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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/41**

Paper 4 (Extended) **October/November 2021**

2 hours 15 minutes

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 graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly and you will be given marks for correct methods, including sketches, even if your answer is incorrect.
- 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 your calculator value.

INFORMATION

- The total mark for this paper is 120.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages.

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Formula List

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

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

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

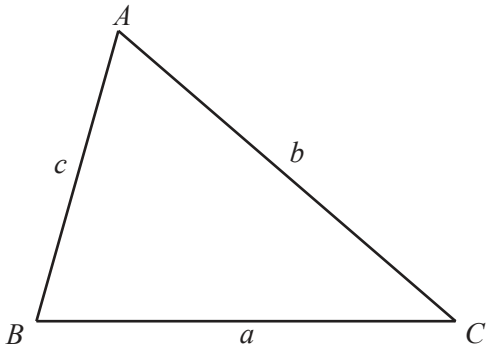
Curved surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

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. $\quad V = \frac{4}{3}\pi r^3$



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

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

$$\text{Area} = \frac{1}{2}bc\sin A$$

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Answer **all** the questions.

1 Amir, Bibi and Caitlyn are each given \$1500 to invest.

(a) Amir invests his \$1500 in an account which pays compound interest.
The interest rate is 3% per year for 5 years, after which it is 2% per year.

Find the value of Amir's investment at the end of 11 years.

\$ ..... [3]

(b) Bibi invests her \$1500 in an account which pays r% per year **simple** interest.
At the end of 11 years, the investment is worth \$1962.

Calculate the value of r.

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

(c) Caitlyn invests her \$1500 in an account which pays t% per year **compound** interest.
At the end of 11 years, the investment is worth \$1968.13 .

Calculate the value of t.

$t =$ ..... [3]

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2 **(a)** In **part (a)** enlargements and stretches have scale factors greater than 1.

(i) A transformation maps triangle A onto triangle B.
Triangle A is congruent to triangle B.

Tick all the possible transformations it could be.

Transformation	Tick (✓)
Rotation	
Reflection	
Translation	
Enlargement	
Stretch	

[1]

(ii) A transformation maps triangle C onto triangle D.
The angles of triangle C are the same as the corresponding angles of triangle D.

Tick all the possible transformations it could be.

Transformation	Tick (✓)
Rotation	
Reflection	
Translation	
Enlargement	
Stretch	

[1]

(iii) A transformation maps triangle E onto triangle F.
Triangle F has a larger area than triangle E.

Tick all the possible transformations it could be.

Transformation	Tick (✓)
Rotation	
Reflection	
Translation	
Enlargement	
Stretch	

[1]

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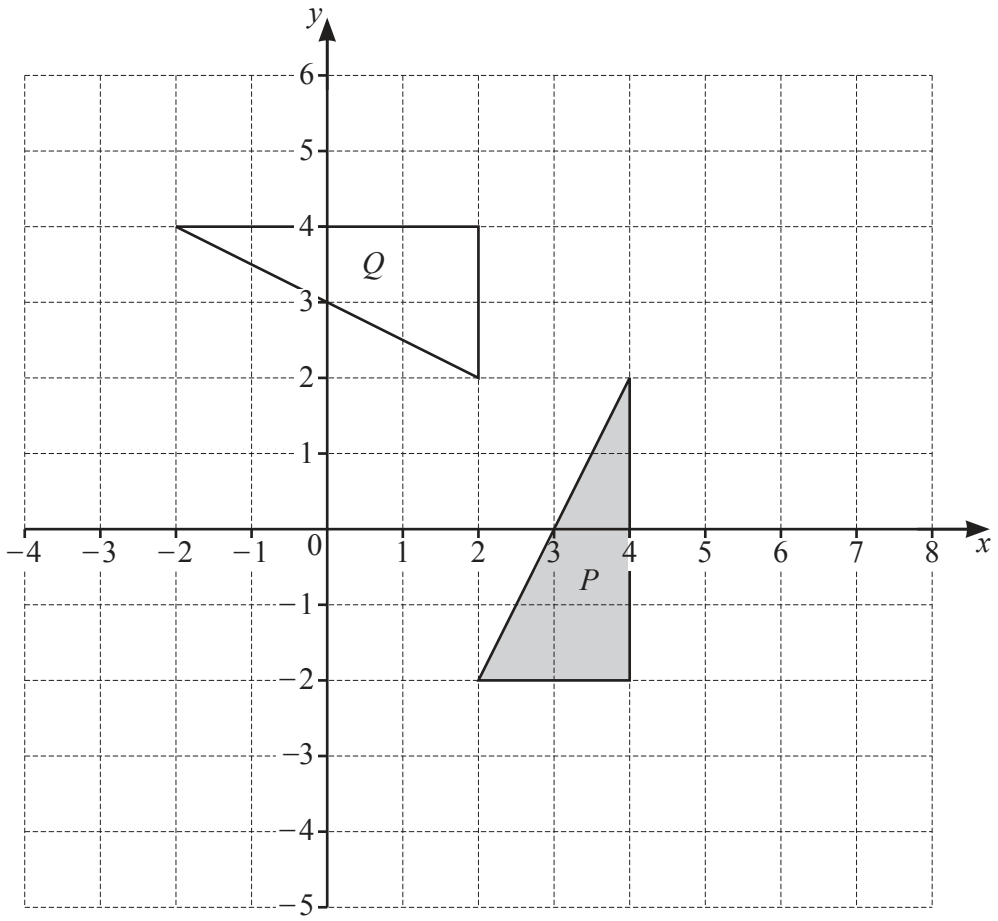
(b)



