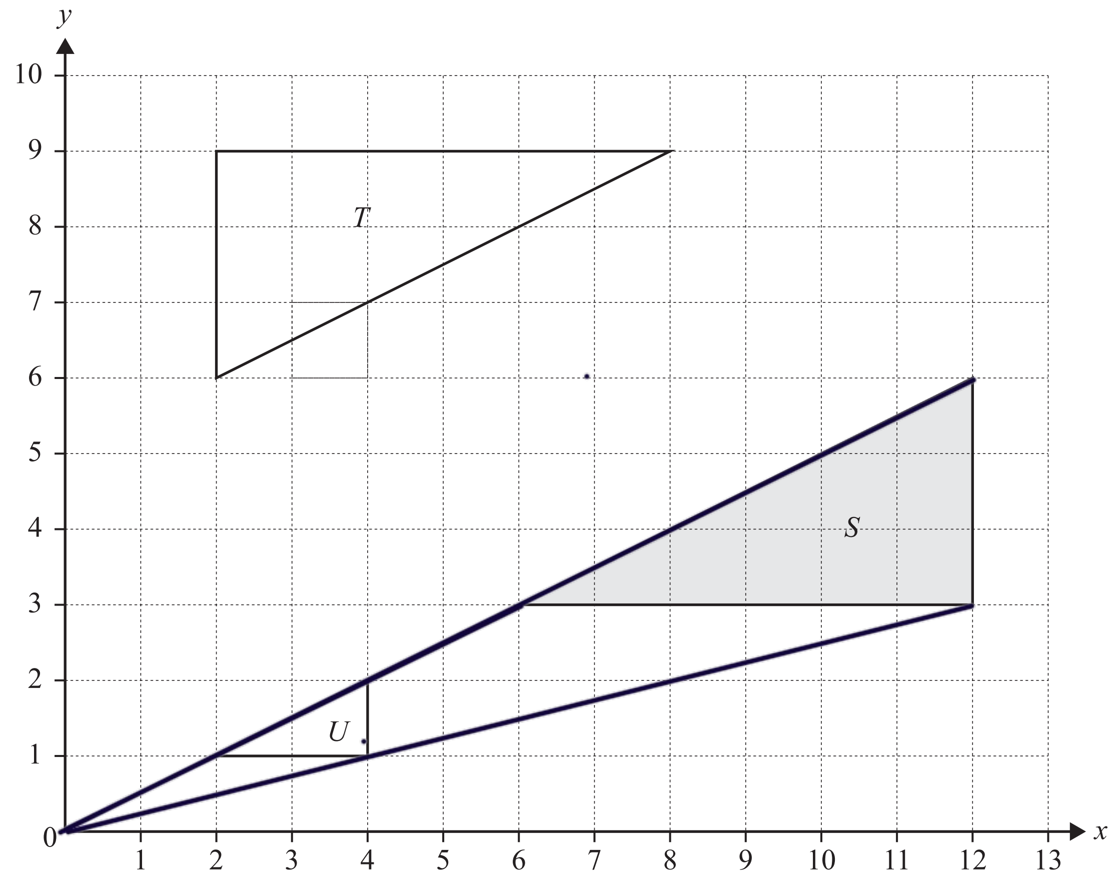
(b) $\left(\frac{8}{27}\right)^{-\frac{1}{3}}$.

$\left(\frac{27}{8}\right)^{\frac{1}{3}}$

$\frac{\sqrt[3]{27}}{\sqrt[3]{8}}$

$\frac{3}{2}$ [2]

12



(a) Describe fully the **single** transformation that maps triangle S onto triangle T.

Rotation 180° centre (7, 6)

[3]

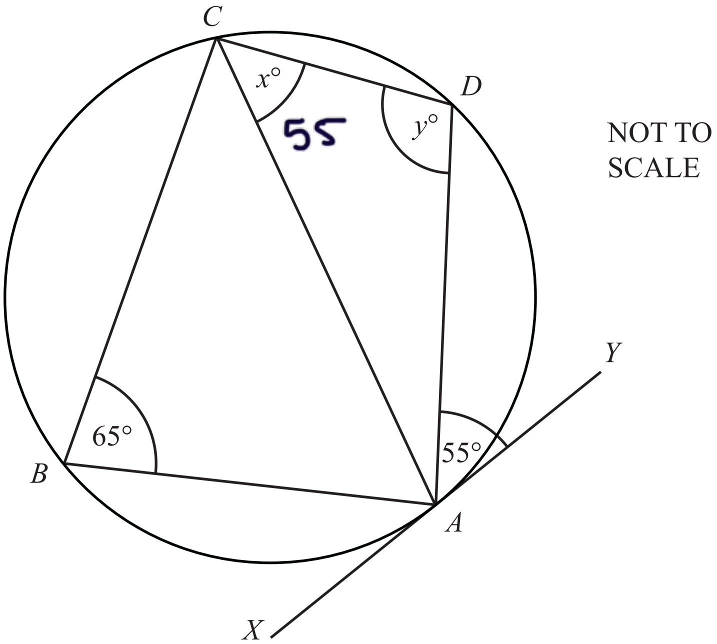
(b) Describe fully the **single** transformation that maps triangle S onto triangle U.

Enlargement SF 3 centre (0, 0)

[3]

SF = $\frac{1}{3}$

13



A, *B*, *C* and *D* are points on the circumference of the circle.
The line *XY* is a tangent to the circle at *A*.

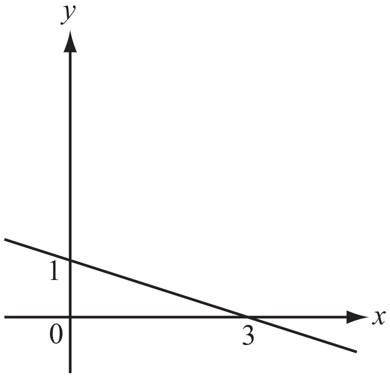
(a) Find the value of *x*, giving a reason for your answer.

$x =$ 55° because ACD = DAY bcs alternate segments [2]

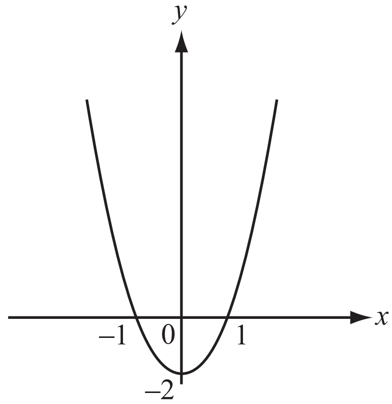
(b) Find the value of *y*, giving a reason for your answer.

$y =$ 115° because opposite angles in a cyclic quad are supplementary (add up to 180) [2]

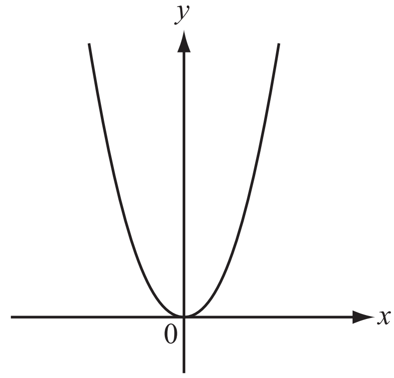
14 The diagrams A, B, C, D, E and F are the graphs of six functions.



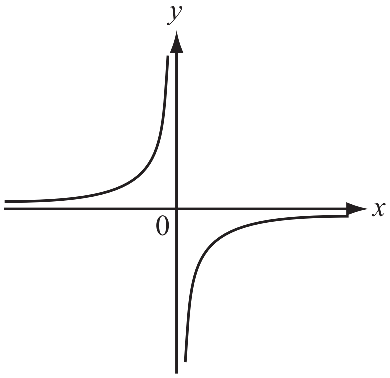
A



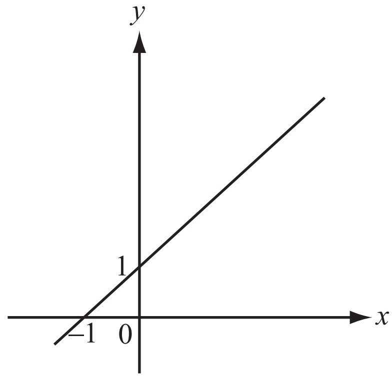
B



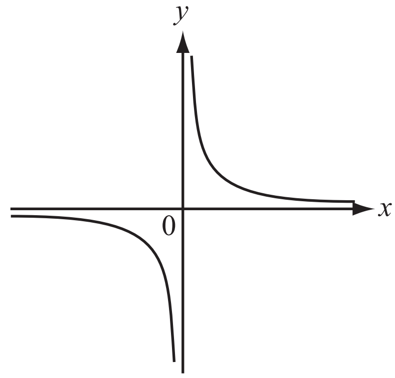
C



D



E



F

Complete the table to show which diagrams represent the given functions.
The first function has been done for you.

Function	$y = 1 - \frac{x}{3}$	$y = 2x^2$	$y = -\frac{4}{x}$
Diagram	A	C	D

[3]

15 $\mathrm{f}(x) = (x-3)^2$ $\mathrm{g}(x) = \frac{x-1}{4}$ $\mathrm{h}(x) = x^3$

Find

(a) h(f(1)),

$f(1) = (1-3)^2$

$= (-2)^2$

$= 4$

$hf(1) = (4)^3$

.......................64....................... [2]

(b) $\mathrm{g}^{-1}(x)$,

$y = \frac{x-1}{4}$

$4y = x-1$

$4y + 1 = x$

$\mathrm{g}^{-1}(x) =$ ....$4x+1$....................... [2]

(c) g(h(x)),

$\frac{x^3-1}{4}$

g(h(x)) = ...$\frac{x^3-1}{4}$....................... [1]

16 y is inversely proportional to the square root of x.
$y = 18$ when $x = 9$.

Find y when $x = 36$.

$y = \frac{k}{\sqrt{x}}$

$18 = \frac{k}{\sqrt{9}}$

$18 = \frac{k}{3}$

$K = 54$

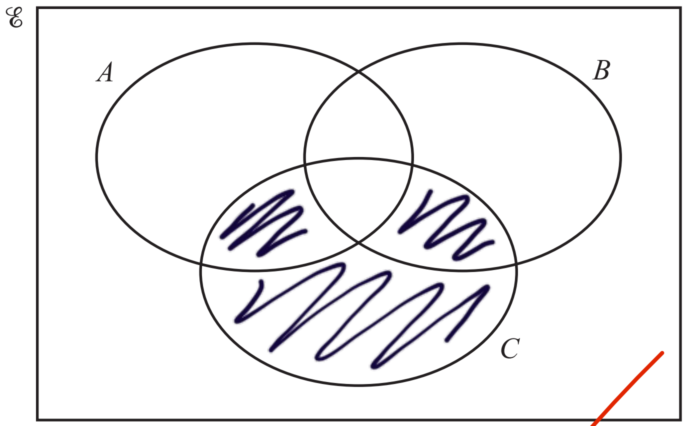
$y = \frac{54}{\sqrt{x}}$

$y = \frac{54}{\sqrt{36}}$

$= \frac{54}{6}$

$y =$ ....9....................... [3]

17 Shade the region $(A \cap B)' \cap C$.



[1]

18 $\text{g}(x) = 1 - 2x$

Solve the equation $\text{g}(3x) = 2x$.

$1 - 2(3x) = 2x$

$1 - 6x = 2x$

$1 = 8x$

$x = \frac{1}{8}$ [3]

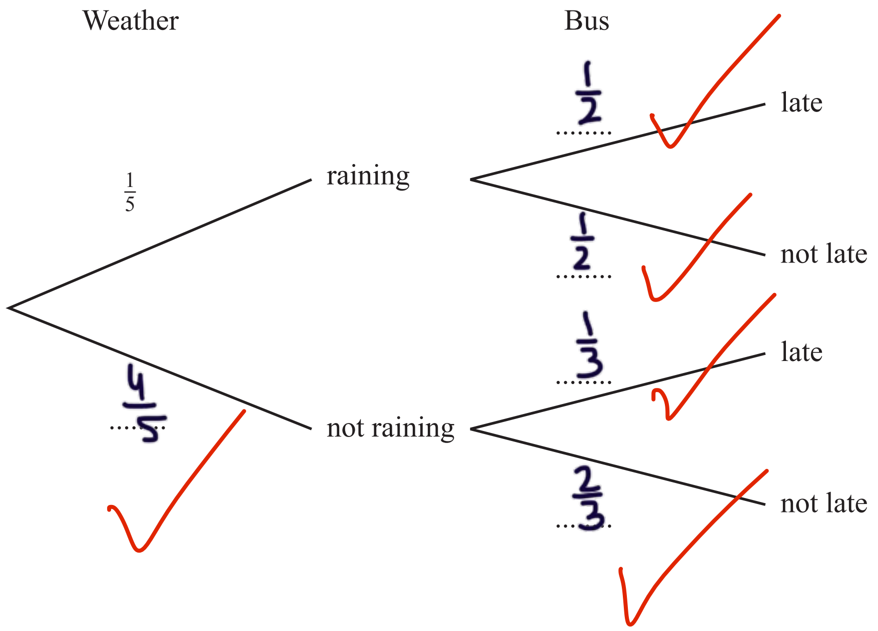
19 Sue takes the bus to school.

