UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0510348785

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **May/June 2013**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **24** printed pages.

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Section A [52 marks]

Answer **all** questions in this section.

For Examiner's Use

1 **(a)** Solve $4(x - 2) = 7 - x$.

Answer $x =$ ..... [2]

(b) Solve the simultaneous equations.

$$2x + y = 7$$
$$4x - 3y = 19$$

Answer $x =$ .....

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

(c) **(i)** Write down the integer values that satisfy $-1 \leqslant n < 2$.

Answer ..... [1]

(ii) Solve $2 - 3y < 8$.

Answer ..... [2]

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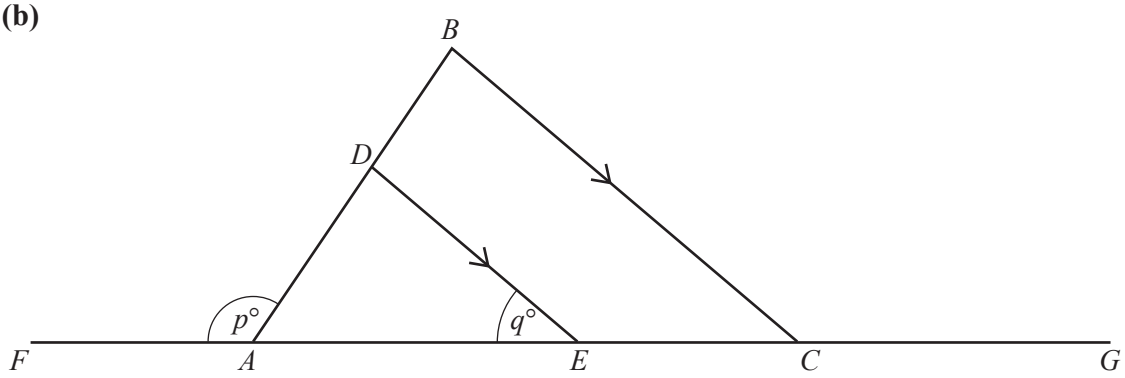
2 **(a)** The interior angle of a regular polygon is 165^o.

How many sides has the polygon?

For Examiner's Use

Answer ..... [2]

(b)



FAECG and *ADB* are straight lines. *DE* is parallel to *BC*.

(i) $F\hat{A}D = p°$ and $A\hat{E}D = q°$.
Find an expression in terms of p and/or q for

(a) $B\hat{C}G$,

Answer ..... [1]

(b) $D\hat{B}C$.

Answer ..... [1]

(ii) $AE = 7\,\text{cm}$, $EC = 3\,\text{cm}$, $DE = 5.6\,\text{cm}$ and $DB = 2.1\,\text{cm}$.

(a) Find BC.

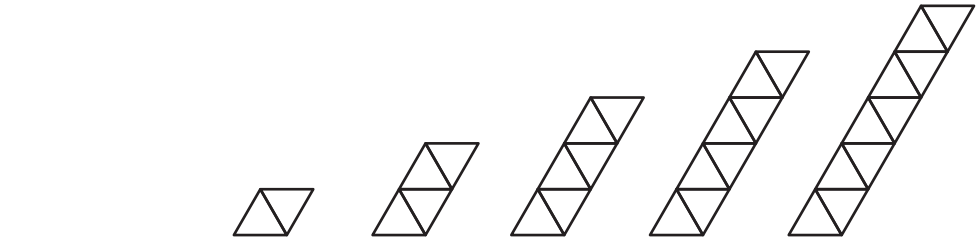
Answer ..... cm [1]

(b) Find AD.

Answer ..... cm [1]

For Examiner's Use

3 **(a)** The diagrams show parallelograms made from small triangles.



(i) Complete the table below.

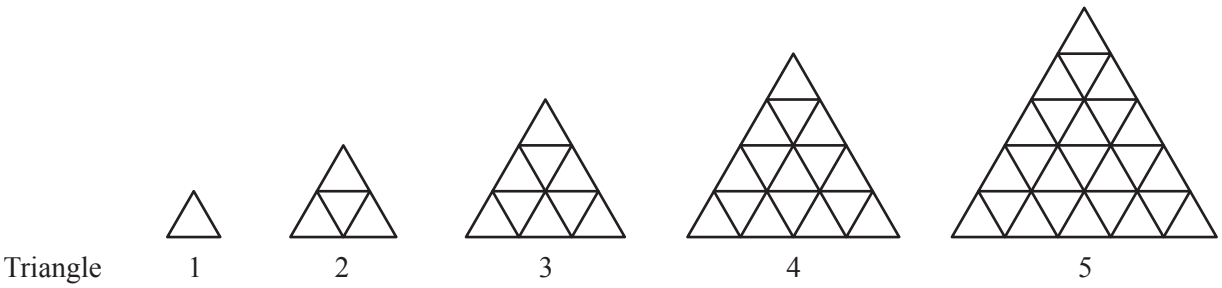
Parallelogram m	1	2	3	4	5	6
Number of small triangles	2	4	6	8		

[1]

(ii) Find an expression, in terms of m, for the number of small triangles used to make Parallelogram m.