(i) Describe fully the **single** transformation that maps triangle *P* onto triangle *Q*.

.....

..... [3]

(ii) Stretch triangle *P* with the *x*-axis invariant and scale factor 2. [2]

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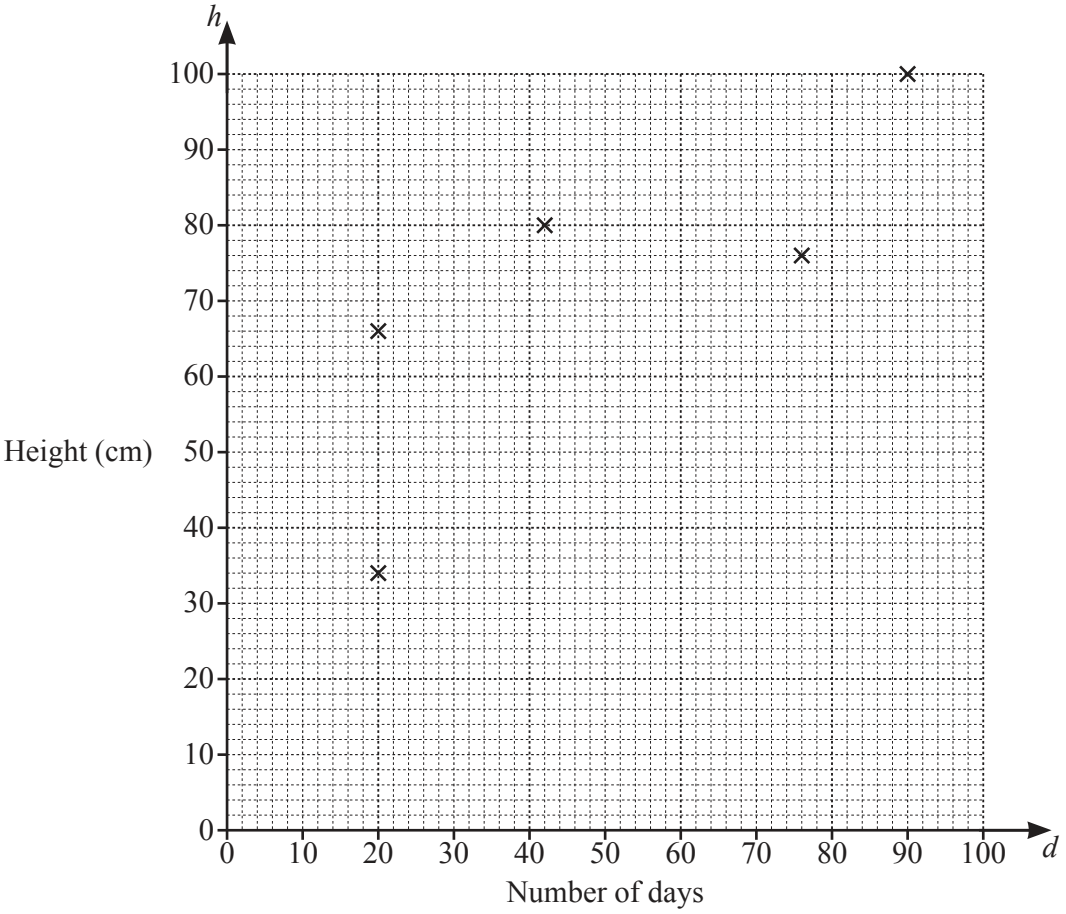
3 The table shows the number of days, d, since planting and the heights, h cm, of some plants.