The probability that it is raining is $\frac{1}{5}$.

When it is raining, the probability that the bus is late is $\frac{1}{2}$.

When it is not raining, the probability that the bus is late is $\frac{1}{3}$.

(a) Complete the tree diagram.



[2]

(b) Find the probability that the bus is **not** late.

$$\left(\frac{1}{5} \times \frac{1}{2}\right) + \left(\frac{4}{5} \times \frac{2}{3}\right)$$

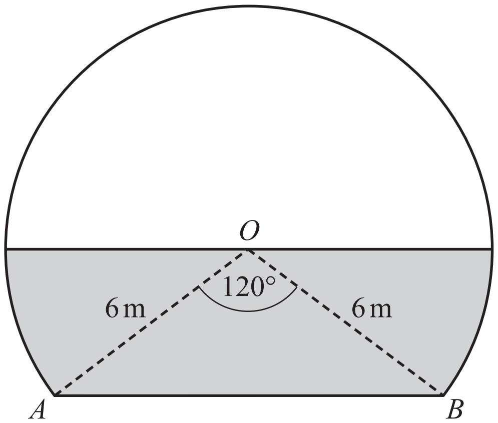
$$\frac{1}{10} + \frac{8}{15}$$

$$\frac{15+80}{150} = \frac{95}{150}$$

$\frac{19}{30}$ .... [3]

20 The diagram shows the entrance to a tunnel.

The circular arc has a radius of 6 m and centre O.
AB is horizontal and angle $AOB = 120°$.



NOT TO SCALE

During a storm the tunnel filled with water, to the level shown by the shaded area in the diagram.

The shaded area is equal to $c\pi + d\sqrt{3}$.

Find the value of c and the value of d.

$\frac{180-120}{2} = 30°$

$\frac{30}{360} \times \pi \times 6^2$

$= \frac{108\cancel{0}\pi}{36\cancel{0}}$

$= 3\pi \times 2$

$= \underline{6\pi}$

$6\pi + 9\sqrt{3}$

$A = \frac{1}{2}ab\sin C$

$= \frac{1}{2} \times 6^2 \times \sin 120$

$\sin 120 = \sin 60$

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

$= \frac{18\sqrt{3}}{2} = \underline{9\sqrt{3}}$

$c =$ ....6........

$d =$ ....9........ [5]

21 **(a)** Simplify $\frac{\sqrt{12}}{\sqrt{6}}$.

$$\sqrt{72} = \sqrt{18 \times 4}$$
$$= \sqrt{9 \times 2 \times 4}$$

$$\frac{\sqrt{12}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$$

$$\frac{\sqrt{72}}{6} = \frac{\cancel{6}\sqrt{2}}{\cancel{6}}$$

$\sqrt{2}$ .... [1]

(b) Write $\left(\frac{8}{2-\sqrt{2}}\right)$ in the form $a + b\sqrt{2}$, where a and b are integers.

$$\frac{8}{2-\sqrt{2}} \times \frac{2+\sqrt{2}}{2+\sqrt{2}}$$

$$\frac{16+8\sqrt{2}}{2}$$

$$\frac{16+8\sqrt{2}}{(2-\sqrt{2})(2+\sqrt{2})}$$

$$\frac{16+8\sqrt{2}}{4-2}$$

$8 + 4\sqrt{2}$ .... [3]

22 **(a)** Simplify $\frac{15x+3x^2}{x^2-25}$.

$$\frac{3x\cancel{(5+x)}}{\cancel{(x+5)}(x-5)}$$

$\frac{3x}{x-5}$ .... [3]

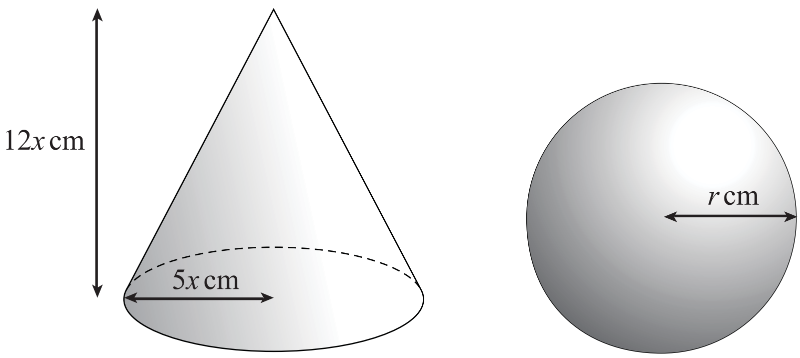
(b) Show that $3 - \frac{t+2}{t-1}$ can be written as $\frac{2t-5}{t-1}$.

$$\frac{3(t-1) - (t+2)}{t-1}$$

$$\frac{3t-3-t-2}{t-1} = \frac{2t-5}{t-1}$$

[2]

23 The diagram below shows a solid circular cone and a solid sphere.



NOT TO SCALE

The cone has the same **total** surface area as the sphere.
The cone has radius $5x$ cm and height $12x$ cm.
The sphere has radius r cm.

Show that $r^2 = \frac{45}{2}x^2$.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]
[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

$$\pi r l + \pi r^2 = 4\pi r^2$$

$$l = \sqrt{(12x)^2 + (5x)^2}$$
$$= \sqrt{144x^2 + 25x^2}$$
$$= \sqrt{169x^2}$$
$$= 13x$$

$$\pi(5x)(13x) + \pi(5x)^2 = 4\pi(r)^2$$
$$65\pi x^2 + 25\pi x^2 = 4\pi r^2$$
$$90\pi x^2 = 4\pi r^2$$
$$r^2 = \frac{90\cancel{\pi} x^2}{4\cancel{\pi}}$$
$$r^2 = \frac{45}{2}x^2$$

[6]

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MATHEMATICS **0580/02**

Paper 2 Non-calculator (Extended) **For examination from 2025**

Practice Test 6 **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 **18** pages.

List of formulas

Area, A, of triangle, base b, height h. $A = \frac{1}{2}bh$

Area, A, of circle of radius r. $A = \pi r^2$

Circumference, C, of circle of radius r. $C = 2\pi r$

Curved surface area, A, of cylinder of radius r, height h. $A = 2\pi rh$

Curved surface area, A, of cone of radius r, sloping edge l. $A = \pi rl$

Surface area, A, of sphere of radius r. $A = 4\pi r^2$

Volume, V, of prism, cross-sectional area A, length l. $V = Al$

Volume, V, of pyramid, base area A, height h. $V = \frac{1}{3}Ah$

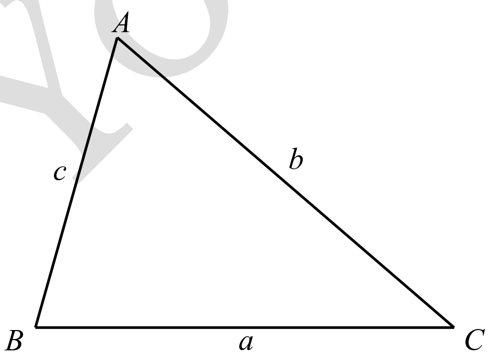
Volume, V, of cylinder of radius r, height h. $V = \pi r^2 h$

Volume, V, of cone of radius r, height h. $V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $V = \frac{4}{3}\pi r^3$

For the equation $ax^2 + bx + c = 0$, where $a \neq 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For the triangle shown,



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

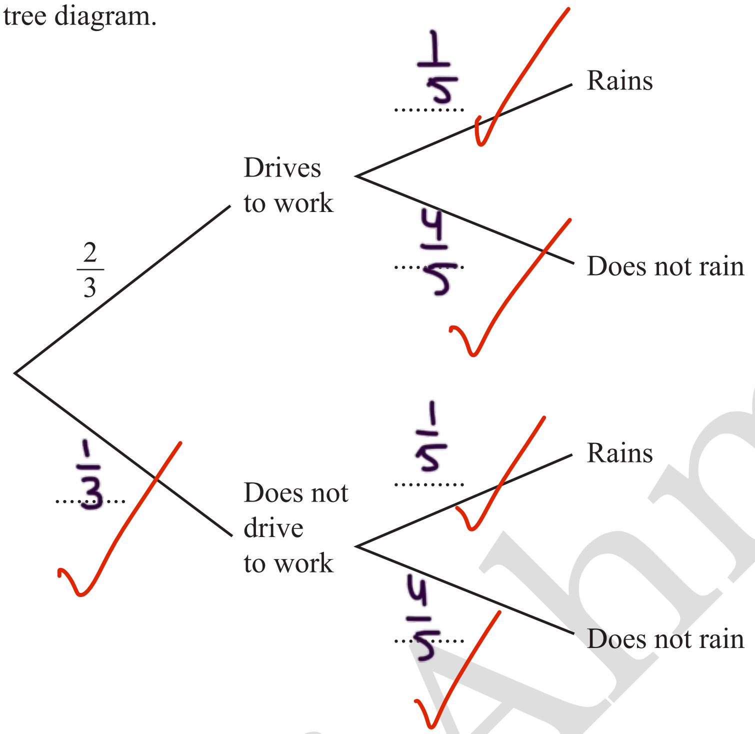
$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

1 The probability that Marc drives to work on any day is $\frac{2}{3}$.

The probability that it rains on any day is $\frac{1}{5}$.

(a) Complete the tree diagram.



[2]

(b) Work out the probability that one day Marc drives to work and it does not rain.

$\frac{2}{3} \times \frac{4}{5}$

$\frac{8}{15}$ .... [2]

2 Expand and simplify.

$$4(2r+3)+3(1-5r)$$

$8r + 12 + 3 - 15r$

$15 - 7r$ .... [2]

3 By rounding each number correct to 1 significant figure, estimate the value of

$$\frac{43.01+9.94}{32.644-4.777}.$$

$\frac{40 + 10}{30 - 5} = \frac{50}{25} =$

2 .... [2]

4 Work out the fraction that is exactly halfway between the two fractions $\frac{3}{4}$ and $\frac{4}{5}$.

$5 \times \left(\frac{3}{4}\right) \quad \left(\frac{4}{5}\right) \times 4$

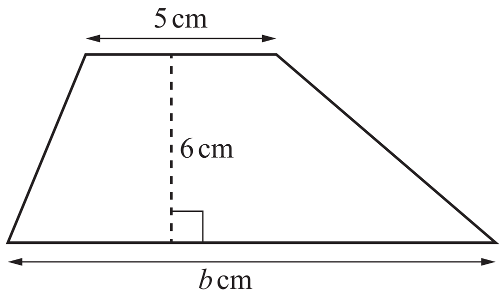
$\frac{15}{20} + \frac{16}{20}$

$= \frac{31}{20} \div 2$

$= \frac{31}{20} \times \frac{1}{20}$

$\frac{31}{40}$ .... [3]

5



NOT TO SCALE

The area of this trapezium is $39\,\text{cm}^2$.

Find the value of b.

$A = \frac{1}{2}(a+b)h$

$39 = \frac{1}{2}(5+b) \times 6$

$78 = 6(5+b)$

$78 = 30 + 6b$

$48 = 6b$

$b = \frac{48}{6}$

$b =$ ....8........ [3]

6 The width, w cm, of an oven is 60 cm correct to the nearest centimetre.

(a) Complete this statement about the value of w.

$60 < \begin{matrix} 59.5 \\ 60.5 \end{matrix}$

....59.5.... $\leqslant w <$ ....60.5.... [2]

(b) There is a gap between two cupboards in a kitchen.
The width of the gap is 90 cm, correct to the nearest centimetre.
The oven is placed in the gap.

Work out the upper bound of the width of the remaining space.

$90 < \begin{matrix} 89.5 \\ 90.5 \end{matrix}$

$90.5 - 59.5$

........31.0........ cm [2]

7 **(a)** Work out $\left(\sqrt[3]{64}\right)^2$.

$(4)^2$

16 [2]

(b) $4x^3y^{-2} \times px^qy^r = 20x^{10}$

Find the values of p, q and r.

$3 + n = 10$

$n = 10 - 3$

$p =$ 5

$q =$ 7

$r =$ 2 [3]

8 The interior angle of a regular polygon is 150°.

Show that the polygon has 12 sides.

int angle + ext angle = 180

$180 - 150 = 30$

$\frac{360}{n} = 30$

$\frac{36\cancel{0}}{3\cancel{0}} = n$

$n = 12$

[2]

9 **(a)** Solve $5(7-x) = 55$.

$35 - 5x = 55$

$-5x = 20$

$x = \frac{20}{-5}$

$x =$ ......-4...... [3]

(b) Rearrange the formula $L = \sqrt{\pi r}$ to make r the subject.