Answer ..... [1]

(b) The diagrams show triangles made from the same small triangles.



(i) Complete the table below.

Triangle n	1	2	3	4	5	6
Number of small triangles	1	4	9	16		

[1]

(ii) Find an expression, in terms of n, for the number of small triangles used to make Triangle n.

Answer ..... [1]

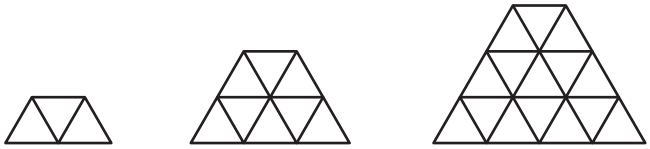
(iii) Triangle q is made from 324 small triangles.
Find q.

Answer ..... [1]

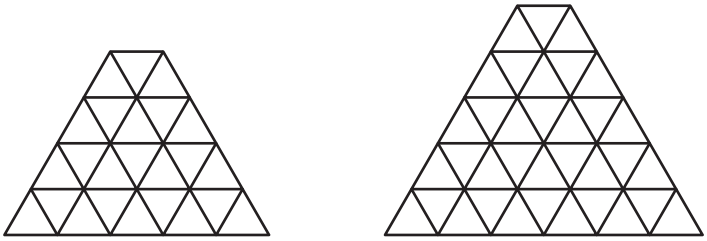
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(c) The diagrams show trapeziums made from the same small triangles.

For Examiner's Use



Trapezium 1 2 3



Trapezium 4 5

(i) By comparing the diagrams with those in parts **(a)** and **(b)**, find an expression, in terms of t, for the number of small triangles used to make Trapezium t.

Answer ..... [1]

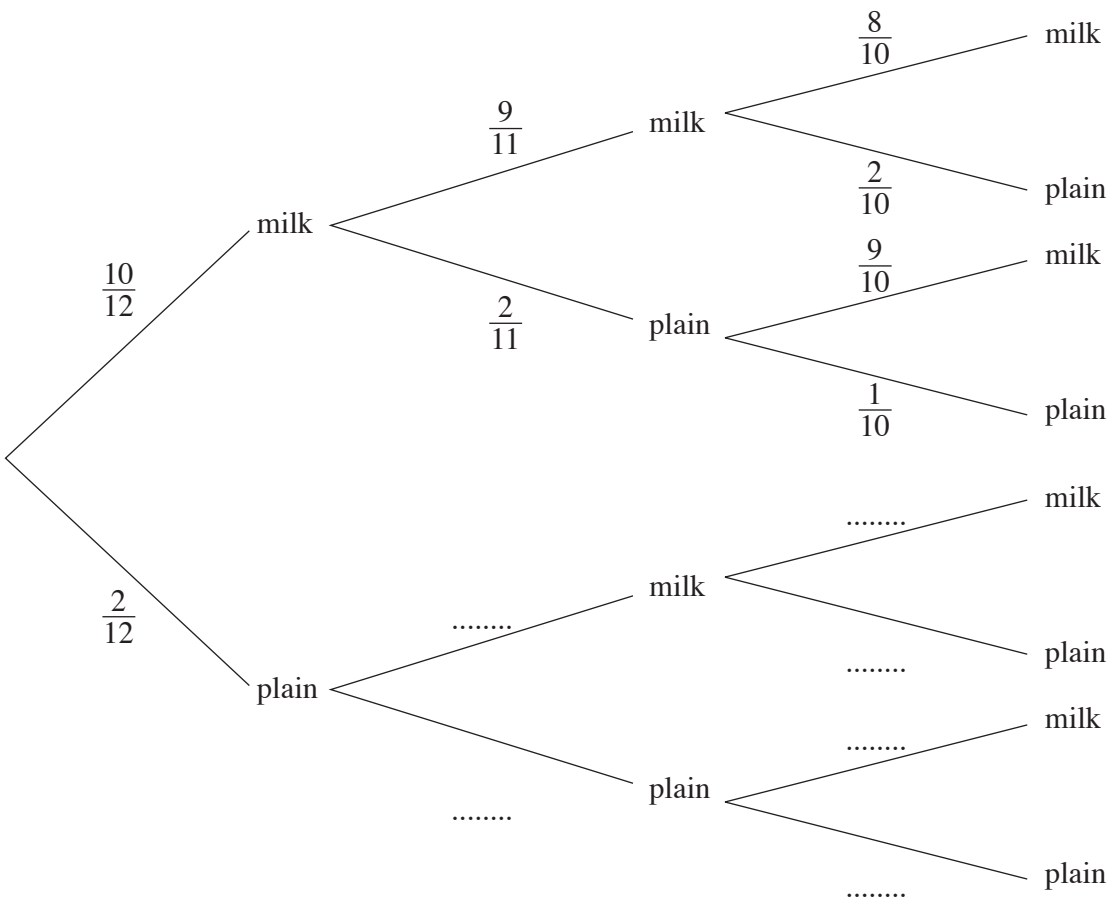
(ii) How many small triangles are used to make Trapezium 25?