Number of days (d)	20	20	42	76	90	24	86	98	10	56
Height (h cm)	34	66	80	76	100	50	86	94	40	54

(a) Complete the scatter diagram.
The first five points have been plotted for you.



[2]

(b) What type of correlation is shown in the scatter diagram?

..... [1]

(c) Find the equation of the regression line for h in terms of d.

$h =$ ..... [2]

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(d) Use your regression line to estimate the height of a plant that was planted 28 days ago.

..... cm [1]

(e) A plant was planted 140 days ago.

Explain why you should not use the equation of the regression line to estimate the height of this plant.

..... [1]

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4 The table shows a set of data.

x	Frequency
5	16
6	18
7	25
8	11
9	6
10	4
Total	80

(a) When x represents the number of emails Essa receives each day, find

(i) the median,

..... [1]

(ii) the range,

..... [1]

(iii) the upper quartile,

..... [1]

(iv) the mean.

..... [2]

(b) When x represents the height of a seedling, correct to the nearest centimetre, explain why you cannot work out the range of the heights.

.....

..... [1]

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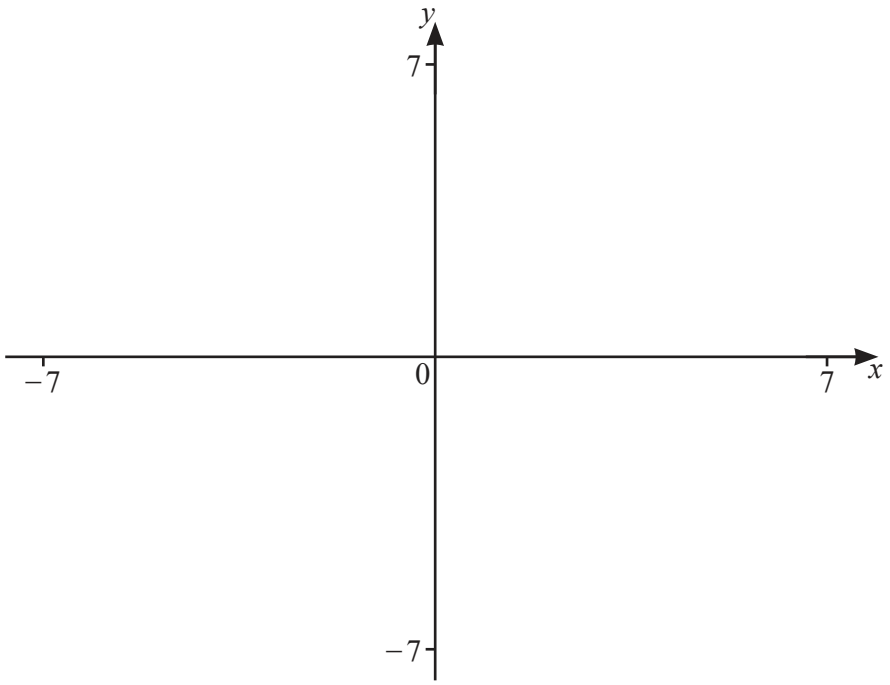
5



$$f(x) = \frac{(2x^2 + 3)}{(x+1)(2-x)} \text{ for } -7 \leqslant x \leqslant 7$$

(a) On the diagram, sketch the graph of $y = f(x)$. [3]

(b) Write down the equation of each asymptote parallel to the y-axis.