$L^2 = \pi r$

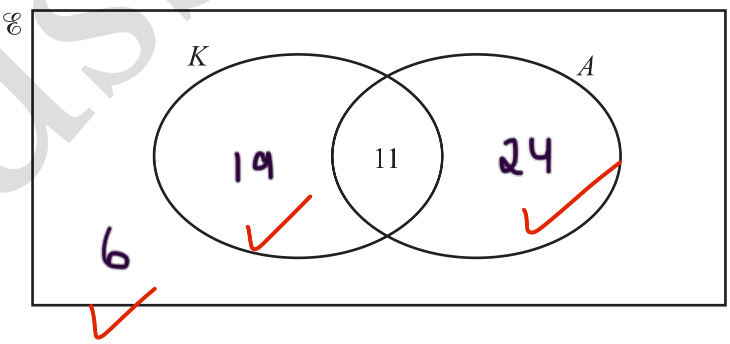
$r =$ ......$\frac{L^2}{\pi}$...... [2]

10 A travel company asked 60 people where they went on holiday last year.

- 30 people went on holiday in the UK
- 11 people went on holiday both in the UK and abroad
- 6 people did not go on holiday

K = {people who went on holiday in the UK}
A = {people who went on holiday abroad}

(a) Complete the Venn diagram to show this information.



[2]

(b) Find $n(A \cup K)$.

......54...... [1]

11 Work out the magnitude of the vector $\begin{pmatrix} 6 \\ -8 \end{pmatrix}$.

$\sqrt{6^2 + (-8)^2}$

$= \sqrt{36 + 64}$

$= \sqrt{100}$

10 .... [2]

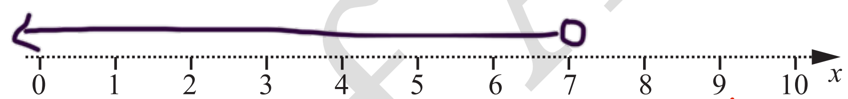
12 **(a)** **(i)** Solve the inequality $4x + 12 < 40$.

$4x < 28$

$x < \frac{28}{4}$

$x < 7$ .... [2]

(ii) Show your solution to **part (a)(i)** on this number line.



[1]

(b) Write down all the **integers** that satisfy this inequality.

$$-2 < x \leqslant 3$$

$-1, 0, 1, 2, 3$ .... [2]

13 Simplify $(25x^{10})^{\frac{3}{2}}$.

$(\sqrt{25})^3 = 125$

$10 \times \frac{3}{2} = \frac{30}{2}$

$125x^{15}$ .... [2]

14 The surface area of a cube is 54 cm^2.

Find the volume of this cube.

A of cube = $l \times w$

$\sqrt{54} = \sqrt{9 \times 6}$

$= 3\sqrt{6}$

$V = 54 \times 3\sqrt{6}$

Surface area of Cube $= 6l^2$

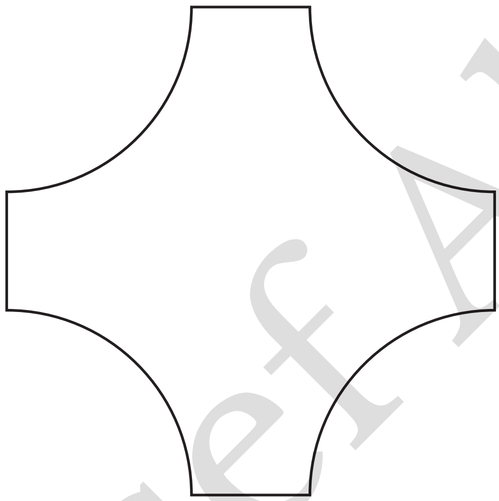
$54 = 6l^2$

$l^2 = \frac{54}{6} = 9 \Rightarrow l = 3$

volume $= l^3 = 3^3 = 27$

~~$162\sqrt{6}$~~ 27 cm^3 [3]

15



NOT TO SCALE

3cm

This shape is made from four straight edges and four arcs.
Each straight edge has length 3 cm.
Each arc is a quarter of the circumference of a circle of radius 5 cm.

Find the perimeter of this shape.
Give your answer in terms of π.

Arc length:

$\frac{90}{360} \times 2\pi \times 5$

$\frac{900\pi}{360}$

$= \frac{10\pi}{4}$

$\frac{10\pi}{4} \times 4$

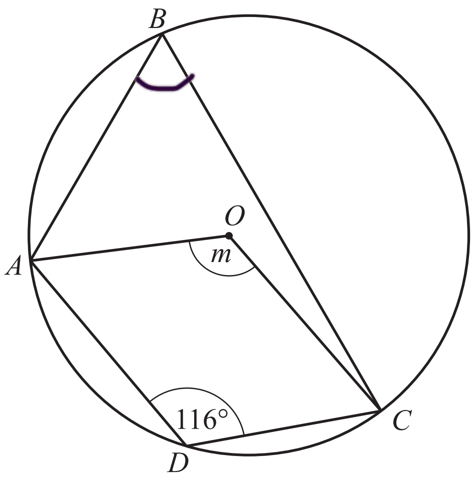
$= \frac{40\pi}{4}$

$= 10\pi$

$3 \times 4 = 12$

$12 + 10\pi$ cm [3]

16



NOT TO SCALE

A, B, C and D are points on a circle, centre O.

Show that angle $m = 128°$.
Give a reason for each step of your working.

ABC =
180 − 116
= 64 bcs opposite angles in a cyclic quad add up to 180°

m = 2×64
= 128° bcs angle at centre is twice angle at circumference

[3]

17 You are given that w is a 2-digit number and that $\sqrt{2} \times \sqrt{w}$ is an integer that is less than 10.

Find the two possible values of w.

$\sqrt{2} \times \sqrt{w} = \sqrt{2w}$

$\sqrt{2w} = 8$

$\sqrt{2w} = 6$

$2w = 64$
$w = 32$

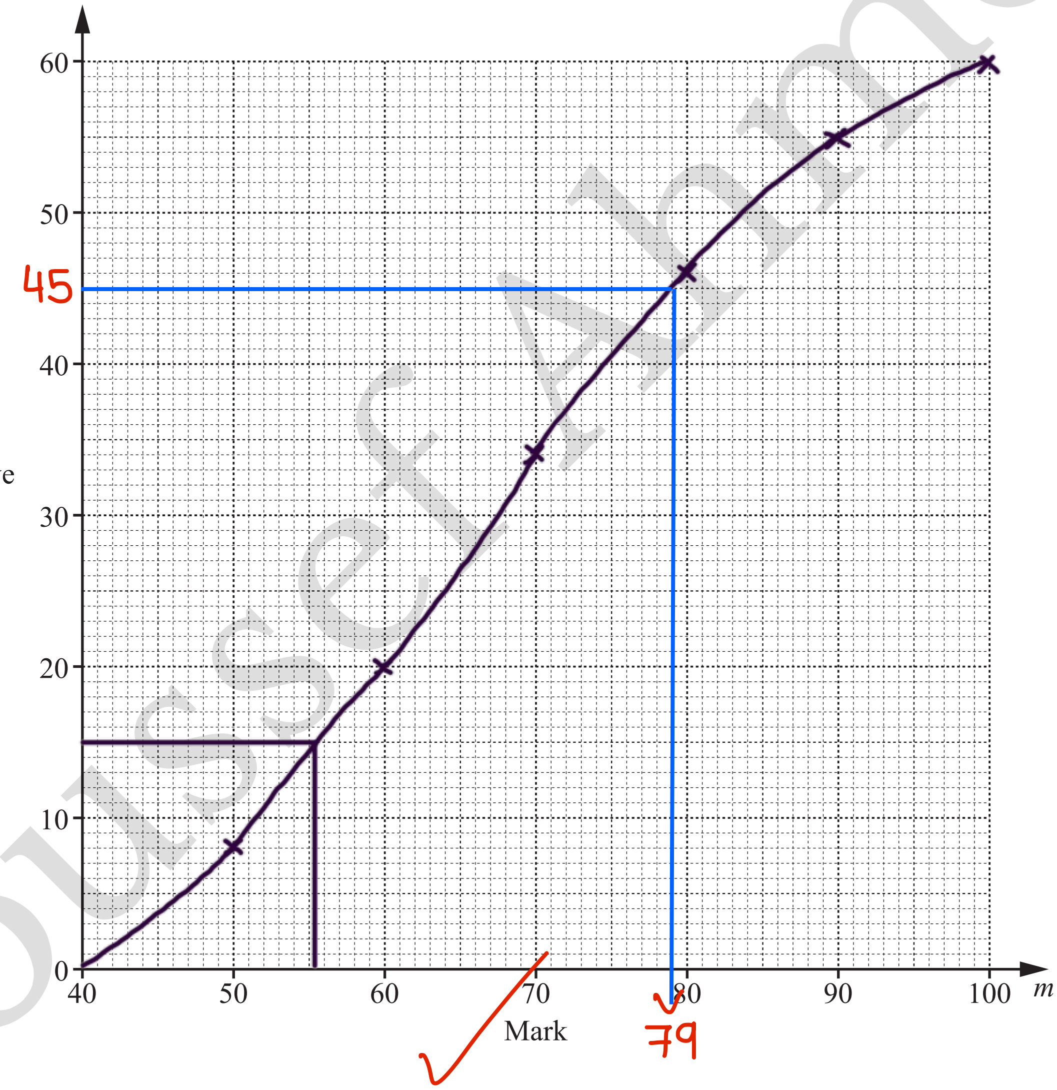
$2w = 36$
$w = 18$

$w =$ ......32...... or $w =$ ......18...... [3]

18 This table shows the distribution of marks in a literacy test taken by 60 students.

Mark (m)	Frequency	CF
$40 < m \leqslant 50$	8	8
$50 < m \leqslant 60$	12	20
$60 < m \leqslant 70$	14	34
$70 < m \leqslant 80$	12	46
$80 < m \leqslant 90$	9	55
$90 < m \leqslant 100$	5	60

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



[4]

(b) Three-quarters of the students pass the test.

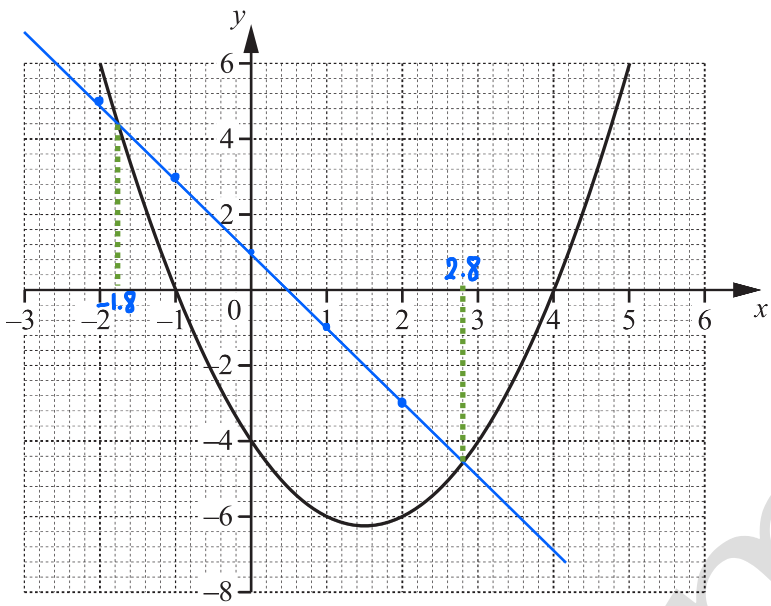
Use your diagram to find an estimate for the pass mark of the test.

$\frac{3}{4} \times 60 = 45$

$\frac{1}{4} \times 60 = \frac{60}{4} = 15$ X

X 55 79 [2]

19



The graph of $y = x^2 - 3x - 4$ is shown on the grid.

By drawing a suitable straight line on the grid, solve the equation $x^2 - x - 5 = 0$.

$$x^2 - 3x - 4$$
$$- \quad x^2 - x - 5$$
$$0 - 2x + 1$$

$$y = -2x + 1$$

x	0	1	2
y	1	-1	-3

$x = 2.8$, $x = -1.8$ [3]

20 **(a)** $\mathrm{f}(x) = 5x - 3$

Find and simplify an expression for $\mathrm{ff}(x)$.

$5(5x-3)-3$

$25x-15-3$

$25x-18$ .... [2]

(b) A function $\mathrm{g}(x)$ is defined as self-inverse if $\mathrm{g}(x) = \mathrm{g}^{-1}(x)$.

$$\mathrm{h}(x) = 2 - x$$

Show that $\mathrm{h}(x)$ is self-inverse.

$y = 2 - x$

$y + x = 2$

$x = 2 - y$

$h^{-1}(x) = 2 - x$

$h(x) = h^{-1}(x)$

$\therefore h(x)$ is self-inverse

[2]

21 Express $x^2 - 8x - 7$ in the form $(x+p)^2 + q$ where p and q are integers.

$(x-4)^2 - (4)^2 - 7$

$(x-4)^2 - 23$ .... [2]

22 Given that $\frac{x-2}{x-3}+\frac{x}{4}=3$, show that $x^2-11x+28=0$.

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

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

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

$$3(4x-12)=x^2+x-8$$

$$12x-36x=x^2+x-8$$

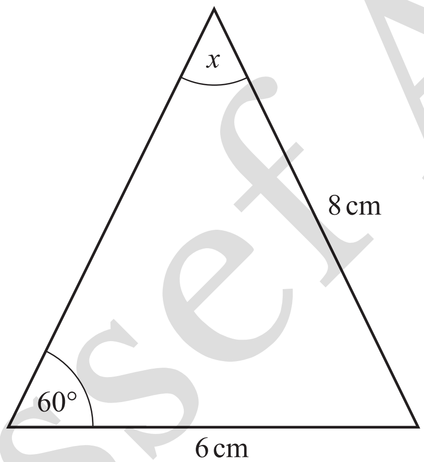
$$x^2-11x+28=0$$

[3]

23 **(a)** Write down the exact value of sin 60°.