Answer ..... [1]

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For Examiner's Use

4 **(a)** A box of chocolates contains 10 milk chocolates and 2 plain chocolates.
Sacha eats 3 chocolates chosen at random from the box.
The tree diagram shows the possible outcomes and their probabilities.



(i) Complete the tree diagram. [2]

(ii) Expressing each answer as a fraction in its lowest terms, find the probability that Sacha

(a) eats 3 milk chocolates,

Answer ..... [1]

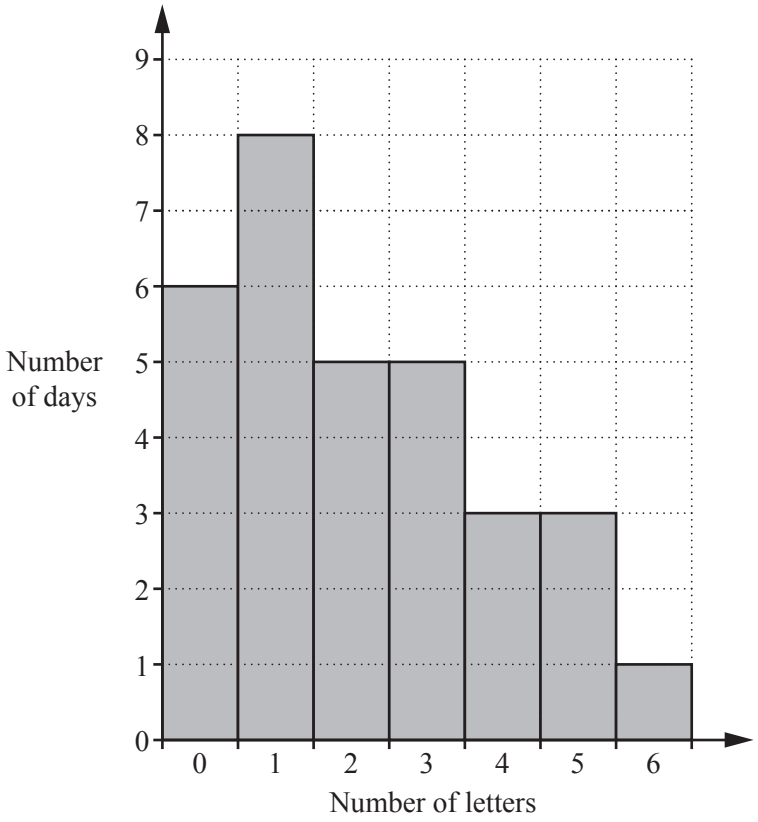
(b) eats 2 milk chocolates and 1 plain chocolate in any order.

Answer ..... [2]

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(b) The frequency diagram shows the distribution of the number of letters received by a family each day over a 31 day period.

For Examiner's Use



For this distribution, find

(i) the mode,

Answer ..... [1]

(ii) the median.

Answer ..... [1]

5 (a) (i)

For Examiner's Use

Exchange rate
$1 = €0.72

Eddie travels from the USA to Germany.
He changes $300 into euros (€).

How many euros does he receive?

Answer €..... [1]

(ii) When Eddie returns to the USA he has €51 left that he exchanges for $75.

What exchange rate has been used in this case?

Answer $1 = € ..... [1]

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(b) Greg buys 60 garden plants at a cost price of \$2.00 each to sell in his shop.
He sells 25 of them at a profit of 75% and 18 of them at a profit of 35%.
He sells the rest of the plants for $\frac{4}{5}$ of the cost price.

For Examiner's Use

(i) Calculate the profit or loss he makes from selling these 60 plants, stating if it is a profit or loss.

