Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8175411573

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

Paper 2 **October/November 2014**

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, 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.

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Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** The table shows some of the nutritional information for a 300 g tin of soup.

Carbohydrate	18 g
Fat	20.1 g
Fibre	0.6 g
Sodium	1.38 g

(i) What percentage of the 300 g tin of soup is carbohydrate?

Answer ..... % [1]

(ii) What fraction of the 300 g tin of soup is fibre?
Give your answer as a fraction in its lowest terms.

Answer ..... [1]

(iii) Of the carbohydrates, 15% are sugars.

How many grams of sugars are in one tin of soup?

Answer ..... g [1]

(b) I need 2500 g of soup.

How many 300 g tins of soup do I need to buy?

Answer ..... [1]

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(c) During March there is a special promotion and the soup is on sale in tins containing 20% extra.

(i) These tins of soup each contain 4.2 g of protein.

How much protein was contained in each original 300 g tin of soup?

Answer ..... g [2]

(ii) The special promotion tins cost \$0.80 .
The soup can also be bought in larger tins containing 500 g for \$1.12 .

Is it better value to buy the 500 g tin or the special promotion tin?
Show your working.

[2]

2 Hendrik travels by plane from London to Bangkok.
When it is 04 00 local time in London it is 10 00 local time in Bangkok.

(a) The flight takes 11 hours and 15 minutes.

If he leaves London at 21 50 local time, what is the local time in Bangkok when he arrives?

Answer ..... [2]

(b) On his return journey, Hendrik leaves Bangkok at 07 45 local time and arrives back in London on the same day at 13 40 local time.

How long was his return flight?

Answer ..... hours ..... minutes [2]

(c) The graph opposite shows the exchange rate between British Pounds (£) and Thai Baht (THB) on the day Hendrik arrives in Bangkok.

(i) Use the graph to estimate the cost in British Pounds of an item costing 13 000 THB.

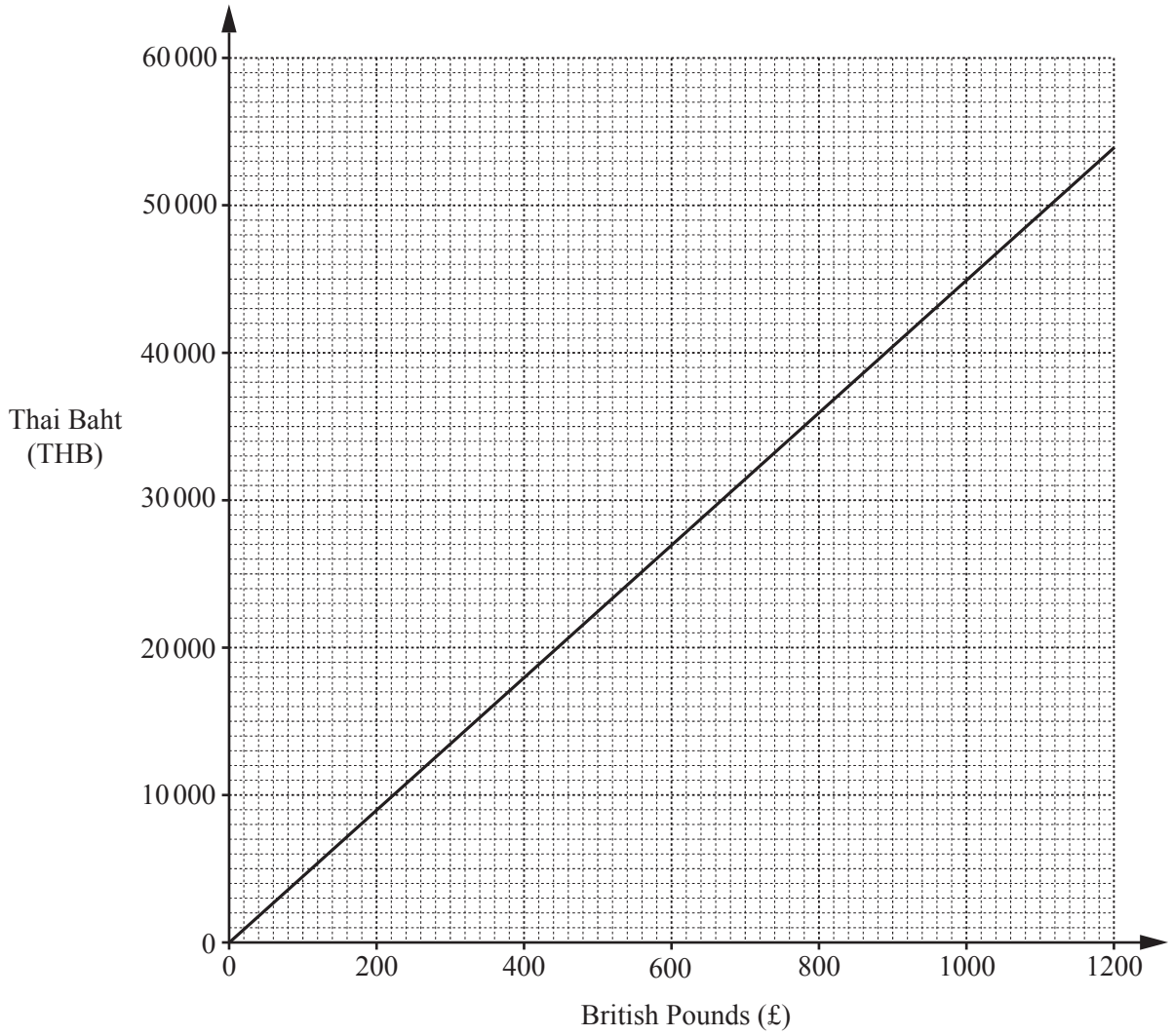
Answer £ ..... [1]

(ii) The exchange rate can be written as £1 = k THB.