..... [2]

(c) Write down the coordinates of the local minimum.

(..... , ...) [2]

(d) Find the range of values of x for which the gradient of $f(x)$ is negative.

..... [3]

(e) Solve $f(x) = -x$.

$x =$ ..... [1]

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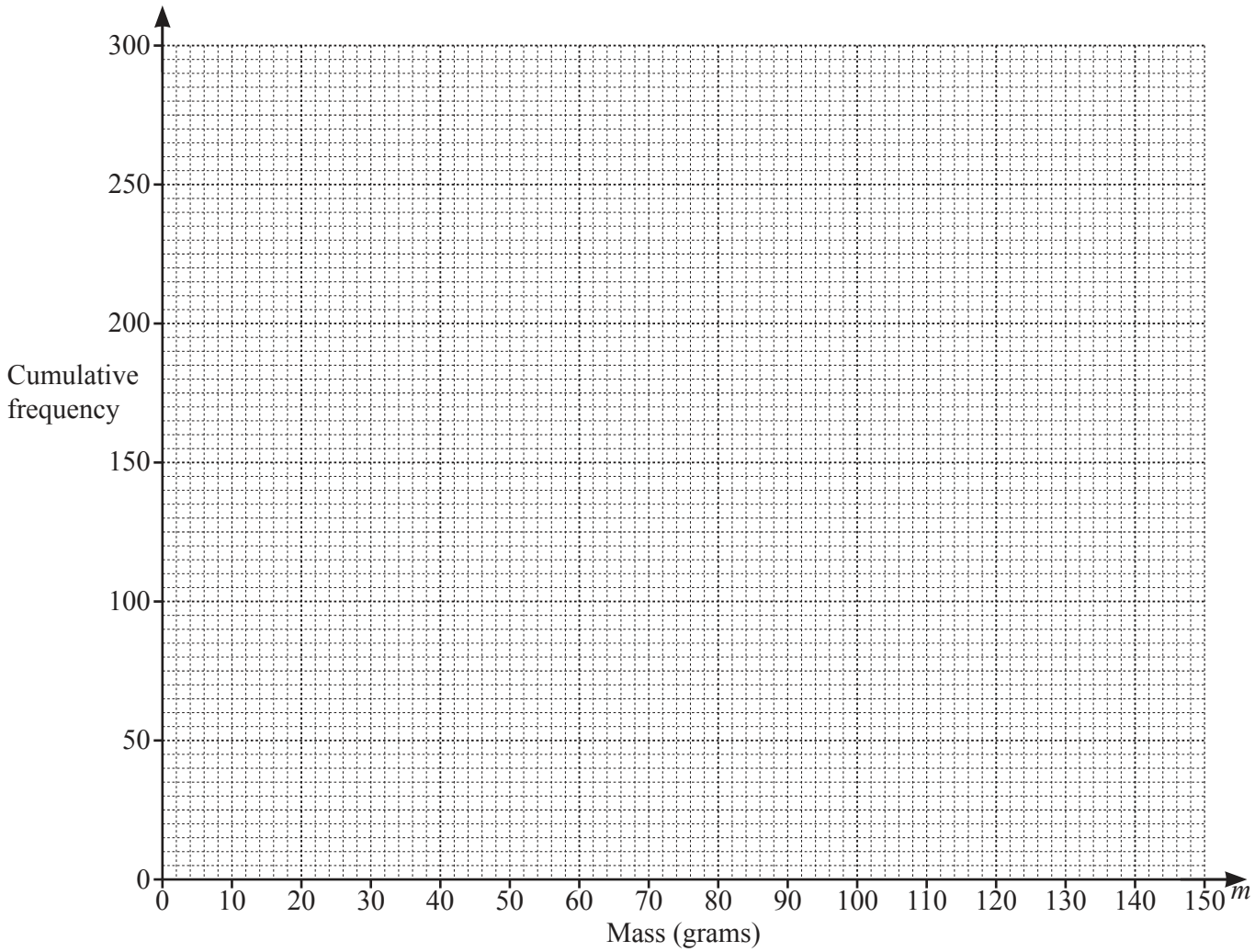
6 The masses of 300 apples are shown in the table.