$\frac{\sqrt{3}}{2}$ .... [1]

(b)



NOT TO SCALE

Find the exact value of sin x.

Write your answer in the form $\frac{a\sqrt{3}}{b}$ where a and b are integers.

$$\frac{\sin x}{6}=\frac{\sin 60}{8}$$

$$\sin x=\frac{6\times\frac{\sqrt{3}}{2}}{8}$$

$$\sin x=\frac{6\sqrt{3}}{2}\div 8$$

$$\sin x=3\sqrt{3}\times\frac{1}{8}$$

$$=\frac{3\sqrt{3}}{8}$$

$\frac{3\sqrt{3}}{8}$ .... [3]

24 **(a)** Given that $y = 2x^3 + 3x^2 - 12x$, find $\frac{dy}{dx}$.

$\frac{dy}{dx} = 6x^2 + 6x - 12$ [2]

(b) Find the co-ordinates of the two turning points of the curve $y = 2x^3 + 3x^2 - 12x$.

$\frac{dy}{dx} = 0$

~~$6x^2 + 6x - 12 = 0$~~

~~$x^2 + x - 6 = 0$~~

~~$S = 1 \quad P = -6 < \begin{smallmatrix} 3 \\ -2 \end{smallmatrix}$~~

~~$(x+3)(x-2) = 0$~~

~~$x + 3 = 0 \quad x - 2 = 0$~~

~~$x = -3 \quad x = 2$~~

$6x^2 + 6x - 12 = 0$

$x^2 + x - 2 = 0$

$(x-1)(x+2) = 0$

$x - 1 = 0 \quad x + 2 = 0$

$x = 1 \quad x = -2$

~~for $x = -3$:~~

~~$y = 2(-3)^3 + 3(-3)^2 - 12(-3)$~~

~~$= -54 + 27 + 36$~~

~~$= 9$~~

for $x = -2$:-

$y = 2(-2)^3 + 3(-2)^2 - 12(-2)$

$= 20$

$(-2, 20)$

For $x = 1$

$y = 2(1)^3 + 3(1)^2 - 12(1)$

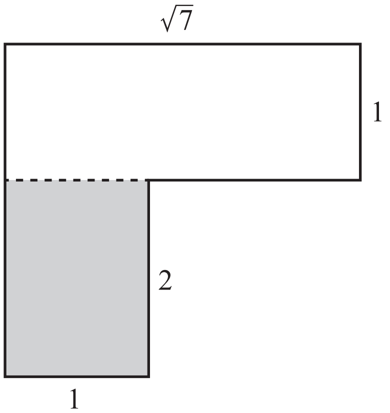
$= -7$

$(1, -7)$

(~~-3~~ , ~~9~~) and (~~2~~ , ~~4~~) [4]

$(1, -7)$ and $(-2, 20)$

25 In this question all lengths are in centimetres.



NOT TO SCALE

This shape is made from two rectangles.

Show that the fraction of the whole shape that is shaded is $\dfrac{2\sqrt{7}-4}{3}$.

A of whole shape:

$1 \times \sqrt{7} = \sqrt{7}$

$+ 2 \times 1$

$= \sqrt{7} + 2$

Fraction of region shaded $= \dfrac{2}{\sqrt{7}+2}$

$$\frac{2}{\sqrt{7}+2} \times \frac{\sqrt{7}-2}{\sqrt{7}-2}$$

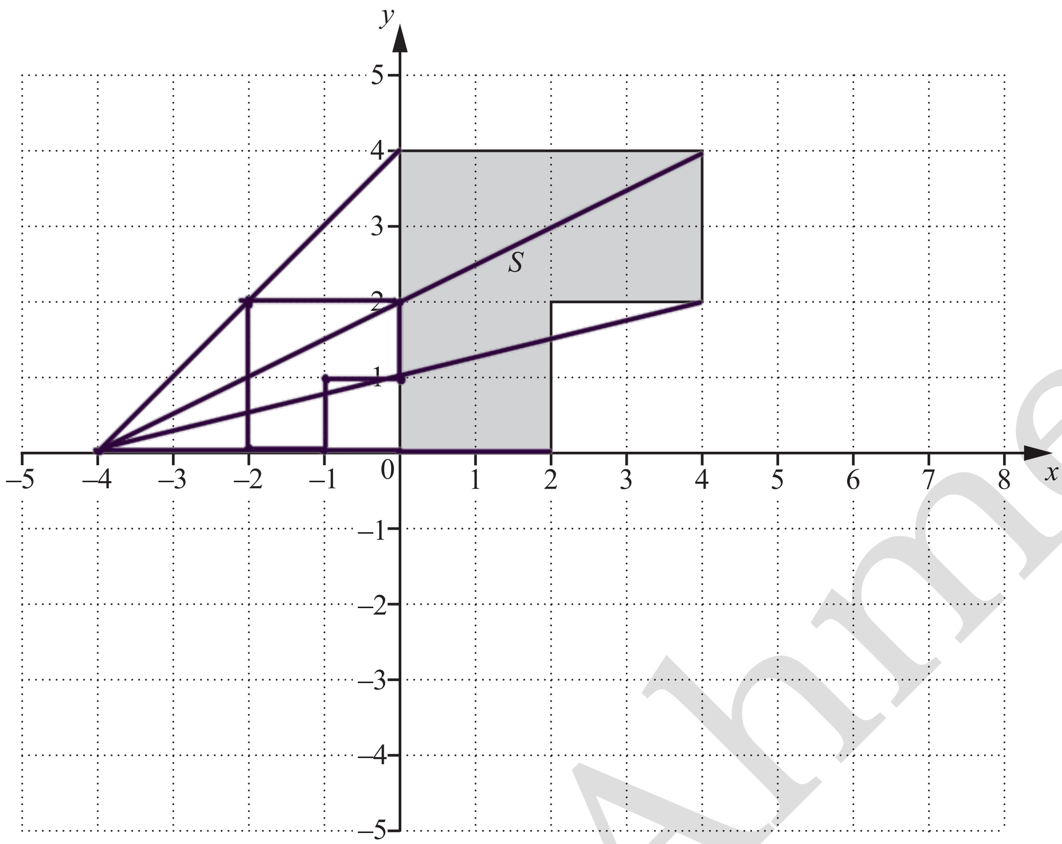
$$\frac{2\sqrt{7}-4}{(\sqrt{7})^2-(2)^2}$$

$$\frac{2\sqrt{7}-4}{7-4}$$

$$\frac{2\sqrt{7}-4}{3}$$

[5]

26



Draw the enlargement of shape S with scale factor $\frac{1}{2}$ and centre $(-4, 0)$. [2]

Shape with vertices :- (-2,2) & (-2,0) & (-1,0) & (-1,1)

27 Solve $\sqrt{2}\cos x - 1 = 0$ for $0° \leqslant x \leqslant 360°$.

	0	30	45	60	90
cos	$\sqrt{\frac{4}{4}} = 1$	$\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$	$\sqrt{\frac{2}{4}} = \frac{\sqrt{2}}{2}$	$\sqrt{\frac{1}{4}} = \frac{1}{2}$	$\sqrt{\frac{0}{4}} = 0$

$\sqrt{2}\cos x = 1$

$\cos x = \frac{1}{\sqrt{2}}$

$x = \cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

$x = 45$

$360 - 45 = 315$

45 , 315 [3]

28 **(a)** A straight line, L, passes through point A (–2, –8) and point B (5, 6).

(i) Find the length of the line segment AB.

$|AB| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$|AB| = \sqrt{(5+2)^2 + (6+8)^2}$

$= \sqrt{(7)^2 + (14)^2}$

$= \sqrt{49+196}$

$= \sqrt{245}$

$= \sqrt{49 \times 5}$

$AB =$ $7\sqrt{5}$ ✓ [3]

(ii) Find the equation of the line L.
Give your answer in the form $y = mx + c$.

$m = \frac{y_2-y_1}{x_2-x_1} = \frac{6-(-8)}{5-(-2)} = \frac{14}{\cancel{10}\ 7} = \cancel{\frac{7}{5}}\ 2$

$y - y_1 = m(x - x_1)$

$y - 6 = \cancel{\frac{7}{5}}^{\,2}(x-5)$

$5y - 30 = 7x - 35$

$5y = 7x - 5$

$y =$ $\frac{7}{5}x - 1$ ✗ [3]

$y - 6 = 2(x-5)$

$y - 6 = 2x - 10$

$y = 2x - 4$

(b) Q is the midpoint of the line segment PR.
P is the point (–1, 3) and Q is the point (5, 1).

Find the coordinates of point R.

$M = \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}$

$5 = \frac{-1+x_2}{2}$ $\quad$ $1 = \frac{3+y_2}{2}$

$10 = -1 + x$ $\quad$ $2 = 3 + y_2$

$x = 11$

$R = ($ 11 , –1 $)$ ✓ [2]

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MATHEMATICS **0580/02**

Paper 2 Non-calculator (Extended) **For examination from 2025**

Practice Test 7 **2 hours**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS
- Answer **all** questions.
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List of formulas

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
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Volume, V, of cone of radius r, height h.	$V = \frac{1}{3}\pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$
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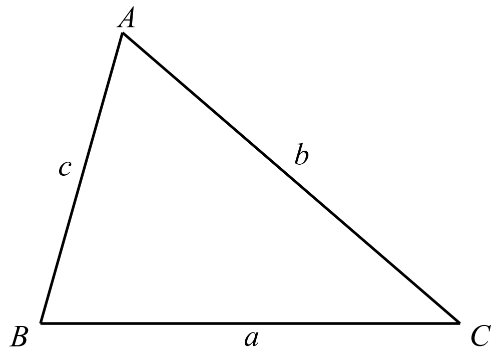
For the triangle shown,



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

1 Simplify $\sqrt{\frac{9}{16}} + 2^{-1}$.

$\frac{3}{4} + \frac{1}{2}$

Answer ....$\frac{5}{4}$.......... [2]

2 $y = \frac{x}{2} + x^2$

Find the value of y when $x = 0.1$.

$\frac{0.1}{2} + (0.1)^2$

$= 0.05 + 0.01$

Answer ....0.06.......... [2]

3 Solve the equation.

$$\frac{n-8}{2} = 11$$

$n - 8 = 22$

$n = 22 + 8$

Answer $n =$ ....30.......... [2]

4 $$p = \frac{4.8 \times 1.98276}{16.83}$$

(a) In the spaces provided, write each number in this calculation correct to 1 significant figure.

Answer(a)

$$\frac{5 \times 2}{20}$$

[1]

(b) Use your answer to **part (a)** to estimate the value of p.

$\frac{10}{20}$

Answer(b) ....0.5.......... [1]

[Turn over

5 A straight line passes through the point (0, 3) and the point (2, 11).

(a) Work out the gradient of this line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{11 - 3}{2 - 0} = \frac{8}{2} = 4$$

.... 4 .... [2]

(b) Write down the equation of this line.

$$y - y_1 = m(x - x_1)$$

$$y - 11 = 4(x - 2)$$

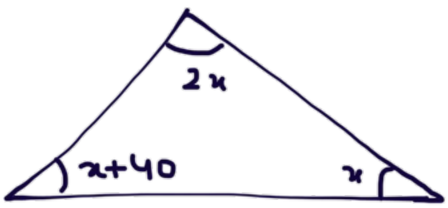
$$y - 11 = 4x - 8$$

$$y = 4x - 8 + 11$$

$y =$ .... $4x + 3$ .... [1]

6 One of the angles in a triangle is twice as big as the smallest angle.
The third angle in the triangle is 40° bigger than the smallest angle.

Work out the sizes of the three angles in the triangle.



$$x + 2x + x + 40 = 180$$

$$4x = 140$$

$$x = \frac{140}{4}$$

$$\underline{\underline{x = 35}}$$

.... 35 ....°, ... 70 ....°, ... 75 ....° [4]

7 Write as a fraction in simplest form.

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

$$\frac{2(x+1)-2x}{x(x+1)}$$

$$\frac{\cancel{2x}+2-\cancel{2x}}{x(x+1)}$$

Answer ..... $\frac{2}{x(x+1)}$ ..... [3]

8 A bus company in Dubai has the following operating times.

Day	Starting time	Finishing time
Saturday	06 00	24 00
Sunday	06 00	24 00
Monday	06 00	24 00
Tuesday	06 00	24 00
Wednesday	06 00	24 00
Thursday	06 00	24 00
Friday	13 00	24 00

(a) Calculate the total number of hours that the bus company operates in one week.

$$\begin{array}{r} 24\,00 \\ -\ 06\,00 \\ \hline 18\,00 \end{array}$$

$6 \times 18 + 11$

$= 108 + 11$

$= 119$

Answer(a) ..... 119 ..... h [3]

(b) Write the starting time on Friday in the 12-hour clock.