Find k.

Answer ..... [1]

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(d) The cost of flights from London to Bangkok is shown in the table below.
For this cost, passengers are allowed to take luggage up to the weight shown.
Passengers taking more than this weight of luggage pay an excess charge at the rate shown.

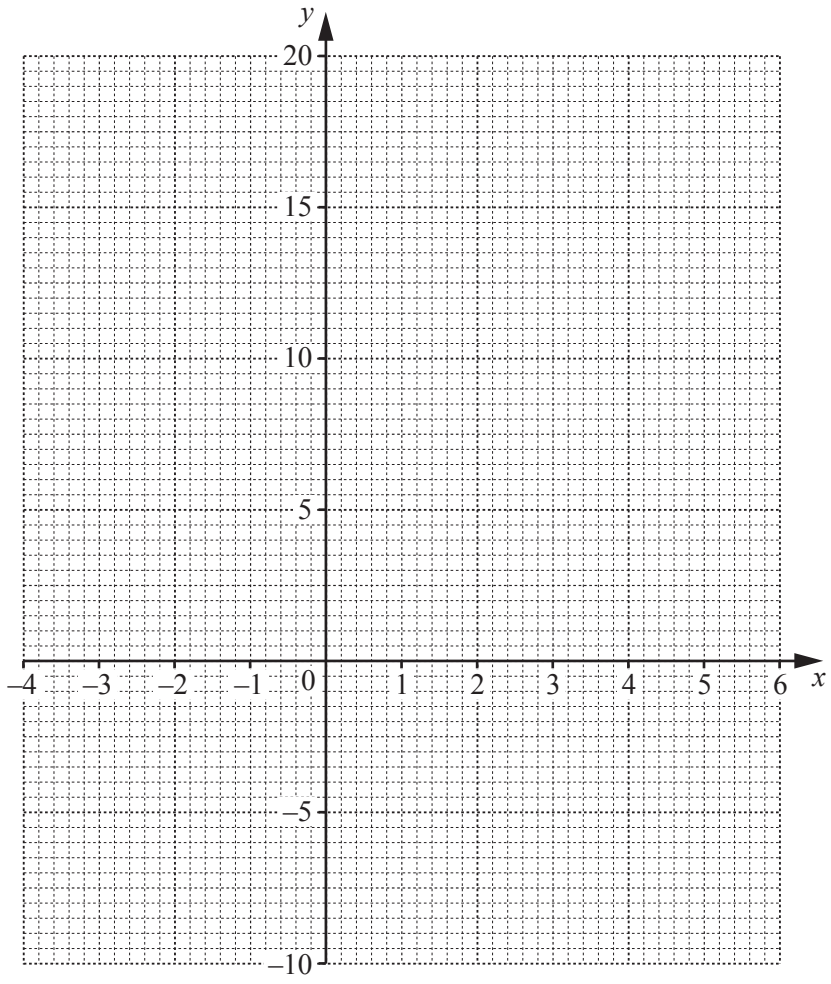
	Cost of flight	Weight of luggage included	Charge per extra 1 kg
Business Class	£1932	30 kg	£24
Economy Class	£683	23 kg	£24

Calculate the total cost of Hendrik flying Economy Class from London to Bangkok with luggage weighing 29 kg.

Answer £ ..... [2]

3 **(a)** **(i)** Complete the table and hence draw the graph of $y = x^2 - 2x - 8$.

x	–4	–3	–2	–1	0	1	2	3	4	5	6
y		7	0	–5	–8	–9	–8	–5	0	7	



[3]

(ii) Use your graph to solve $x^2 - 2x - 8 = 2$.

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

(iii) By drawing a tangent, estimate the gradient of the curve at $(3, -5)$.

Answer ..... [2]

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(b) Solve algebraically $x^2 + x - 9 = 0$, giving your answers correct to 2 decimal places.