Mass (m grams)	$0 < m \leqslant 25$	$25 < m \leqslant 50$	$50 < m \leqslant 75$	$75 < m \leqslant 100$	$100 < m \leqslant 125$	$125 < m \leqslant 150$
Frequency	4	26	60	88	106	16

(a) Draw a cumulative frequency curve to show these results.



[4]

(b) Use your curve to find the interquartile range.

..... [2]

(c) Apples with a mass below 80 g are used to make drinks.

Find the percentage of the 300 apples that are used to make drinks.

..... % [2]

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7 **(a)** The nth term of a sequence is $\frac{n(n+1)(2n+1)}{6}$.

Find the first three terms of this sequence.

..... , ... , ... [2]

(b) For each of the following sequences:

- find the next two terms
- find an expression for the nth term.

(i) 11 8 5 2

Next two terms ..... , ...

nth term ..... [3]

(ii) -2 -2 0 4 10 18

Next two terms ..... , ...

nth term ..... [3]

(iii) 3 5 9 17 33

Next two terms ..... , ...

nth term ..... [3]

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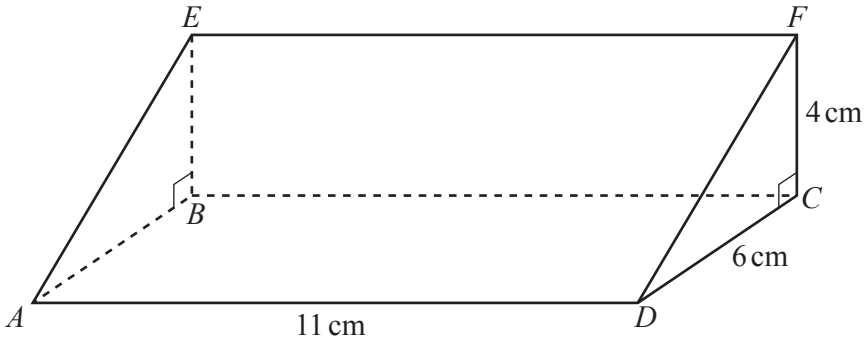
8



NOT TO SCALE

The diagram shows a right-angled triangular prism.
ABCD, *ADFE* and *BCFE* are rectangles.
$AD = 11\,\text{cm}$, $DC = 6\,\text{cm}$ and the height $CF = 4\,\text{cm}$.

(a) Calculate the volume of the prism.

..... cm^3 [2]

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

..... cm^2 [4]

(c) Calculate the length *AF*.

AF = ... cm [3]

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(d) Calculate angle *FAC*.

Angle *FAC* = ... [2]

(e) The volume of a mathematically similar prism is $445.5\,cm^3$.

Calculate the total surface area of this similar prism.

..... cm^2 [3]

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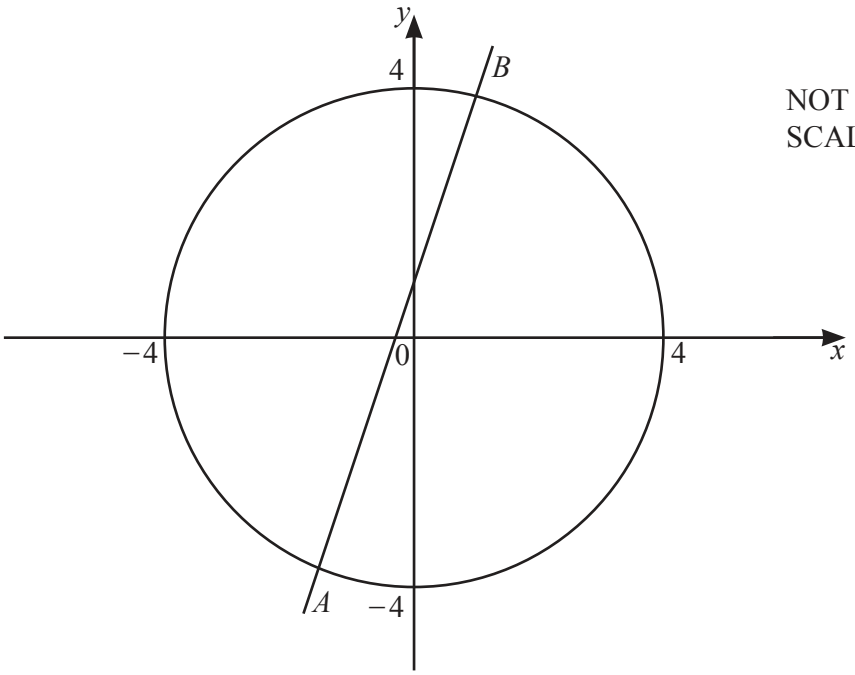