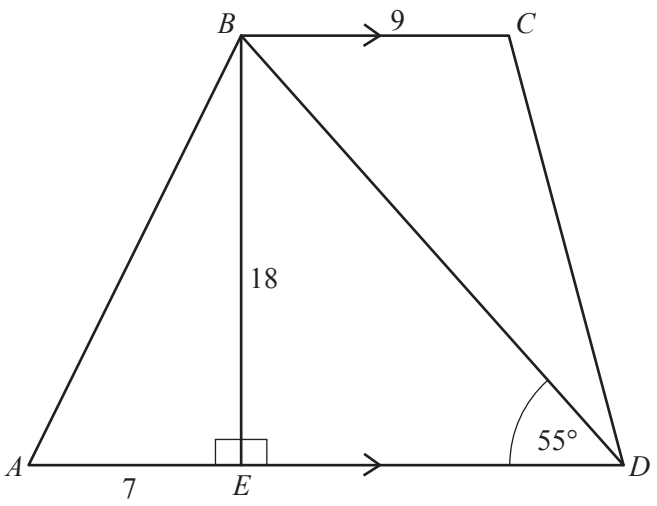
Answer Greg makes a ..... of \$..... [3]

(ii) Find the percentage profit or loss.

Answer ..... % [1]

For Examiner's Use

6 **(a)** *ABCD* is a trapezium with *BC* parallel to *AD*.



E is the point on *AD* such that *BE* is perpendicular to *AD*.
$B\hat{D}A = 55°$, $AE = 7\,\text{cm}$, $BE = 18\,\text{cm}$ and $BC = 9\,\text{cm}$.

Calculate

(i) $B\hat{A}E$,

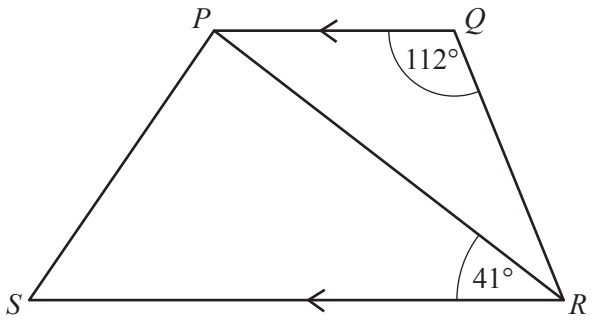
Answer ..... [2]

(ii) the area of the trapezium *ABCD*.

Answer .....cm^2 [4]

(b)

For Examiner's Use



$PQRS$ is another trapezium.
$P\hat{Q}R = 112°$ and $P\hat{R}S = 41°$, each measured correct to the nearest degree.

Find the smallest possible value of $Q\hat{R}P$.

Answer ..... [2]

For Examiner's Use

7 **(a)** In an athletics match Ben won the 100 m race in 9.98 s and Calvin won the 200 m race in 19.94 s.

What is the difference in their average speeds?
Give your answer in metres per second, correct to two decimal places.

Answer ..... m/s [2]

(b) Two cars each complete a journey of 120 km.
The first car is driven at an average speed of x km/h.
The second car is driven at an average speed 3 km/h faster than the first car.
The first car takes 6 **minutes** longer to complete the journey.

(i) Write down an equation in x and show that it simplifies to $x^2 + 3x - 3600 = 0$.

[3]

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(ii) Solve the equation $x^2 + 3x - 3600 = 0$, giving each answer correct to one decimal place.

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Answer $x =$ ..... or ..... [3]

(iii) How many **minutes** does the **first** car take to travel the 120 km?

Answer ..... minutes [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

For Examiner's Use

8 **(a)** $f(x) = \frac{4x - 3}{2}$

Find

(i) f (–2),

Answer f (–2) = ... [1]

(ii) $f^{-1}(x)$,

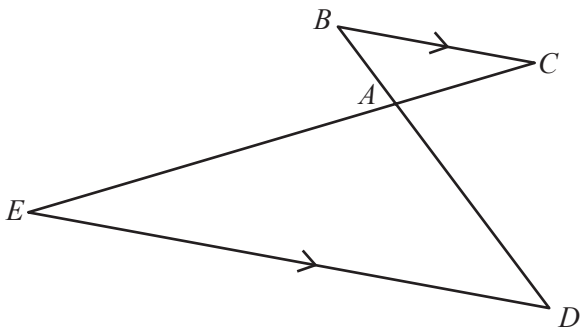
Answer $f^{-1}(x)$ = ... [2]

(iii) the value of g such that $f(2g) = g$.

Answer g = ... [2]

(b)

For Examiner's Use



BAD and CAE are straight lines and BC is parallel to ED.

$\overrightarrow{BA} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$, $\overrightarrow{ED} = \begin{pmatrix} 12 \\ -3 \end{pmatrix}$ and $\overrightarrow{BA} = \frac{1}{4}\overrightarrow{BD}$.

(i) Describe fully the **single** transformation that maps triangle ABC onto triangle ADE.

Answer .....

..... [2]

(ii) Calculate $|\overrightarrow{BA}|$.