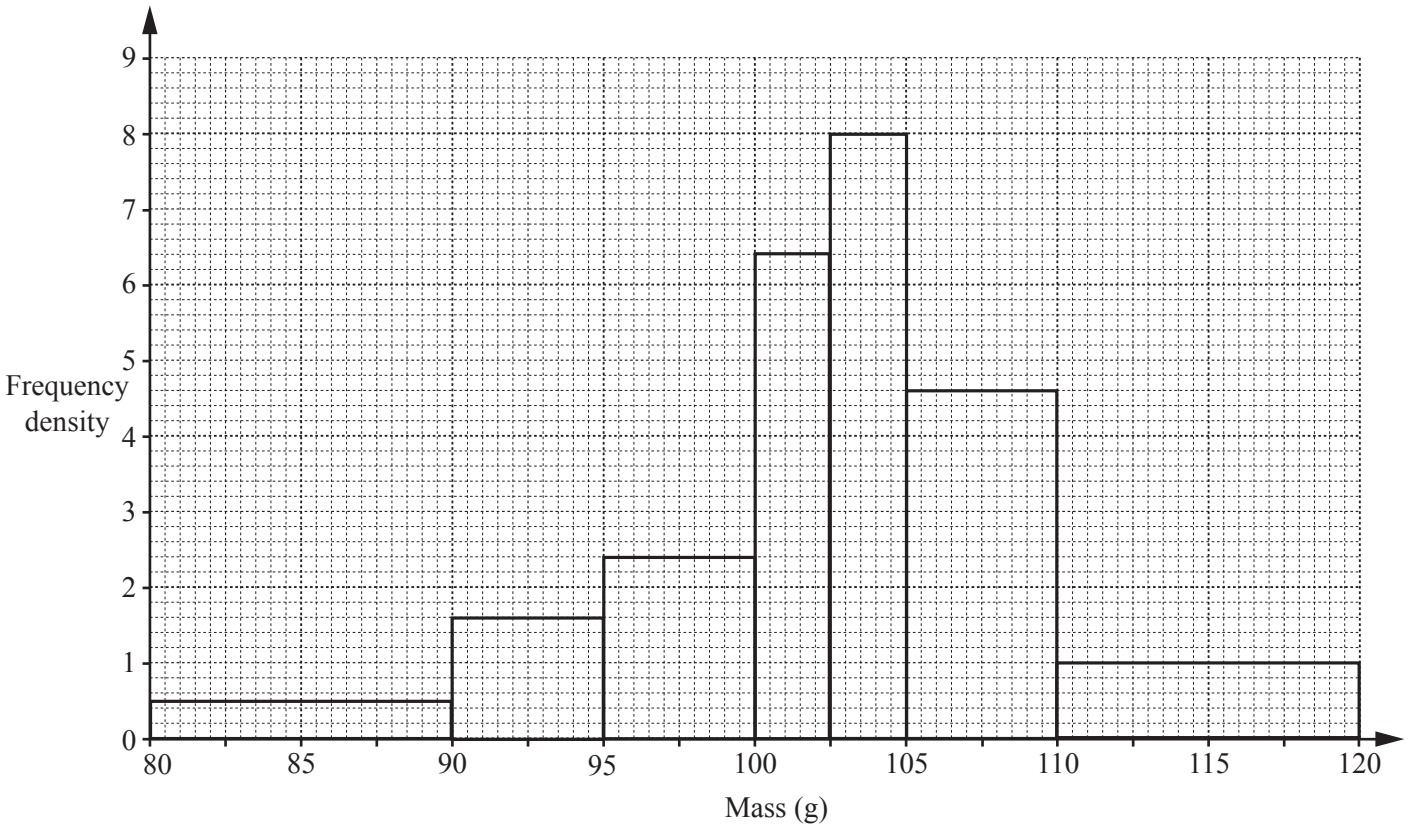
Answer $x =$ ..... or ..... [3]

(c) The x-coordinates of the intersection of the line L and the curve $y = x^2 - 2x - 8$ are the solutions of the equation $x^2 + x - 9 = 0$.

Find the equation of the line L.

Answer ..... [2]

4 **(a)** The histogram represents the distribution of the masses, in grams, of individual apples in a box.



This information is summarised in the table below.

Mass (m g)	Frequency
$80 < m \leqslant 90$	5
$90 < m \leqslant 95$	8
$95 < m \leqslant 100$	p
$100 < m \leqslant 102.5$	q
$102.5 < m \leqslant 105$	20
$105 < m \leqslant 110$	23
$110 < m \leqslant 120$	10

Calculate p and q.

Answer p = ... q = ... [2]

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(b) The mass of each plum in a box is recorded correct to the nearest 5 grams.

Mass (to the nearest 5 g)	Frequency
10 – 15	6
20 – 25	18
30 – 35	25
40 – 45	10
50 – 55	1

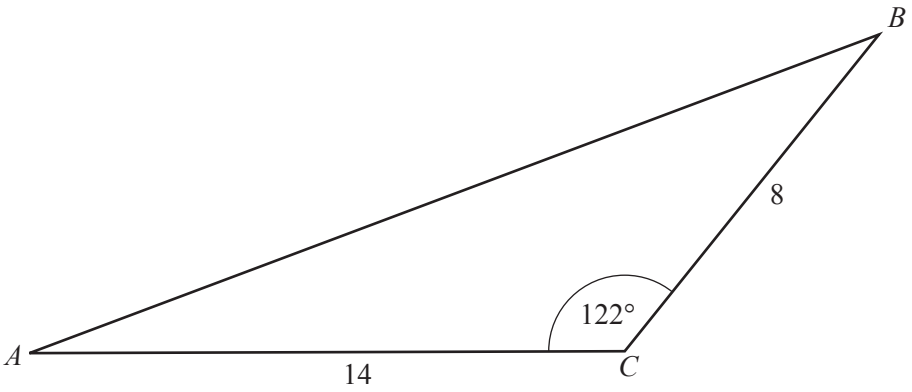
(i) Calculate an estimate of the mean mass of a plum.