Answer(b) ..... 01 :00 pm ..... [1]

9 Simplify

(a) $(3\sqrt{2})^2$, $\Rightarrow (3)^2(\sqrt{2})^2 = 9 \times 2 = 18$

$(3\sqrt{2})(3\sqrt{2})$

3×2

Answer(a) 18 ~~6~~ [1]

(b) $\sqrt{24} + \sqrt{54}$.

$\sqrt{6 \times 4} + \sqrt{9 \times 6}$

$2\sqrt{6} + 3\sqrt{6}$

Answer(b) $5\sqrt{6}$ [2]

10 $Q = 2^n - 1$

(a) Work out the value of Q when $n = 3$.

$2^3 - 1$

$= 8 - 1$

$Q =$ 7 [1]

(b) Q is a prime number for some values of n.

Find the values of Q that are prime when $n = 2, 3, 4$ or 5.

when $n = 2$, $Q = 3$

when $n = 3$, $Q = 7$

when $n = 4$, $Q = 15$

when $n = 5$, $Q = 31$

3, 7, 31 [2]

(c) When $n = 6$, Q is not a prime number.

Explain how you know this value of Q is not prime.

when $n = 6$, $Q = 63$; 63 has 7 and 9 as its ~~multiple~~ factors

not just 1 and itself ∴ Q is not prime [1]

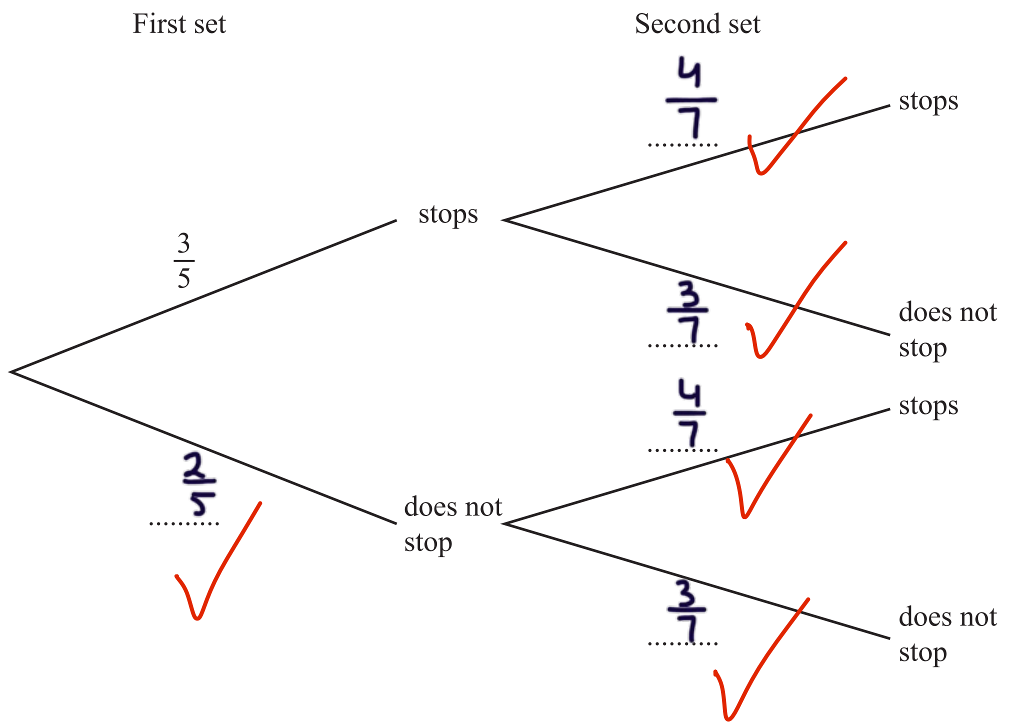
11 Ewan travels to work by car.
He goes through two sets of traffic lights on his journey.

The probability that he stops at the first set of traffic lights is $\frac{3}{5}$.

The probability that he stops at the second set of traffic lights is $\frac{4}{7}$.

These probabilities are independent.

(a) Complete the tree diagram.



[2]

(b) Work out the probability that Ewan stops at **neither** set of traffic lights.

$\frac{2}{5} \times \frac{3}{7}$

$\frac{6}{35}$ .... [2]

12 **(a)** Factorise $x^2 - 3x - 18$.

$S = -3 \quad P = -18 < {-6 \atop 3}$

$(x-6)(x+3)$ .... [2]

(b) Solve $x^2 - 3x - 18 = 0$.

$x =$ ....6.... or $x =$ ....-3.... [1]

13 Sophie drives 125 miles from Adton to Berham at an average speed of 50 miles per hour.
She then drives 90 miles from Berham to Chand.
She does not stop and her whole journey takes 4 hours.

What is her average speed driving from Berham to Chand?

Adton $\xrightarrow[\text{125 miles}]{\text{50mph}}$ Berham

Berham $\xrightarrow[\text{90 miles}]{}$ Chand

$s = \frac{d}{t}$

time from Adton → Berham

$= \frac{125}{50}$

$= \frac{25}{10}$

$= \frac{5}{2}$ hours

$4 - \frac{5}{2} = \frac{3}{2}$h

time from Berham → Chand $= \frac{3}{2}$h

$s = \frac{90}{\frac{3}{2}}$

$= \frac{180}{3}$

.......60....... mph [4]

14 Show that $(x+7)(x-4)+3x(x-1)$ simplifies to $4(x^2-7)$.

$x(x-4)+7(x-4) + 3x^2 - 3x$

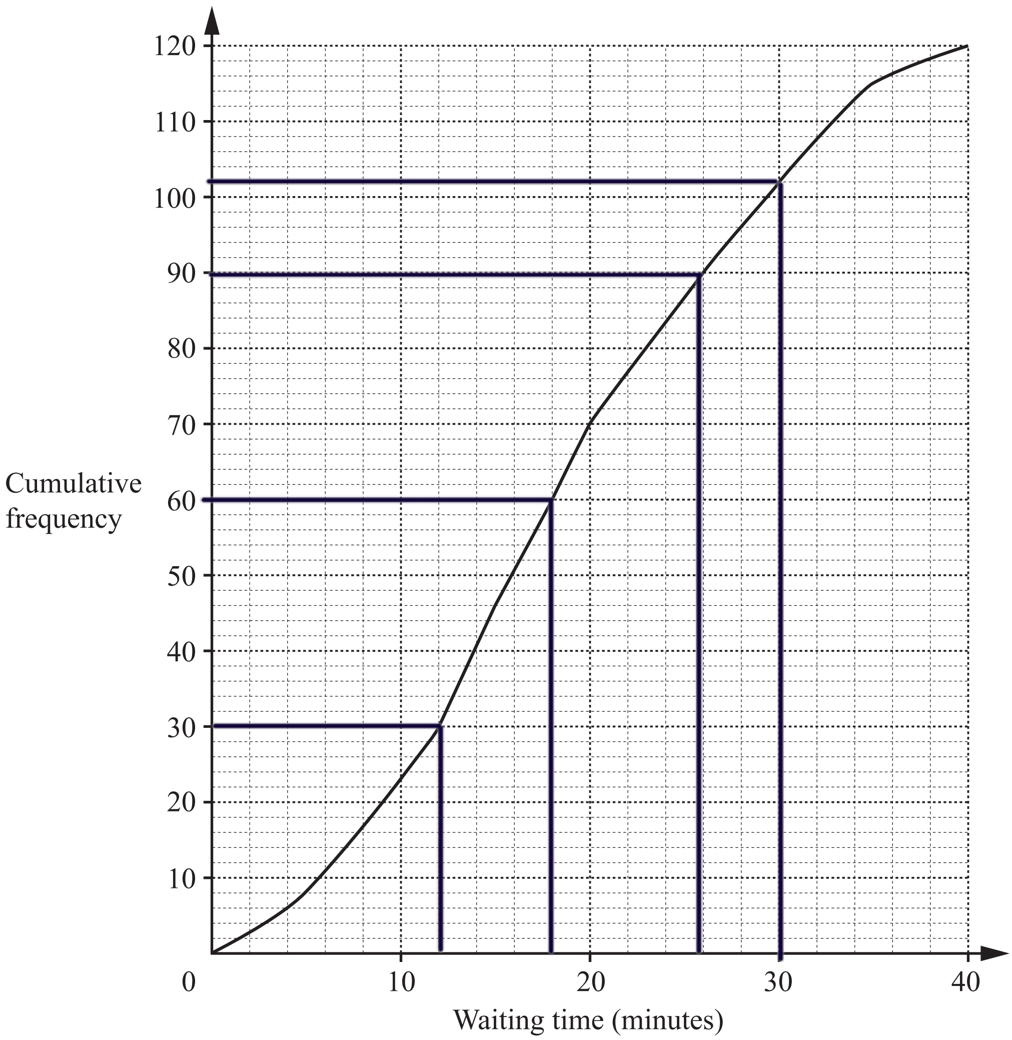
$x^2 - \cancel{4x} + \cancel{7x} - 28 + 3x^2 - \cancel{3x}$

$4x^2 - 28$

$\underline{4(x^2-7)}$

[3]

15



This cumulative frequency diagram summarises the waiting times of 120 patients in a doctor's surgery.

(a) Use the diagram to estimate

(i) the median waiting time,

.................18................. minutes [1]

(ii) the inter-quartile range.

IQR = Q3 − Q1

$\frac{3}{4} \times 120$ $= 90$ $\qquad \frac{1}{4} \times 120$ $= 30$

$= 26 - 12$

.................14................. minutes [2]

(b) Use the diagram to estimate the percentage of patients who waited longer than 30 minutes.

$120 - 102 = 18$

$\frac{18}{120} \times 100$

$= \frac{9}{60} \times 100$

$= \frac{3}{20} \times 100$

$= \frac{30\cancel{0}}{2\cancel{0}}$

15 ....% [3]

16 **(a)** Simplify.

$$9k^2 \div 3k^{-5}$$

$3k^7$ .... [1]

(b) Evaluate.

$$\left(\frac{4}{25}\right)^{-\frac{1}{2}}$$

$\left(\frac{25}{4}\right)^{\frac{1}{2}}$

$\left(\frac{\sqrt{25}}{\sqrt{4}}\right)^{1}$

$\frac{5}{2}$ .... [2]

(c) $27^x = 3$

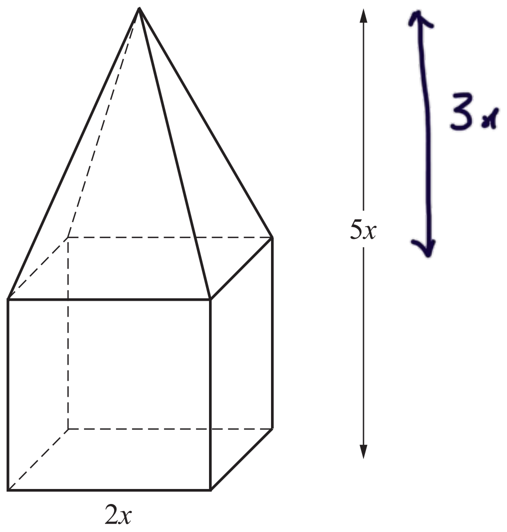
Find the value of x.

$3^{3x} = 3^1$

$3x = 1$

$x =$ $\frac{1}{3}$ .... [1]

17 In this question all lengths are in centimetres.



A solid shape consists of a cube with a pyramid on top.
The cube has sides of length $2x$.

The base of the pyramid is a square with sides of length $2x$.
The vertex at the top of the pyramid is $5x$ above the base of the cube.

Find an expression, in terms of x, for the volume of the solid.
Give your answer in its simplest form.

[The volume, V, of a pyramid with base area A and height h is $V = \frac{1}{3}Ah$.]

V of cube = l x w x h

$= (2x)(2x)(2x)$

$= 8x^3$

V of pyramid

$= \frac{1}{3} \times (2x)(2x)(3x)$

$= \frac{1}{3} \times 12x^3$

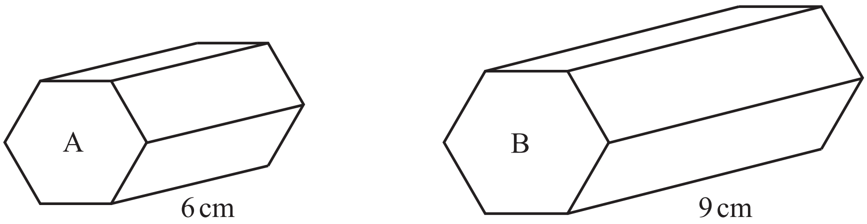
$= \frac{12}{3}x^3$

$= 4x^3$

$8x^3 + 4x^3$

$12x^3$ cm^3 [4]

18



NOT TO SCALE

These are two mathematically similar hexagonal prisms.

Prism A has length 6 cm and volume 80 cm^3.
Prism B has length 9 cm.