Answer ..... [1]

(iii) Find $\overrightarrow{CD}$.

Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(iv) F is the midpoint of BD.
Find $\overrightarrow{EF}$.

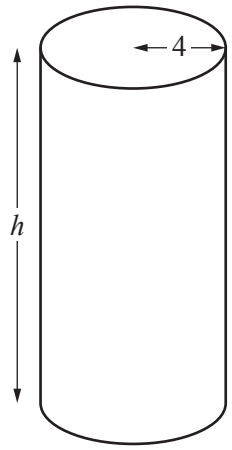
Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

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[Turn over

For Examiner's Use

9 **(a)** **Shape I** is a cylinder with radius 4 cm and height h cm.
The volume of **Shape I** is 1500 cm^3.



Shape I

(i) Find h.

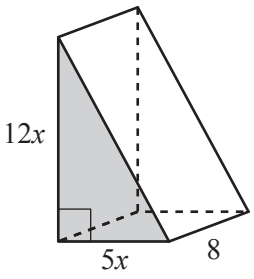
Answer ..... [2]

(ii) **Shape I** is made by pouring liquid into a mould at a rate of 0.9 litres per minute.
Find the number of **seconds** it takes to pour this liquid into the mould.

Answer ..... seconds [1]

(b) **Shape II** is a prism of length 8 cm with a triangular cross-section, shown shaded.
Two sides of the shaded triangle are at right angles to each other and have lengths $5x$ cm and $12x$ cm.

Given that **Shape II** also has a volume of 1500 cm^3, find x.

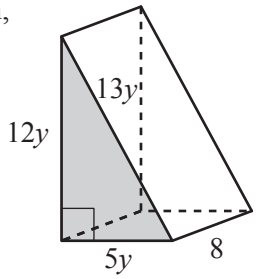


Shape II

Answer ..... [2]

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(c) **Shape III** is also a prism of length 8 cm with a triangular cross-section, shown shaded.
Two sides of the shaded triangle are at right angles to each other and have lengths $5y$ cm and $12y$ cm. The third side is of length $13y$ cm.
y satisfies the equation $4y^2 + 16y - 33 = 0$.



Shape III

For Examiner's Use

(i) Factorise $4y^2 + 16y - 33$.

Answer ..... [1]

(ii) Hence solve the equation $4y^2 + 16y - 33 = 0$.

Answer $y =$ ..... or ..... [1]

(iii) Find the area of the shaded triangle.

Answer ..... cm^2 [1]

(iv) Find the **total** surface area of **Shape III**.

Answer ..... cm^2 [3]

(d) Find $\dfrac{\text{Volume of } \textbf{Shape III}}{\text{Volume of } \textbf{Shape II}}$ as a fraction in its simplest form.

Answer ..... [1]

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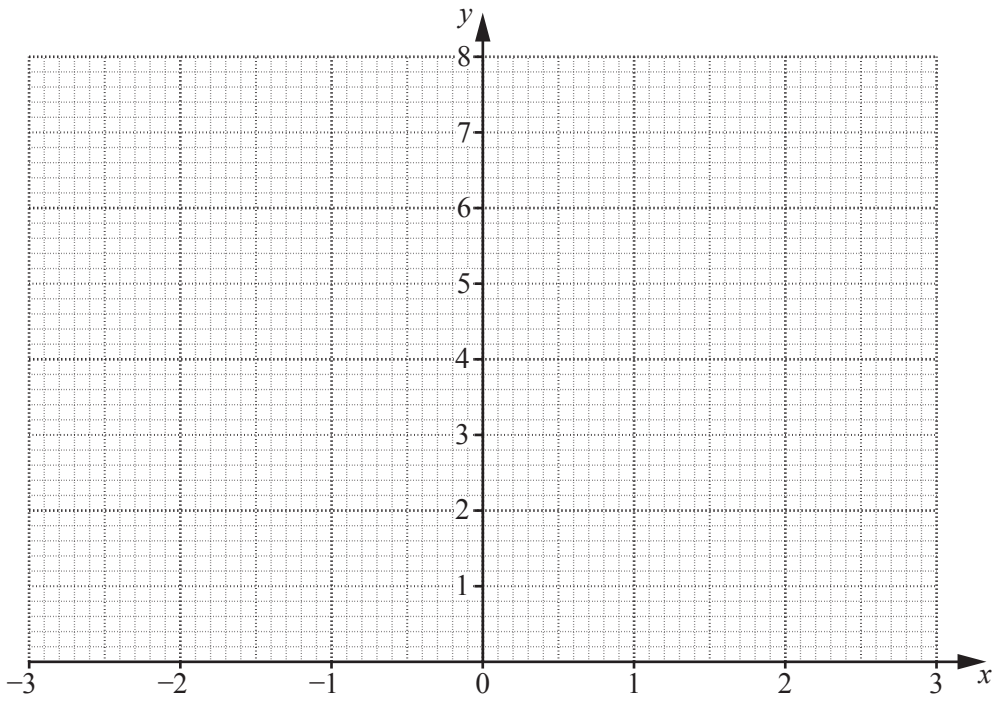
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10 **(a)** The table shows some values of x and the corresponding values of y for $y = \frac{6}{x^2}$.