Answer ..... g [3]

(ii) Calculate the upper bound for the total mass of plums in the box.

Answer ..... g [2]

5



In triangle ABC, $AC = 14$ cm, $BC = 8$ cm and $A\hat{C}B = 122°$.

(a) Show that $AB = 19.5$ cm, correct to 3 significant figures.

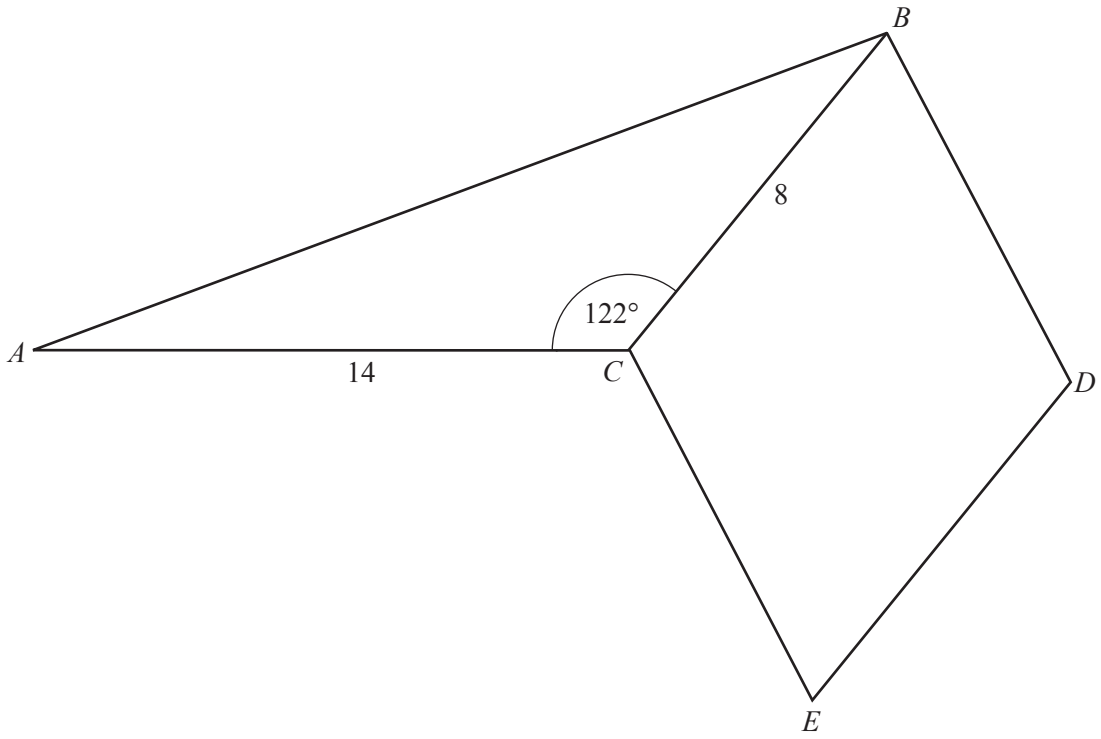
[4]

(b) Calculate $A\hat{B}C$.

Answer ..... [3]

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(c) A rhombus, *BDEC,* of area 52 cm^2 and sides 8 cm is placed next to triangle *ABC* as shown in the diagram.



Given that $B\hat{C}E$ is an obtuse angle, calculate the **reflex** angle $A\hat{C}E$.

Answer ..... [4]

6

$$f(x) = 2x - 7$$

(a) Calculate $f(3)$.

Answer $f(3) =$ ..... [1]

(b) Find $f^{-1}(x)$.

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

(c) Find the value of g given that $f(3g) = g + 4$.

Answer $g =$ ..... [3]

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SECTION B STARTS ON THE NEXT PAGE

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **(a)** Solve

(i) $\frac{4x}{3} = 1$,

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

(ii) $4y - 3(2y + 1) = 5$.

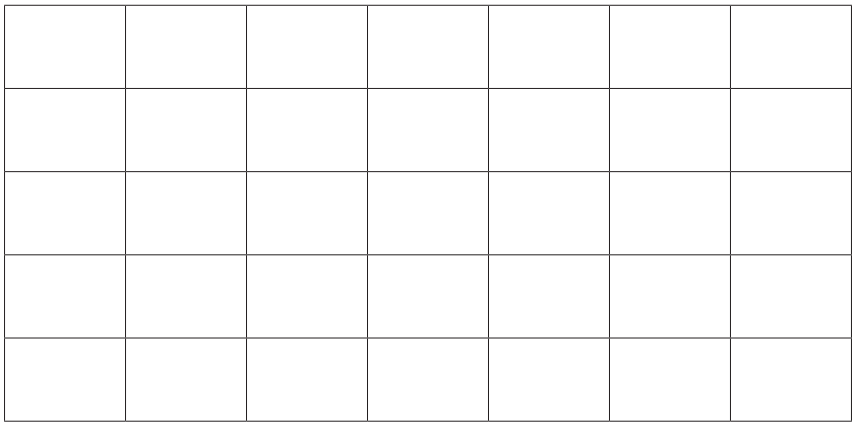
Answer $y =$ ..... [2]

(b) Simplify $\frac{15w^2 - 30w}{5w^2 - 20}$.