Calculate the volume of prism B.

$$\frac{V_1}{V_2} = \left(\frac{L_1}{L_2}\right)^3$$

$$\frac{V_1}{80} = \left(\frac{9}{6}\right)^3$$

$$\frac{V_1}{80} = \left(\frac{3}{2}\right)^3$$

$$\frac{V_1}{80} = \frac{27}{8}$$

×10 ×10

$$V_1 = 27 \times 10$$

.......270....... cm^3 [3]

19 Express $0.\dot{7}\dot{8}$ as a fraction in its simplest form.

$$x = 0.787878$$
$$10x = 7.87878$$
$$100x = 78.7878$$
$$99x = 78$$
$$x = \frac{78}{99} \begin{matrix} \div 3 \\ \div 3 \end{matrix}$$

.... $\frac{26}{33}$ .... [3]

20 A town planner uses this formula to predict the population, P, of a town after 2017.

$$P = 36700 \times 1.06^n$$

where n is the number of years after 2017 and $0 \leqslant n \leqslant 5$.

(a) For how many years is the formula used?

5

.... [1]

(b) What is the population of the town in 2017?

$1.06^0 = 1$

36700

.... [1]

(c) By what percentage is the population expected to grow each year?

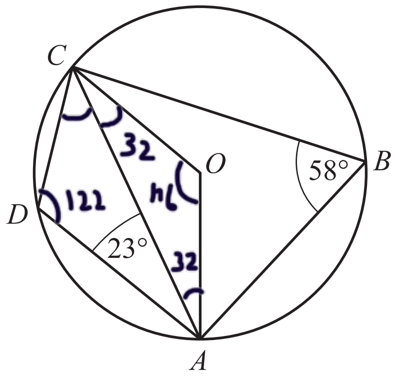
$(1.06 \times 100) - 100$

$106 - 100$

6

.... % [1]

21



NOT TO SCALE

A, B, C and D lie on a circle center O.
Angle $ABC = 58°$ and angle $CAD = 23°$.

Calculate

(a) angle OCA,

$58 \times 2 = 116$

$\dfrac{180 - 116}{2}$

Answer(a) Angle OCA = ...32.......... [2]

(b) angle DCA.

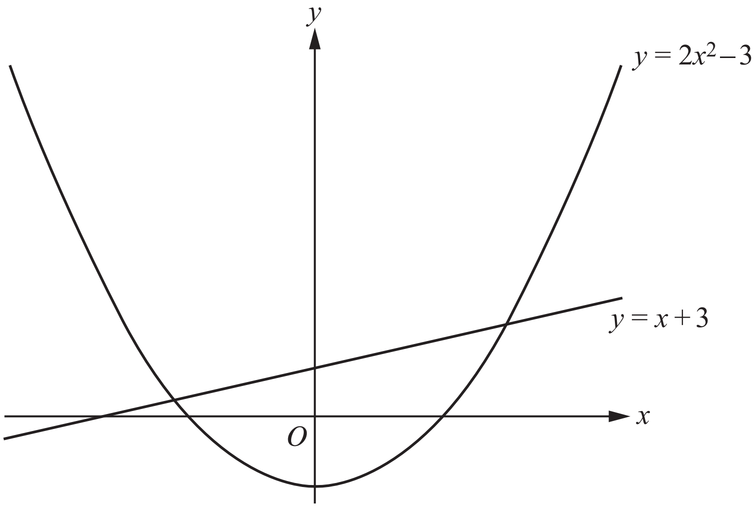
$180 - 58 = 122$

$\begin{array}{r} 180 \\ -\ 58 \\ \hline 122 \end{array}$

$180 - (122 + 23)$

Answer(b) Angle DCA = ...35.......... [2]

22 This is a sketch of the graphs of $y = 2x^2 - 3$ and $y = x + 3$.



Work out the co-ordinates of the points of intersection of $y = 2x^2 - 3$ and $y = x + 3$.

$2x^2 - 3 = x + 3$

$2x^2 - 3 - x - 3 = 0$

$2x^2 - x - 6 = 0$

$S = -1 \quad P = -12 \begin{cases} -4 \\ 3 \end{cases}$

$2x^2 - 4x + 3x - 6 = 0$

$2x(x-2) + 3(x-2) = 0$

$(2x+3)(x-2) = 0$

$x = -\frac{3}{2}, \; x = 2$

for $x = -\frac{3}{2}$

$y = -\frac{3}{2} + 3$

$= \frac{3}{2}$

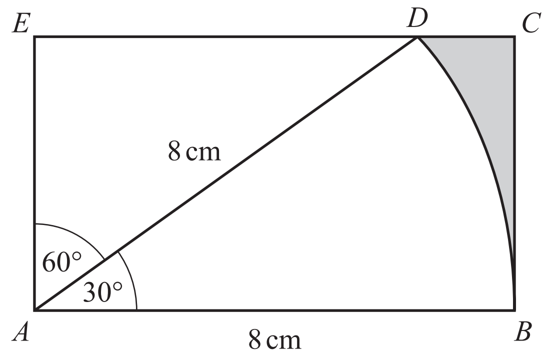
for $x = 2$

$y = 2 + 3$

$= 5$

($-\frac{3}{2}$, $\frac{3}{2}$) and (2 , 5) [6]

23



NOT TO SCALE

The diagram shows a rectangle *ABCE*.
D lies on *EC*.
DAB is a sector of a circle radius 8 cm and sector angle 30°.

Find the perimeter of the shaded region in the form $a + b\sqrt{3} + c\pi$.

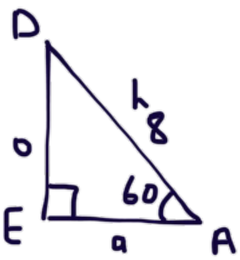
Area of sector:

$\frac{30}{360} \times 2\pi \times 8$

$= \frac{30 \times 16\pi}{360}$

$= \frac{48\cancel{0}\pi}{36\cancel{0}}$

$= \frac{4\pi}{3}$



$\sin 60 = \frac{o}{8}$

$ED = \sin 60 \times 8$

$\sin 60 = \frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2} \times 8$

$= \frac{8\sqrt{3}}{2}$

$= 4\sqrt{3}$

$DC = 8 - 4\sqrt{3}$

EA :

$\cos 60 = \frac{a}{8}$

$EA = \cos 60 \times 8$

$\cos 60 = \frac{1}{2}$

$EA = \frac{1}{2} \times 8$

$= 4$

perimeter =

$4 + \frac{4\pi}{3} + 8 - 4\sqrt{3}$

Answer $12 - 4\sqrt{3} + \frac{4\pi}{3}$ cm [7]

24 $(x-g)(2x^2+x-15)=(x^2-9)(2x+h)$

Find the value of g and the value of h.

LHS : $(x-g)(x^2+x-30)$

$(x-g)(x+\frac{6}{2})(x-\frac{5}{2})$

$(x-g)(x+3)(2x-5)$

RHS : $(x-3)(x+3)(2x+h)$

$(x-g)\cancel{(x+3)}(2x-5)=(x-3)\cancel{(x+3)}(2x+h)$

$(x-g)(2x-5)=(x-3)(2x+h)$

by comparison :

$x-g=x-3 \rightarrow g=3$

$2x-5=2x+h \rightarrow h=-5$

$g =$ 3 ✓

$h =$ −5 ✓ [4]

25 Solve the inequality for positive integer values of x.

$$\frac{21+x}{5} > x+1$$

$21+x > 5(x+1)$

$21+x > 5x+5$

$21-5 > 5x-x$

$16 > 4x$

$\frac{16}{4} > x$

Answer $x < 4$ [4]

$x = 1, 2, 3$

26 Show that $\frac{2}{\sqrt{27}} + \frac{1}{\sqrt{3}}$ can be written as $\frac{m\sqrt{3}}{n}$, where m and n are integers to be found.

$$\frac{2\sqrt{3} + \sqrt{27}}{\sqrt{27} \times \sqrt{3}}$$

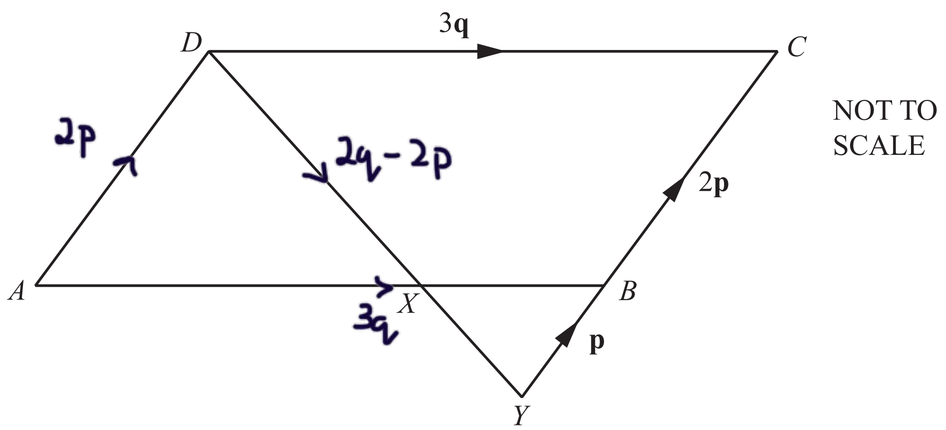
$$= \frac{2\sqrt{3} + \sqrt{9 \times 3}}{\sqrt{81}}$$

$$= \frac{2\sqrt{3} + 3\sqrt{3}}{9}$$

$$= \frac{5\sqrt{3}}{9}$$

[4]

27



ABCD is a parallelogram.

$\overrightarrow{DC} = 3\mathbf{q}$, $\overrightarrow{BC} = 2\mathbf{p}$ and $\overrightarrow{YB} = \mathbf{p}$.
X is the point on AB such that $AX : XB = 2 : 1$.

(a) Find $\overrightarrow{DX}$ in terms of $\mathbf{p}$ and $\mathbf{q}$.
Give your answer in its simplest form.

$$\overrightarrow{DX} = \overrightarrow{DA} + \overrightarrow{AX}$$
$$= -2p + \frac{2}{3}(3q)$$
$$= -2p + \frac{6q}{3}$$

$\overrightarrow{DX} =$ .... $2q - 2p$ .... [3]

(b) Show that DXY is a straight line.

$$\overrightarrow{XY} = \overrightarrow{XB} + \overrightarrow{BY}$$
$$= \frac{1}{3}(3q) - p$$
$$= \frac{3q}{3} - p$$
$$= q - p$$

$$\overrightarrow{DX} = 2\overrightarrow{XY}$$

X is common and is a point on DY so DXY is a straight line

[2]

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Surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

Volume, V, of prism, cross-sectional area A, length l. $\quad V = Al$

Volume, V, of pyramid, base area A, height h. $\quad V = \frac{1}{3}Ah$

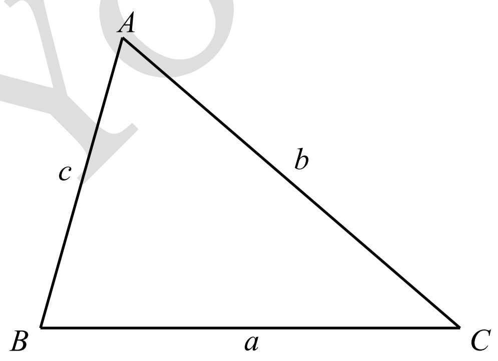
Volume, V, of cylinder of radius r, height h. $\quad V = \pi r^2 h$

Volume, V, of cone of radius r, height h. $\quad V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\quad V = \frac{4}{3}\pi r^3$

For the equation $ax^2 + bx + c = 0$, where $a \neq 0$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For the triangle shown,



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

1 **(a)** Write 6.25×10^{-3} as an ordinary number.

0.00625

.... [1]

(b) Work out $0.03 \times (2 \times 10^{6})$.
Give your answer in standard form.

2000000×0.03

6×10^4

.... [2]

2 **(a)** Write 231 as a product of prime factors.

$$\begin{array}{r|l} 7 & 231 \\ 3 & 33 \\ 11 & 11 \\ & 1 \end{array}$$

$3 \times 7 \times 11$

.... [2]

(b) Abby and Salma are racing in go-karts.
Abby takes 75 seconds to complete each lap.
Salma takes 100 seconds to complete each lap.
At the start of the race, they line up together on the start line.

How many **minutes** later do they next cross the start line together?

$$\begin{array}{r|l} 3 & 75 \\ 5 & 25 \\ 5 & 5 \\ & 1 \end{array}$$

$75 = 3 \times 5^2$

$100 = 2^2 \times 5^2$

$LCM = 3 \times 5^2 \times 2^2$

$= 300s$

$$\begin{array}{r|l} 2 & 100 \\ 2 & 50 \\ 5 & 25 \\ 5 & 5 \\ & 1 \end{array}$$

$\frac{30\cancel{0}}{6\cancel{0}}$

5

.... minutes [2]

3 Work out $5\frac{1}{3} \times 1\frac{3}{4}$.

Give your answer as a mixed number in its lowest terms.

$5\frac{1}{3} = \frac{16}{3}$ $1\frac{3}{4} = \frac{7}{4}$

$\frac{16}{3} \times \frac{7}{4}$

$\frac{112}{12} = \frac{56}{6} = \frac{28}{3}$

$9\frac{1}{3}$ [3]

4 The exterior angle of a regular polygon is 12°.
The polygon has n sides.

Find the value of n.