x	–3	–2.5	–2	–1.5	–1	1	1.5	2	2.5	3
y		0.96	1.5	2.67	6	6	2.67	1.5	0.96	

(i) Complete the table. [1]

(ii) On the grid draw the graph of $y = \frac{6}{x^2}$ for $-3 \leqslant x \leqslant 3$.



[2]

(iii) Use your graph to find the values of x when $y = 2$.

Answer $x =$ ..... or ..... [1]

(iv) By drawing a tangent, find the gradient of the curve when $x = 1.5$.

Answer ..... [2]

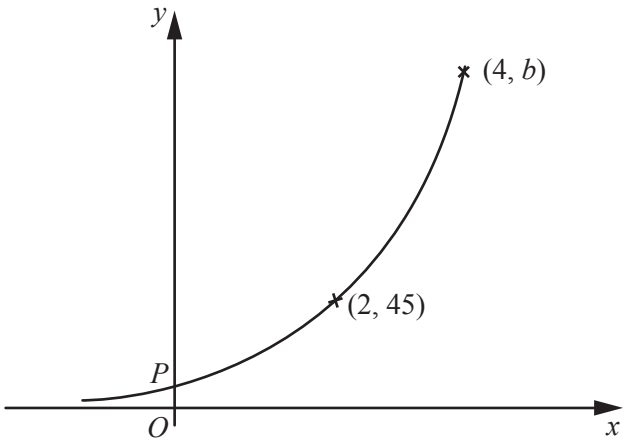
(v) By drawing a suitable line on the grid, solve the equation $\frac{6}{x^2} = 2 - x$.

Answer $x =$ ..... [2]

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(b) The graph shows a sketch of $y = 5a^x$.

For Examiner's Use



Two points on the curve are (2, 45) and (4, b).

(i) Find the values of a and b.

Answer $a =$ .....

$b =$ ..... [2]

(ii) Find the coordinates of the point, P, where the graph crosses the y-axis.

Answer (..... , ...) [1]

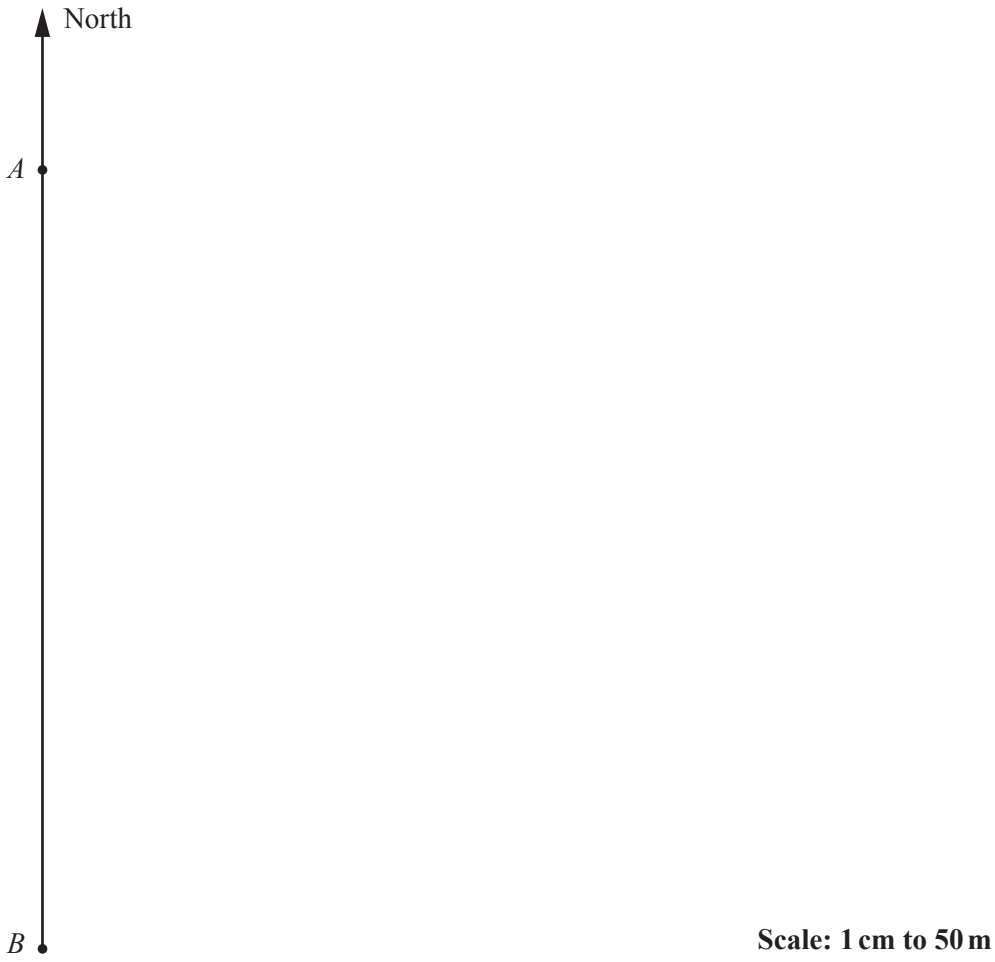
(iii) Find the gradient of the straight line joining the points P and (2, 45).