Answer ..... [3]

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(c)



The diagram shows the plan of a patio made from rectangular paving slabs.
The width of each paving slab is p cm.
The length of each paving slab is 20 cm longer than its width.

(i) Find an expression, in terms of p, for the area, in cm^2, of **one** paving slab.

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

(ii) Given that the area of the patio is 12.25 m^2, show that p satisfies the equation

$$p^2 + 20p - 3500 = 0 .$$

[2]

(iii) **(a)** Solve by factorisation $p^2 + 20p - 3500 = 0$.

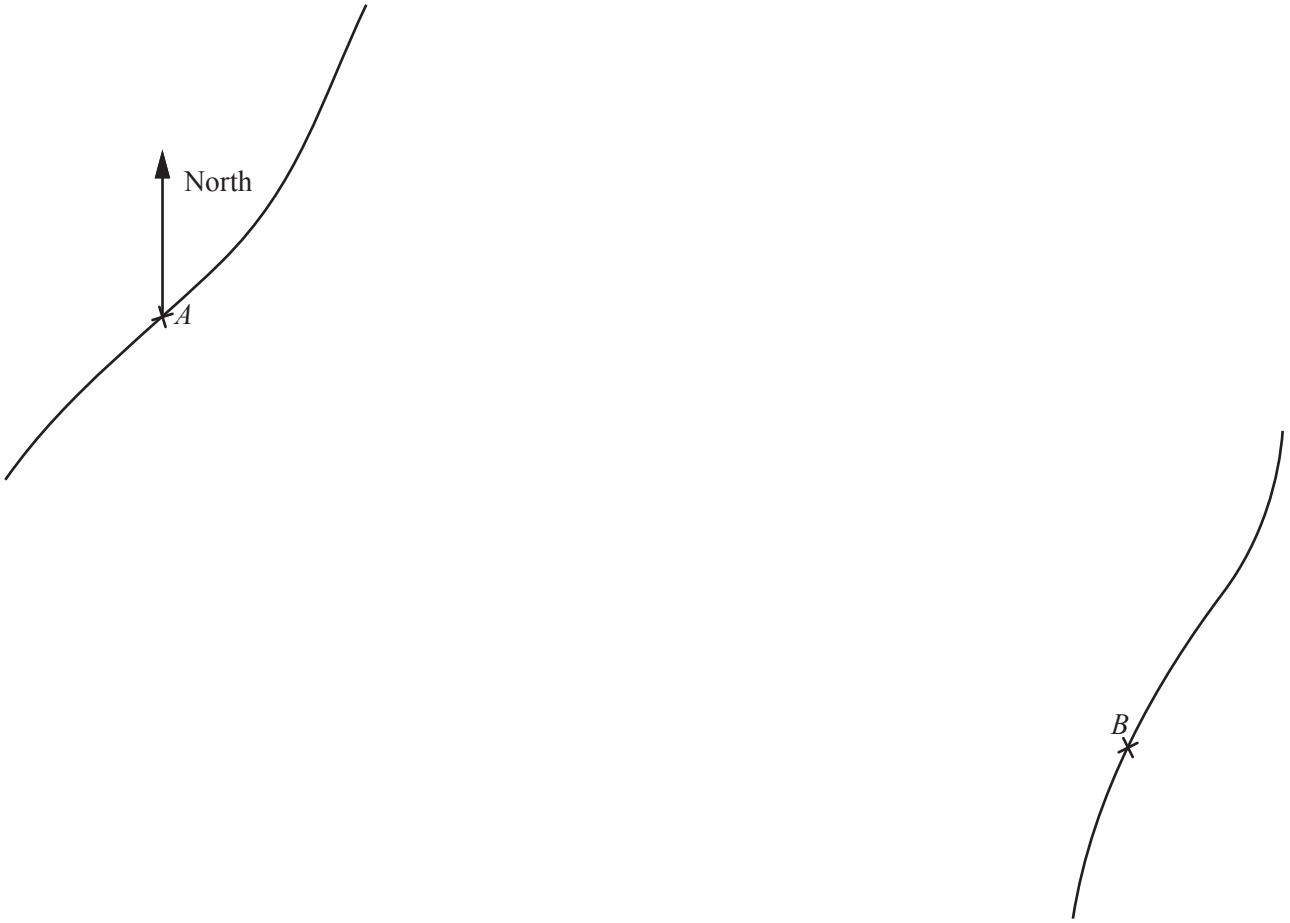
Answer $p =$ ..... or ..... [2]

(b) Hence state the **length** of each paving slab.

Answer ..... cm [1]

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8 (a)



The scale drawing shows two coastal towns, A and B.
The scale of the drawing is 2 cm to 1 km.

(i) Measure the bearing of B from A.

Answer ..... [1]

(ii) Draw the locus of points equidistant from A and B. [1]

(iii) A rock, C, is known to be less than 4 km from B and nearer to A than B.

(a) Construct and shade the region in which C must lie. [2]

(b) Find the shortest possible distance between A and C.