$\frac{360}{12} = n$

$n =$ 30 [2]

5 There are 300 marbles in a bag.
Luna carries out an experiment to estimate how many of the marbles are red.
She takes a marble out of the bag at random, records its colour and replaces it in the bag.
Luna does this 50 times and she records a red marble 11 times.

Estimate how many of the marbles are red.

$\frac{11}{50} \times 300$

$\frac{330\cancel{0}}{5\cancel{0}}$

66 [2]

6 Solve.

(a) $7 - 2(x - 3) = 6x + 1$

$7 - 2x + 6 = 6x + 1$

$13 - 1 = 6x + 2x$

$12 = 8x$

$x = \frac{12}{8}$

$x =$ .... $\frac{3}{2}$ .... [3]

(b) $x^2 - 4x = 0$

$x(x - 4) = 0$

$x = 0 \quad x - 4 = 0$

$x =$ .... 0 .... or $x =$ .... 4 .... [2]

7 **(a)** Find the value of each of the following.

(i) 10^0

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

(ii) $64^{\frac{1}{2}}$

.... 8 .... [1]

(iii) $12^5 \div 12^3$

12^2

.... 144 .... [2]

(b) Harry writes:

$$x^{-1} = \frac{1}{x} \quad \text{so} \quad x^{-2} = \frac{2}{x}$$

Is Harry correct?
Explain how you know.

NO, Since $x^{-1} = \frac{1}{x}$, then $x^{-2} = (x^{-1})^2 = \left(\frac{1}{x}\right)\left(\frac{1}{x}\right) = \left(\frac{1}{x^2}\right)$

$x^{-1} = \frac{1}{x}$ is just reciprocal but x^{-2} must equal $\left(\frac{1}{x}\right)^2$
because its has a power. .... [1]

8 **(a)** The nth term of a sequence is given by $7-5n$.

Which term in the sequence has the value –88?

$7-5n=-88$

$-5n=-95$

$n=\frac{-95}{-5}$

19^{th} term .... [2]

✓

(b) Find an expression for the nth term of the following sequence.

3 24 81 192 375 …

$6a=18$

$a=3$

21 57 111 183

$12(3)-2b=36$

$b=0$

36 54 72

18 18

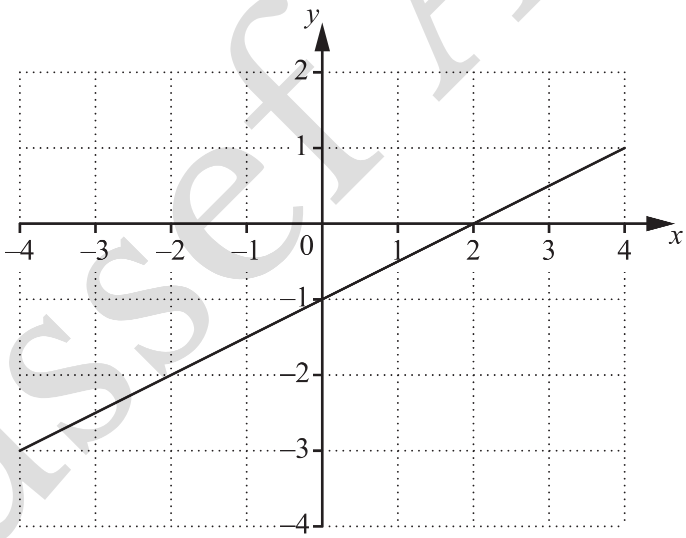
$7(3)+3b+c=21$

$c=0$

$3n^3$ .... [2]

✓

9



The diagram shows the graph of a straight line.

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

$(2,0)\ (0,-1)$

$m=\frac{y_2-y_1}{x_2-x_1}=\frac{-1-0}{0-2}$

$=\frac{-1}{-2}$

$y=$ $\frac{1}{2}x-1$ .... [3]

✓

10 **(a)** Expand and simplify $(a + b)^2$.

$(a)^2 + 2(a)(b) + (b)^2$

$a^2 + 2ab + b^2$ .... [2]

(b) Find the value of $a^2 + b^2$ when $a + b = 6$ and $ab = 7$.

$(a+b)^2 = a^2 + b^2 + 2ab$

$a^2 + b^2 + 2(7)$

$a^2 + b^2 + 14$

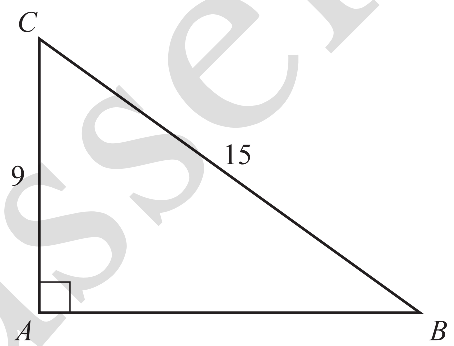
$a^2 + b^2 = (a+b)^2 - 14$

$a^2 + b^2 = (6)^2 - 14$

$a^2 + b^2 = 36 - 14$

22 .... [1]

11



NOT TO SCALE

Find AB.

$c^2 = a^2 + b^2$

$AB = \sqrt{15^2 - 9^2}$

$= \sqrt{225 - 81}$

$= \sqrt{144}$

$AB =$ .... 12 .... [3]

12 The surface area of a child's model car is $200\,\text{cm}^2$.
The surface area of the full size car is $32\,\text{m}^2$.

Find the scale of the model in the form $1:n$.

$1\text{m} = 100\text{cm}$
$1\text{m}^2 = 10000\text{cm}^2$

$\sqrt{1} : \sqrt{1600}$

$32\text{m}^2 = 320000\text{cm}^2$

$\frac{320000}{200} = 1600\text{cm}^2$

1 : ......40...... [3]

13 By rounding each number correct to 1 significant figure, estimate the value of

$$\sqrt{\frac{19.01 - 1.95}{0.016}}.$$

$\sqrt{\frac{20 - 2}{0.02}}$
$= \sqrt{900}$
$= \sqrt{9 \times 100}$

......30...... [2]

14 Emily invests $\$x$ at a rate of 4% per year simple interest.
After 5 years she has $26 interest.

Find the value of x.

$I = \frac{PRT}{100}$

$26 = \frac{x \times 4 \times 5}{100}$

$2600 = 20x$

$x = \frac{260\cancel{0}}{2\cancel{0}}$

x = ...130...... [3]

15 **(a)** Show that $0.\dot{3}\dot{1}$ can be written as $\frac{31}{99}$.

$x = 0.3131$

$10x = 3.131$

$100x = 31.31$

$$\begin{array}{r} 100x = 31.31 \\ - \quad x = 0.3131 \\ \hline 99x = 31 \end{array}$$

$x = \frac{31}{99}$

[2]

(b) Write $\sqrt{80} + \sqrt{45}$ in the form $a\sqrt{5}$, where a is an integer.

$\sqrt{80} = \sqrt{4 \times 20}$

$= \sqrt{16 \times 5}$

$= 4\sqrt{5}$

$\sqrt{45} = \sqrt{9 \times 5}$

$= 3\sqrt{5}$

$4\sqrt{5} + 3\sqrt{5}$

$7\sqrt{5}$ .... [2]

16 Write as a single fraction in its simplest form.

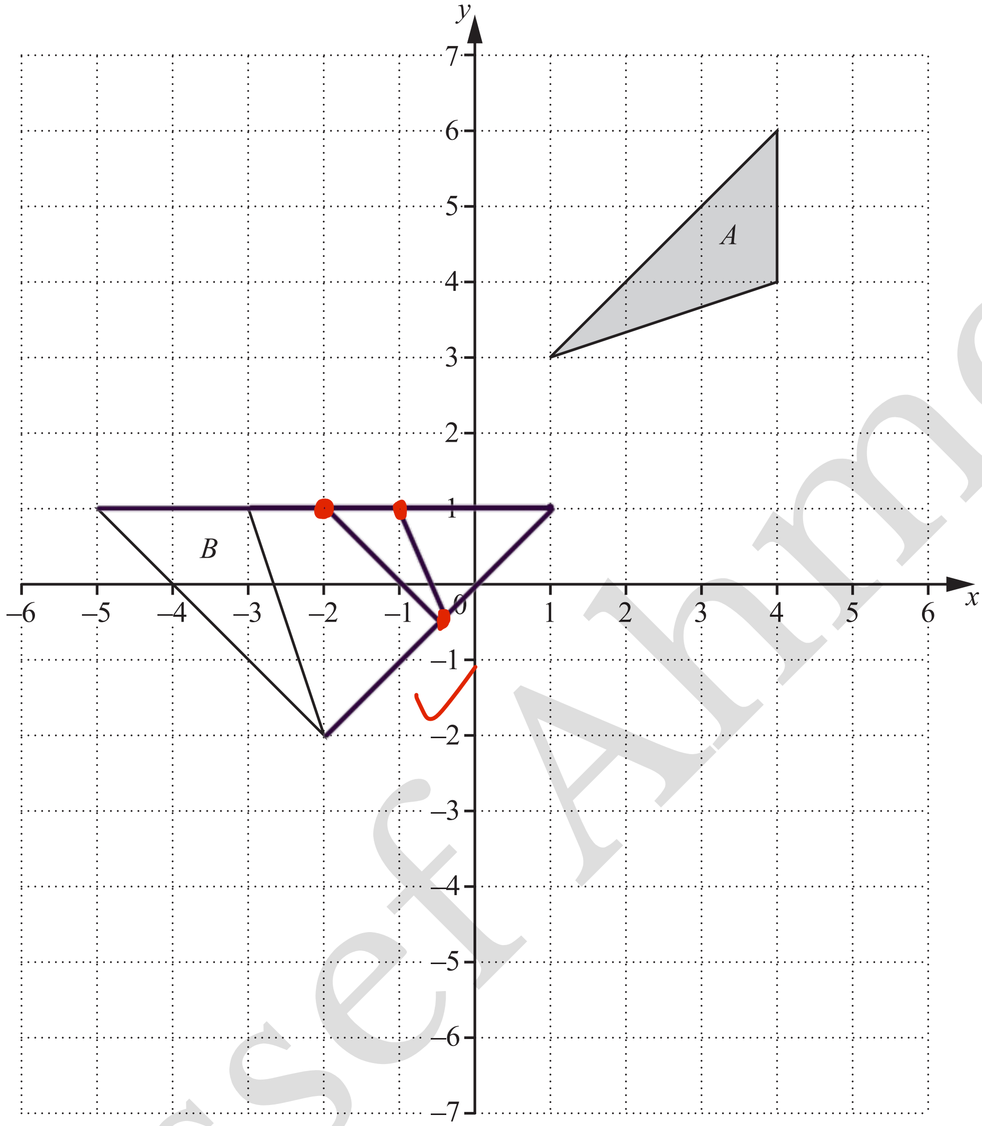
$$\frac{5}{3x-2} - \frac{7}{x+1}$$

$\frac{5(x+1) - 7(3x-2)}{(3x-2)(x+1)}$

$\frac{5x + 5 - 21x + 14}{(3x-2)(x+1)}$

$\frac{19-16x}{(3x-2)(x+1)}$ .... [3]

15



(a) Describe fully the **single** transformation that maps triangle A onto triangle B.