Answer ..... [1]

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For Examiner's Use

11 **(a)** The scale diagram shows the positions, A and B, of two boats.



(i) Find the actual distance between the two boats.

Answer .....m [1]

(ii) A third boat is positioned at C, such that $AC = 350$ m and $BC = 300$ m.
C is east of the line AB.

Use ruler and compasses to find C. [2]

(iii) Measure the bearing of C from A.

Answer ..... [1]

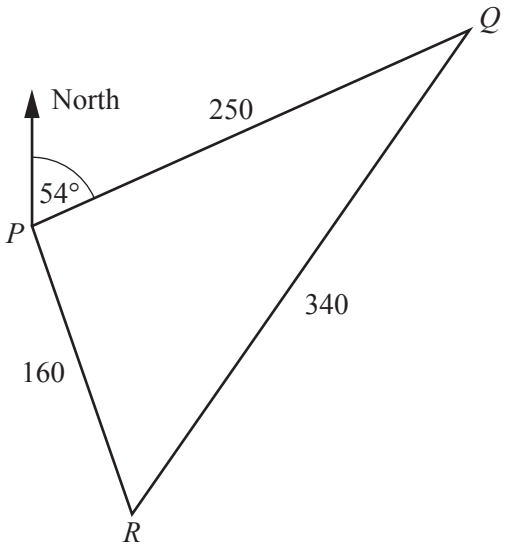
(iv) A fourth boat is positioned at D, such that AC is the line of symmetry of the quadrilateral $ABCD$.

Complete the quadrilateral $ABCD$. [2]

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(b) The diagram shows the positions, P, Q and R, of three buoys.
The bearing of Q from P is 054°, $PQ = 250$ m, $QR = 340$ m and $PR = 160$ m.

For Examiner's Use



(i) **Calculate** the bearing of R from P.

Answer ..... [4]

(ii) Calculate the area of triangle PQR.

Answer ..... m^2 [2]

12 **(a)** The distribution of the weights of luggage for 140 passengers is shown in the table.

For Examiner's Use

Weight of luggage (w kg)	$0 < w \leqslant 6$	$6 < w \leqslant 10$	$10 < w \leqslant 14$	$14 < w \leqslant 16$	$16 < w \leqslant 18$	$18 < w \leqslant 22$	$22 < w \leqslant 30$
Frequency	15	14	20	24	31	24	12

(i) Calculate an estimate of the mean weight of luggage.