Answer ..... km [1]

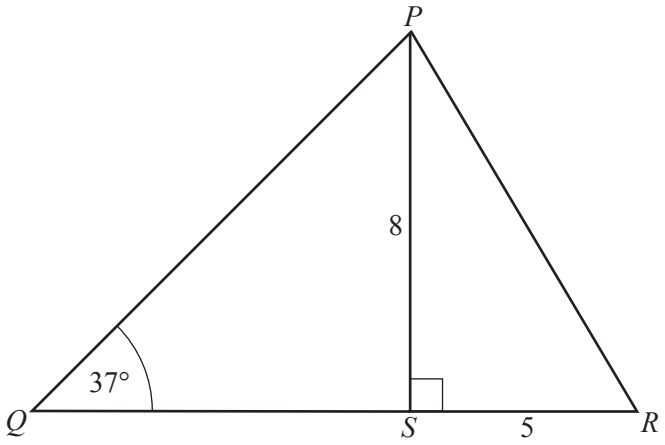
(iv) A boat, D, starts at the point 3.5 km due south of A and sails on a bearing of 075°.

Draw the path of D and state, with a reason, whether it is possible that D collides with C.

Answer ..... [2]

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(b)



The diagram shows a triangle PQR with $P\hat{Q}R = 37°$.
S is the point on QR such that $P\hat{S}R = 90°$, $PS = 8$ cm and $SR = 5$ cm.

Calculate

(i) PR,

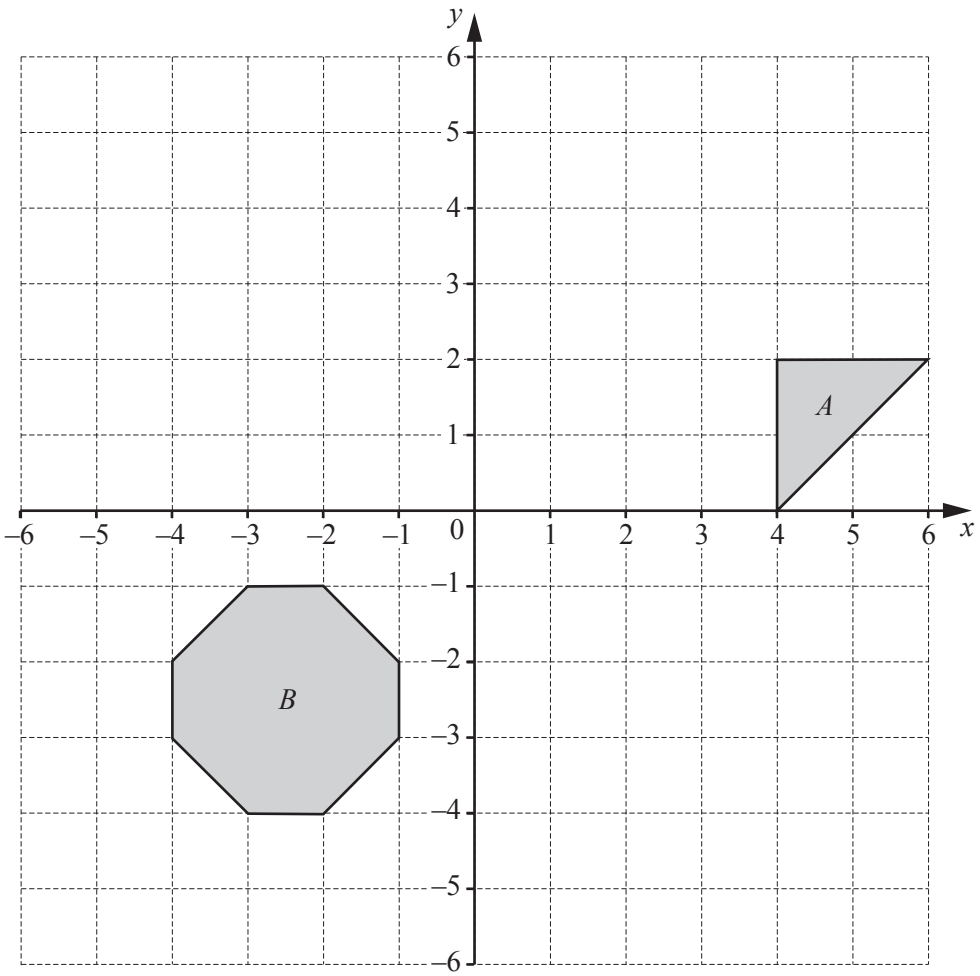
Answer ..... cm [2]

(ii) the shortest distance from S to PQ.

Answer ..... cm [3]

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9



The diagram shows triangle A and octagon B.

(a) Find the gradient of the line of symmetry of triangle A.

Answer ..... [1]

(b) Triangle A is mapped onto triangle C by a reflection in the line $y = x$.

Draw and label triangle C. [2]

(c) Write down the equation of the line of symmetry of octagon B that is parallel to the y-axis.

Answer ..... [1]

(d) State the order of rotational symmetry of octagon B.