The equation of the circle is $x^2 + y^2 = 16$.
The equation of the straight line is $y = 3x + 1$.
The line crosses the circle at the points A and B.

(a) Use substitution to show that the x-coordinates of the points A and B satisfy the equation $10x^2 + 6x - 15 = 0$.

[3]

(b) Solve the equation $10x^2 + 6x - 15 = 0$ to find the coordinates of the points A and B. Show your working and give your answers correct to 2 decimal places.

A (..... , ...)

B (..... , ...) [4]

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10 $f(x) = 3x - 2$ $g(x) = (x-3)^2$

(a) Find $f(g(1))$.

..... [2]

(b) Solve $g(x) = 25$.

$x =$ ..... or $x =$ ..... [2]

(c) Find $f^{-1}(4)$.

..... [2]

(d) Write down $f(f^{-1}(x))$.

..... [1]

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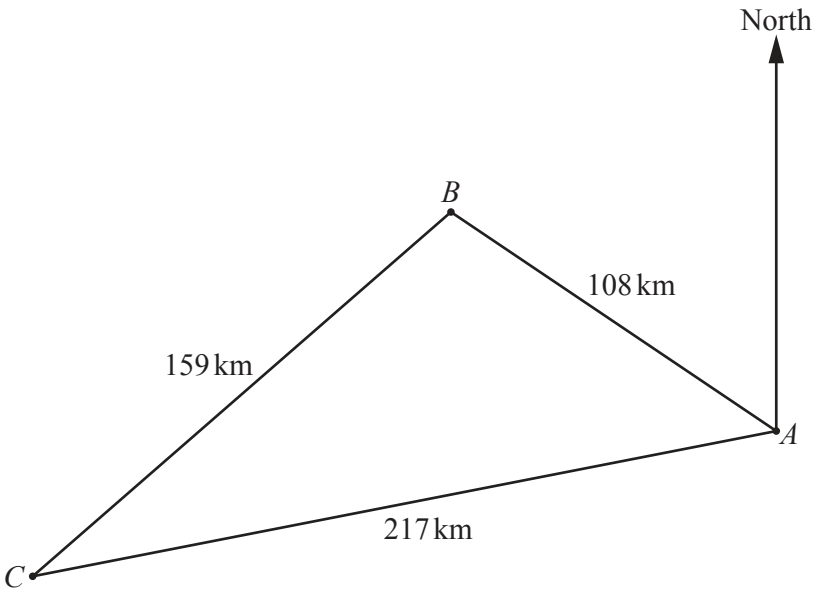
11



NOT TO SCALE

A, B and C are three ports.

(a) Show that angle $ABC = 107.2°$ correct to 1 decimal place.

[3]

(b) The bearing of B from A is 305°.

(i) Using the sine rule, show that angle $BAC = 44.4°$ correct to 1 decimal place.

[3]

(ii) Find the bearing of C from A.

..... [1]

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(c) A ship leaves A at 22 50 and sails at a constant speed of 24 km/h towards C.

Calculate the time, correct to the nearest minute, when the ship is nearest to B.