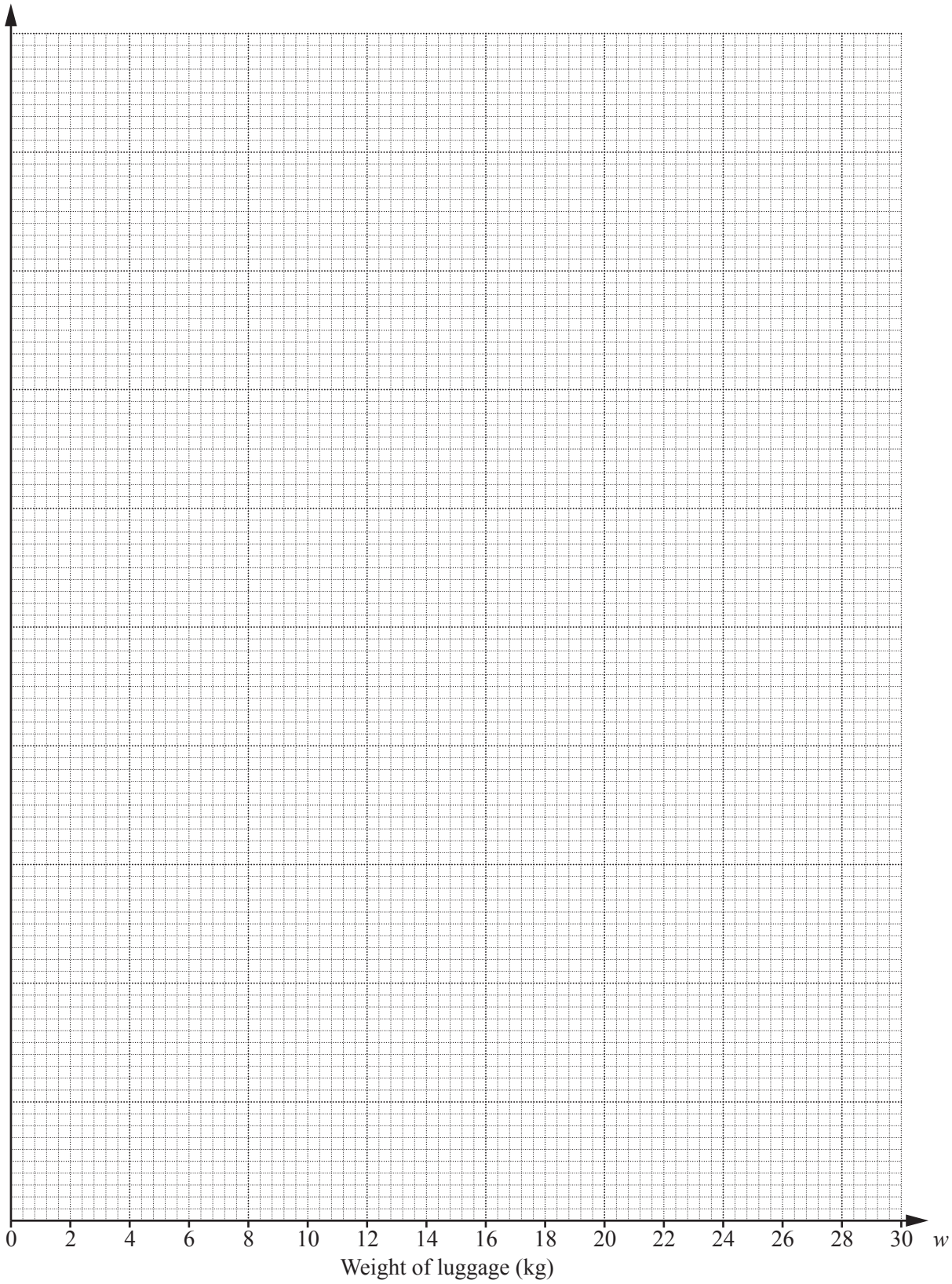
Answer ..... kg [3]

(ii) On the grid opposite, draw a histogram to represent this data. [3]

(iii) Estimate the probability that a passenger, chosen at random, has luggage weighing less than 13 kg.

Answer ..... [2]

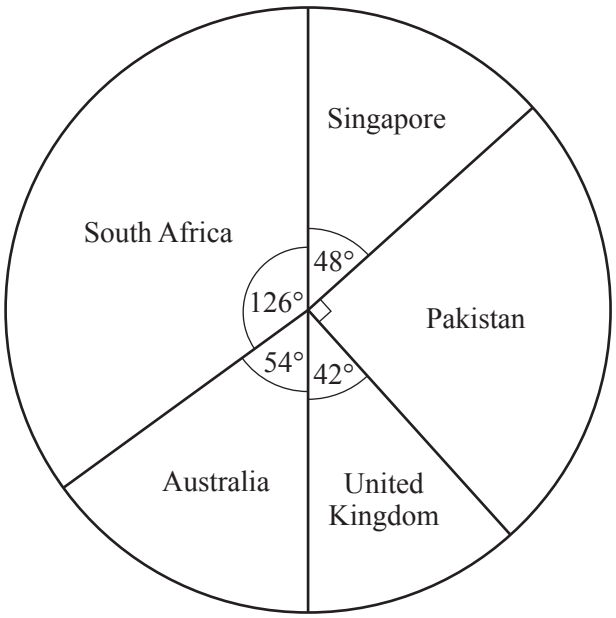
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TURN OVER FOR THE REST OF THE QUESTION

(b) The pie chart represents the distribution of the birth places of a group of 60 students.

Do not write in this margin



(i) Find the number of students in the group who were born in Australia.

Answer ..... [1]

(ii) Calculate the percentage of students in the group who were born in South Africa.

Answer .....% [1]

(iii) Four more students join the group.
Of these, two students were born in Pakistan, one in Singapore and one in China.
A new pie chart is to be drawn using the information about the **whole group** of students.

For the new pie chart, calculate the angle of the sector that represents the students born in Pakistan.
Give your answer correct to the nearest degree.

Answer ..... [2]

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