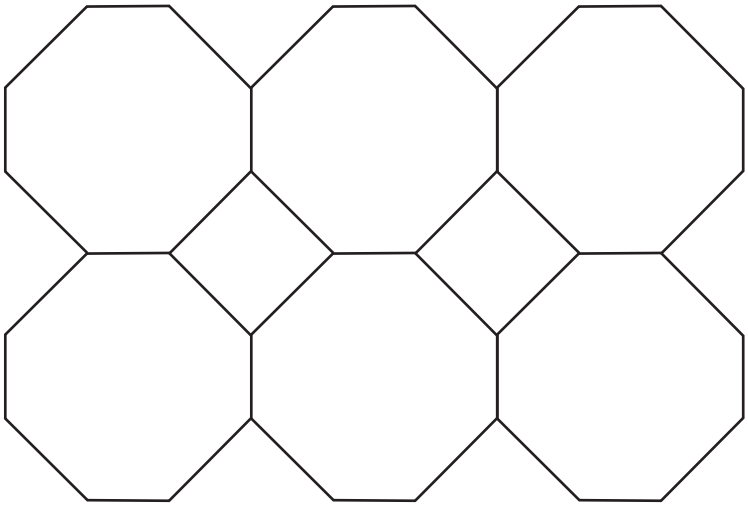
Answer ..... [1]

(e) Octagon B is mapped onto octagon D by an enlargement, scale factor 2 and centre (–3, –3).

Draw and label octagon D. [2]

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(f) A mat is made from six identical octagons, each **similar** to octagon *B*, and two squares, as shown in the sketch below.



The lengths of the short sides of the octagons are each 15 cm.

(i) Calculate the area of one of these octagons.

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

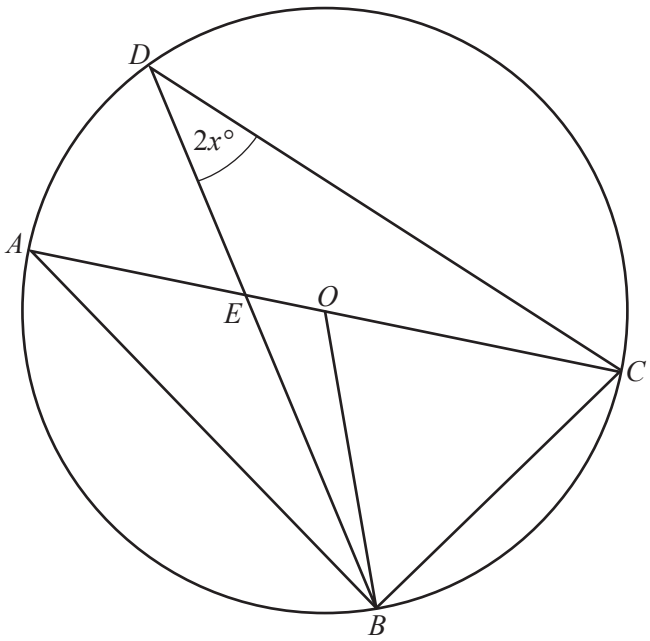
(ii) Find the length of a diagonal of one of the squares.

Answer ..... cm [1]

(iii) Calculate the total area of the mat.

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

10 (a)



A, B, C and D are points on the circumference of a circle, centre O.
The diameter AC intersects BD at E.
$B\hat{D}C = 2x°$.

(i) Find an expression, in terms of x, for

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

Answer ..... [1]

(b) $B\hat{O}C$,

Answer ..... [1]

(c) $O\hat{C}B$.

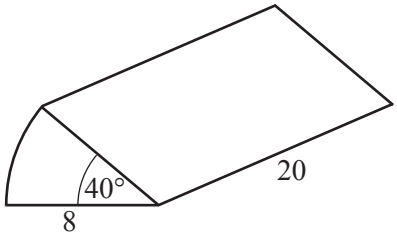
Answer ..... [1]

(ii) Calculate x when $O\hat{B}E = x°$ and $D\hat{E}C = 123°$.

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

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(b)



The cross-section of a prism is a sector of a circle, radius 8 cm and angle 40°.
The prism is 20 cm long.