..... [5]

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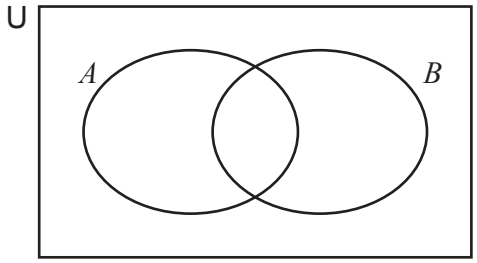
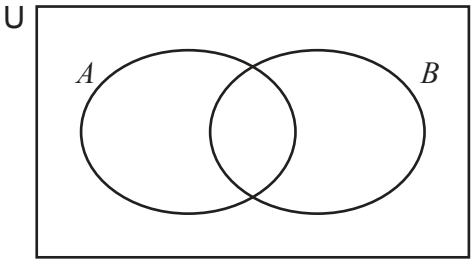
12 (a) (i) For each Venn diagram, shade the given set.



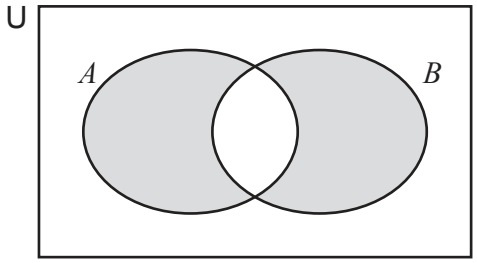
$A' \cup B$



$A \cap B'$

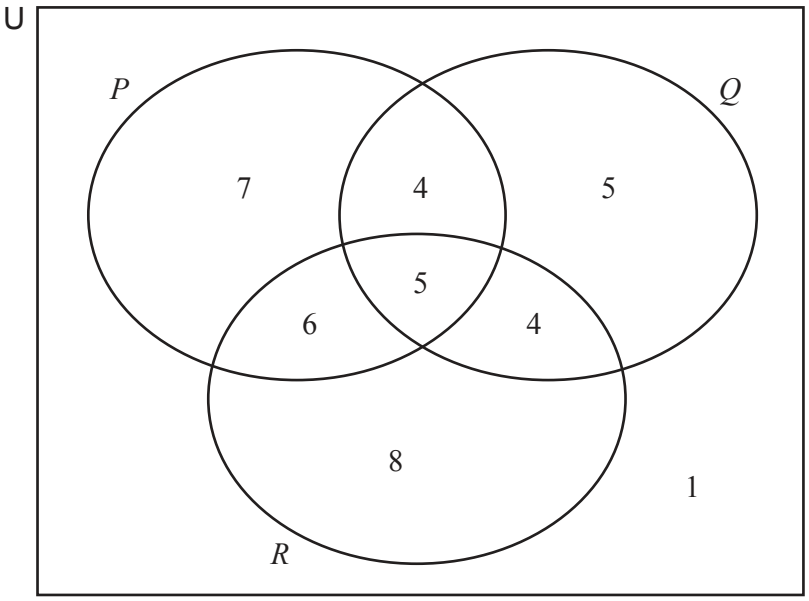
[2]

(ii) Use set language to describe the shaded set.



..... [1]

(b) 40 people are asked which of 3 television programmes, P, Q and R, they watch. The results are shown in the Venn diagram.



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(i) Two of the 40 people are chosen at random.

Find the probability that they both watch exactly 2 of the 3 programmes.

..... [2]

(ii) Two of the people who watch programme *P* are chosen at random.

Find the probability that one of them watches both other programmes and one watches just one of the other programmes.

..... [3]

(iii) Three of the 40 people are chosen at random.

Find the probability that two of them watch only programme *Q* and one of them watches only programme *R*.

..... [3]

Question 13 is printed on the next page.

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13 **(a)** Rearrange $y = \frac{ax+b}{ex+f}$ to make x the subject.

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

(b) $\mathrm{f}(x) = 3\sin(2x)°$

(i) Write down the amplitude and the period of $\mathrm{f}(x)$.

Amplitude = ...

Period = ... [2]

(ii) The graph of $y = \mathrm{f}(x)$ is stretched with the x-axis invariant and scale factor 3 to give the graph of $y = \mathrm{g}(x)$.

Find $\mathrm{g}(x)$.

$\mathrm{g}(x) =$ ..... [1]

(iii) The graph of $y = \mathrm{f}(x)$ is translated through $\begin{pmatrix} -90 \\ 0 \end{pmatrix}$ to give the graph of $y = \mathrm{h}(x)$.

Find $\mathrm{h}(x)$, giving your answer in its simplest form.

$\mathrm{h}(x) =$ ..... [2]

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