Rotation. 90° anticlockwise centre (2, –1)

.... [3]

(b) On the grid, draw the image of triangle A after the transformation represented

Draw the enlargement of shape B with scale factor $\frac{1}{2}$ and centre (1, 1). [2]

Shape with vertices of (–2, 1)
(–1, 1)
$(-\frac{1}{2}, -1)$

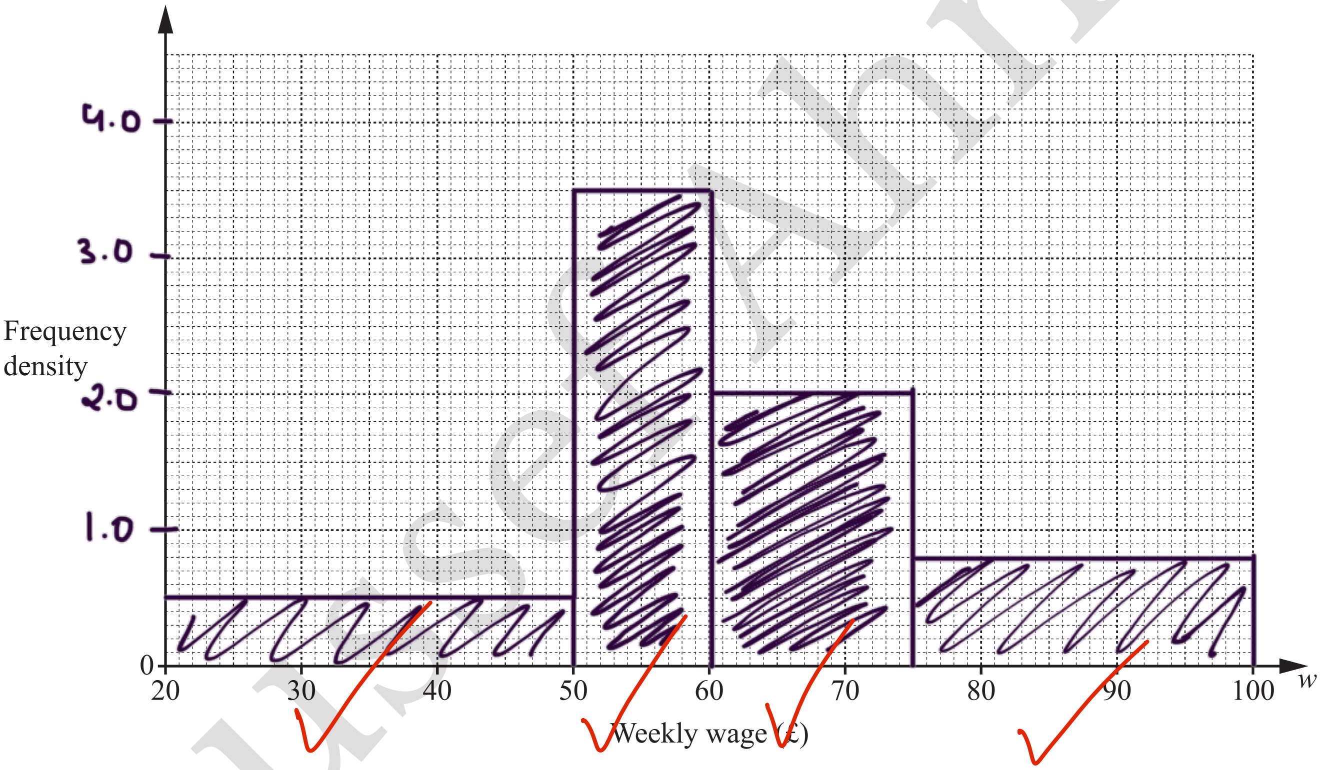
18 The table shows information about the weekly wages earned by each of 100 part-time workers.

$f.d = \frac{f}{c.w}$

Weekly wage (£w)	Frequency
$20 \leqslant w < 50$	15
$50 \leqslant w < 60$	35
$60 \leqslant w < 75$	30
$75 \leqslant w < 100$	20

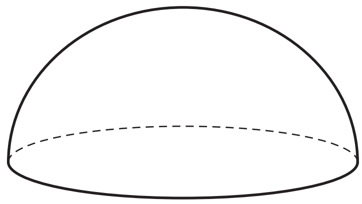
c w	f.d
30	0.5
10	3.5
15	2
25	0.8

On the grid, draw a histogram to represent this information.



[4]

19 The diagram shows a solid hemisphere.



The **total** surface area of this hemisphere is 243π.
The volume of the hemisphere is $k\pi$.

Find the value of k.

SA of sphere $= \frac{4\pi r^2}{2} + \pi r^2$

$= 3\pi r^2$

$3\pi r^2 = 243\pi$

$r^2 = \frac{243\cancel{\pi}}{3\cancel{\pi}}$

$r^2 = \sqrt{81}$

$r = 9$ cm

$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times 9^3$

$= \frac{4}{3}\pi \times 729$

$= \frac{2916\pi}{3}$

$= \frac{972\pi}{2}$ (bcs hemisph)

$k = $ .... 486π .... [4]

$K = 486$

20 The solutions of the equation $x^2 - 6x + d = 0$ are both integers.
d is a prime number.

Find d.

$x^2 - 6x + d = 0$

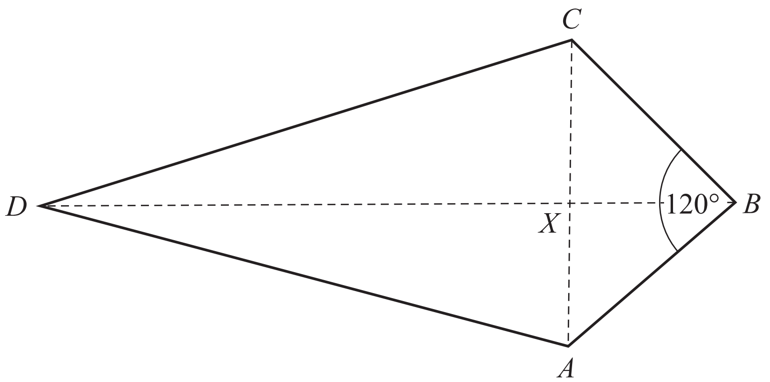
$S = -6$ $P = d < {-5 \atop -1}$ $\times$ $= \underline{\underline{5}}$ (only prime no)

$d < {-3 \atop -3}$ $\times$ $= 9$

$d < {-4 \atop -2}$ $\times$ $= 8$

$d = $ .... 5 .... [3]

21



NOT TO SCALE

ABCD is a kite.
The diagonals *AC* and *BD* intersect at *X*.
$AC = 12$ cm, $BD = 25$ cm and angle $ABC = 120°$.

(a) Work out the area of the kite.

$A = \frac{1}{2}bh$

$= \frac{1}{2}(12)(25)$

$= 300 \times \frac{1}{2}$

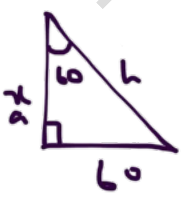
.......150....... cm^2 [2]

(b) Find the length of *BX* in simplest form.

$AC = 12$ cm

$AX = XC = 6$ cm

$\frac{120}{2} = 60$



$\tan 60 = \frac{6}{x}$

$x = \frac{6}{\tan 60}$

$\tan 60 = \sqrt{3}$

$x = \frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \frac{6\sqrt{3}}{3} = 2\sqrt{3}$

.......$2\sqrt{3}$....... cm [3]

22 **(a)** y is inversely proportional to x.
$y = 10$ when $x = 4$.

(i) Find an equation connecting y and x.

$y = \frac{k}{x}$

$10 = \frac{k}{4}$

$k = 40$

$y = \frac{40}{x}$ .... [2]

(ii) Find the value of x when $y = \frac{5}{8}$.

$y = \frac{40}{x}$

$\frac{5}{8} = \frac{40}{x}$

$5x = 320$

$x = \frac{320}{5}$

$x =$ ......64...... [2]

(b) r is directly proportional to the cube root of V.

Complete the statement.

When r is multiplied by 2, V is multiplied by ......8...... [2]

23 Four whole numbers have the following properties

- the mode is 2
- the median is 5.5
- the mean is 6.

Find the four numbers.

$\frac{2+x}{2} = 5.5$

$2 + x = 11$

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

$13 + x = 24$

$x = 24 - 13$

......2...... , ...2...... , ...9...... , ...11...... [3]

24 Fifteen people go on an activity holiday.

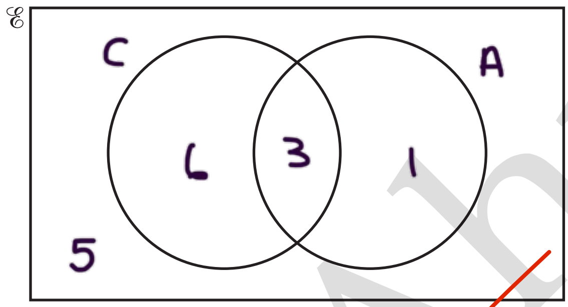
Of these 15 people:

- 9 go canoeing
- 4 go abseiling
- 5 do not go canoeing or abseiling

A person is chosen at random from those who go canoeing or abseiling or both.

Find the probability that this person goes canoeing or abseiling but does not do both activities.

You may use this diagram to help you.



$9 - \cancel{x + x} + 4 - x + 5 = 15$

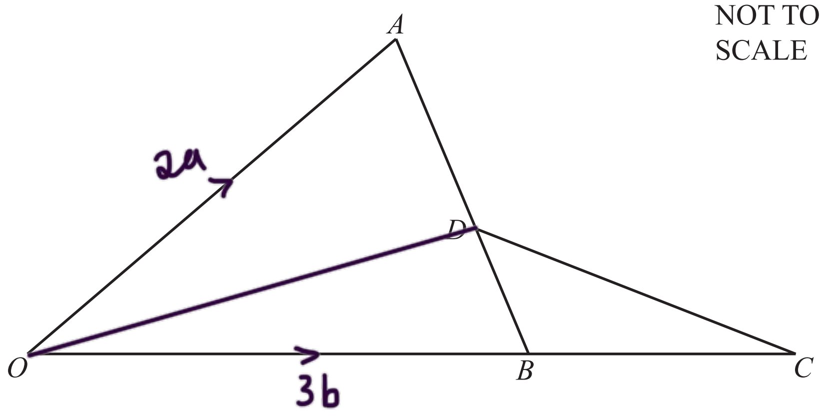
$18 - x = 15$

$3 = x$

$\frac{7}{10}$

.... [4]

25



NOT TO SCALE

In the diagram,

- OBC is a straight line
- $\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$
- $OB : BC = 3 : 2$
- $\overrightarrow{AD} = \frac{3}{5}\overrightarrow{AB}$.

Find an expression, in terms of **a** and **b**, for $\overrightarrow{DC}$.

$$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$$
$$= -2a + 3b$$
$$\overrightarrow{AB} = 3b - 2a$$

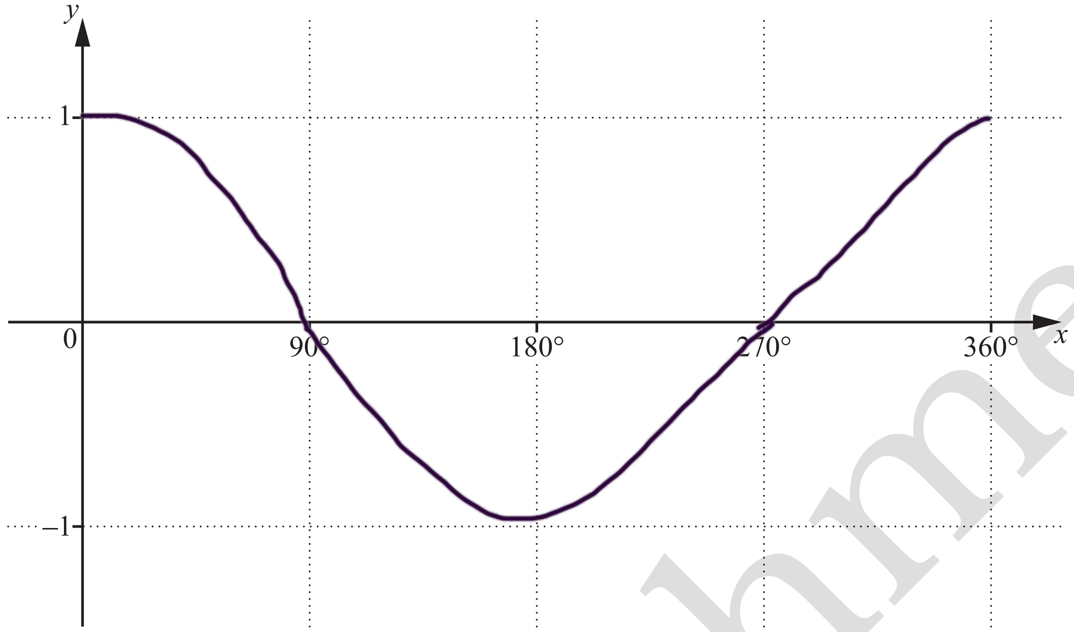
$$\overrightarrow{OD} = \overrightarrow{OA} + \overrightarrow{AD}$$
$$= 2a + \frac{3}{5}(3b - 2a)$$
$$= 2a + \frac{9}{5}b - \frac{6}{5}a$$
$$\overrightarrow{OD} = \frac{4}{5}a + \frac{9}{5}b$$

$$\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC}$$
$$= 3b + \frac{2}{3}(3b)$$
$$= 3b + 2b$$
$$\overrightarrow{OC} = 5b$$

$$\overrightarrow{DC} = \overrightarrow{DO} + \overrightarrow{OC}$$
$$= -\frac{4}{5}a - \frac{9}{5}b + 5b$$
$$= -\frac{4}{5}a + \frac{16}{5}b$$

$\overrightarrow{DC} =$ $\frac{16}{5}b - \frac{4}{5}a$ [4]

26 **(a)** On the grid, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Find all the solutions of the equation $2\cos x = 1$ for $0° \leqslant x \leqslant 360°$.

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

$x = \cos^{-1}\left(\frac{1}{2}\right)$

$x = 60°$

$x = 360 - 60$

$= 300$

60°, 300° [2]

27 $f(x) = 2x + 3$ $g(x) = x^2$

(a) Find f(g(6)).

$g(6) = (6)^2$
$= 36$

$fg(6) = 2(36) + 3$
$= 72 + 3$

75 .... [2]

(b) Find $f^{-1}(x)$.

$y = 2x + 3$
$y - 3 = 2x$

$f^{-1}(x) =$ $\frac{x-3}{2}$ .... [2]

(c) Find $f(f^{-1}(5))$.

$f^{-1}(5) = \frac{5-3}{2}$
$= 1$

$ff^{-1}(5) = 2(1) + 3$

5 .... [1]