Calculate

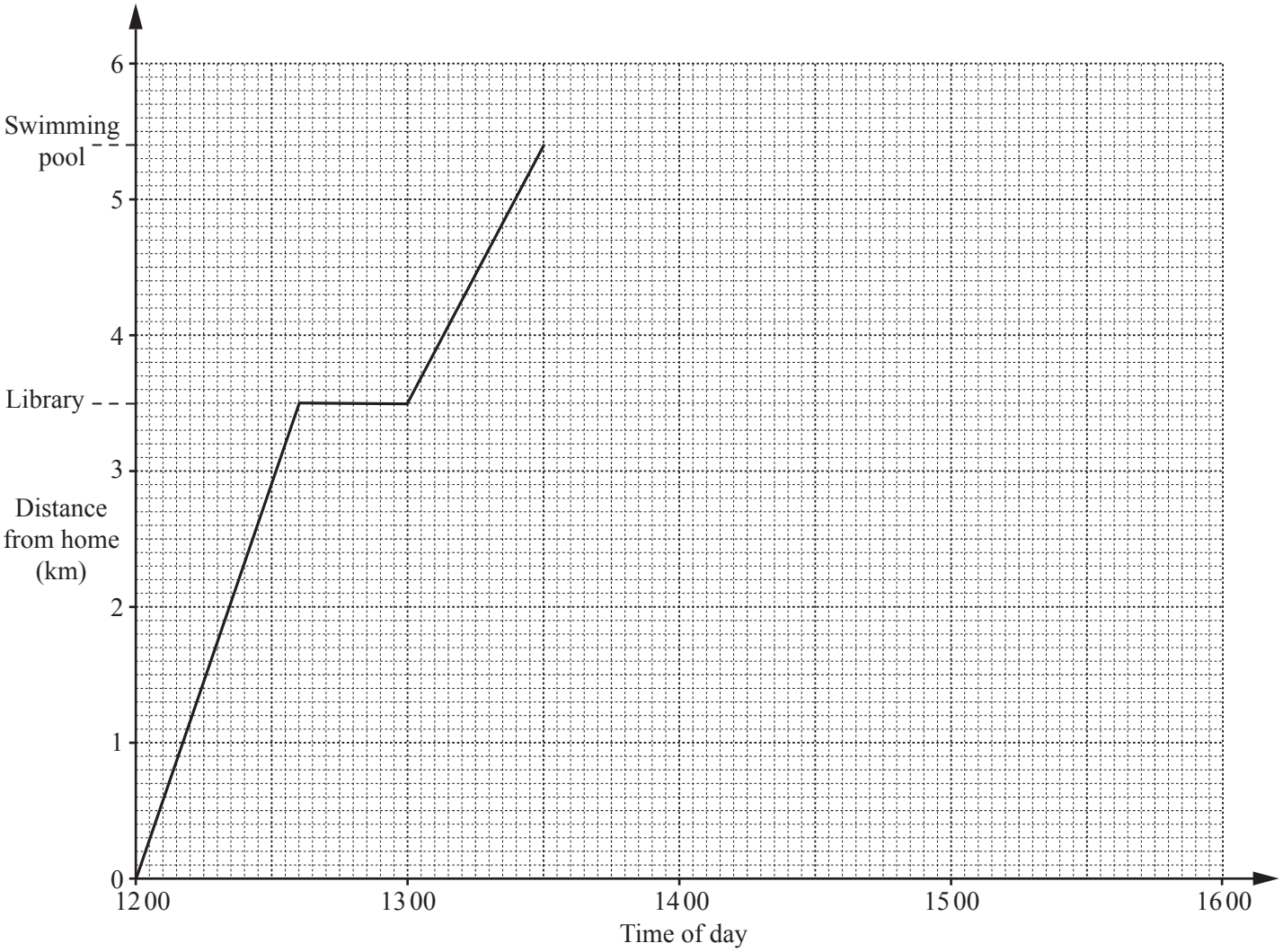
(i) the area of the cross-section,

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

(ii) the **total** surface area of the prism.

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

11 **(a)** One day, two brothers, Zac and Tom, leave their home at different times.
They meet at the library before going to the swimming pool.
The travel graph represents Zac's journey to the swimming pool.



(i) How much time does Zac spend at the library?

Answer ..... minutes [1]

(ii) Tom leaves their home at 12 30 and cycles to the library at 14 km/h.
Calculate the time Tom arrives at the library.

Answer ..... [1]

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(iii) How far is the swimming pool from the library?

Answer ..... km [1]

(iv) Zac stays at the swimming pool for an hour and a quarter.
He then walks home at a constant speed, arriving at 15 39 .

(a) Complete his travel graph. [2]

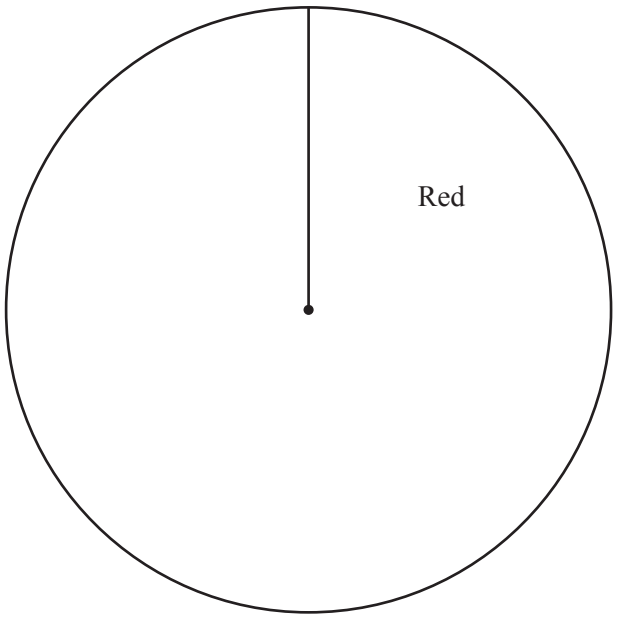
(b) Calculate Zac's speed, in kilometres per hour, as he walks home.

Answer ..... km/h [1]

The rest of this question is on the next page.

(b) A bag contains 5 red counters, 6 blue counters and 1 green counter.

(i) Complete the pie chart to represent this data.



[2]

(ii) Ahmed takes a counter at random from the bag.
Find the probability that the counter is red.

Answer ..... [1]

(iii) Simeon takes two counters at random from the bag of twelve counters.
He places them next to each other on a table.

Find the probability that the two counters are different colours.

Answer ..... [3]

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