Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Wednesday 15 January 2020

Morning (Time: 2 hours 30 minutes) | Paper Reference **4MB1/02**

Mathematics B

Paper 2

You must have: Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Without sufficient working, correct answers may be awarded no marks.

Turn over ▶

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P 5 9 7 6 6 A 0 1 3 6

Pearson

Answer ALL TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $A = 2^3 \times 3^2 \times 5 \times 7$
$B = 2 \times 3^4 \times 5^2 \times 11$

(a) Find the highest common factor (HCF) of A and B.

(1)

(b) Find the lowest common multiple (LCM) of A and B.

(1)

(c) Find the least number that A must be multiplied by to give a square number.

(1)

$C = 3 \times 10^{205} \times 5 \times 10^{205}$

(d) Work out the value of C, giving your answer as a number in standard form.

(2)

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Question 1 continued

(Total for Question 1 is 5 marks)

2 The points with coordinates (2, 1), (5, 1), (3, 3) and (6, 3) are the vertices of parallelogram A.

(a) On the grid, draw and label parallelogram A.

(1)

Parallelogram A is transformed to parallelogram B under the translation $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$

(b) On the grid, draw and label parallelogram B.

(2)

Parallelogram B is transformed to parallelogram C by a reflection in the line with equation $x = 2$

(c) On the grid, draw and label parallelogram C.

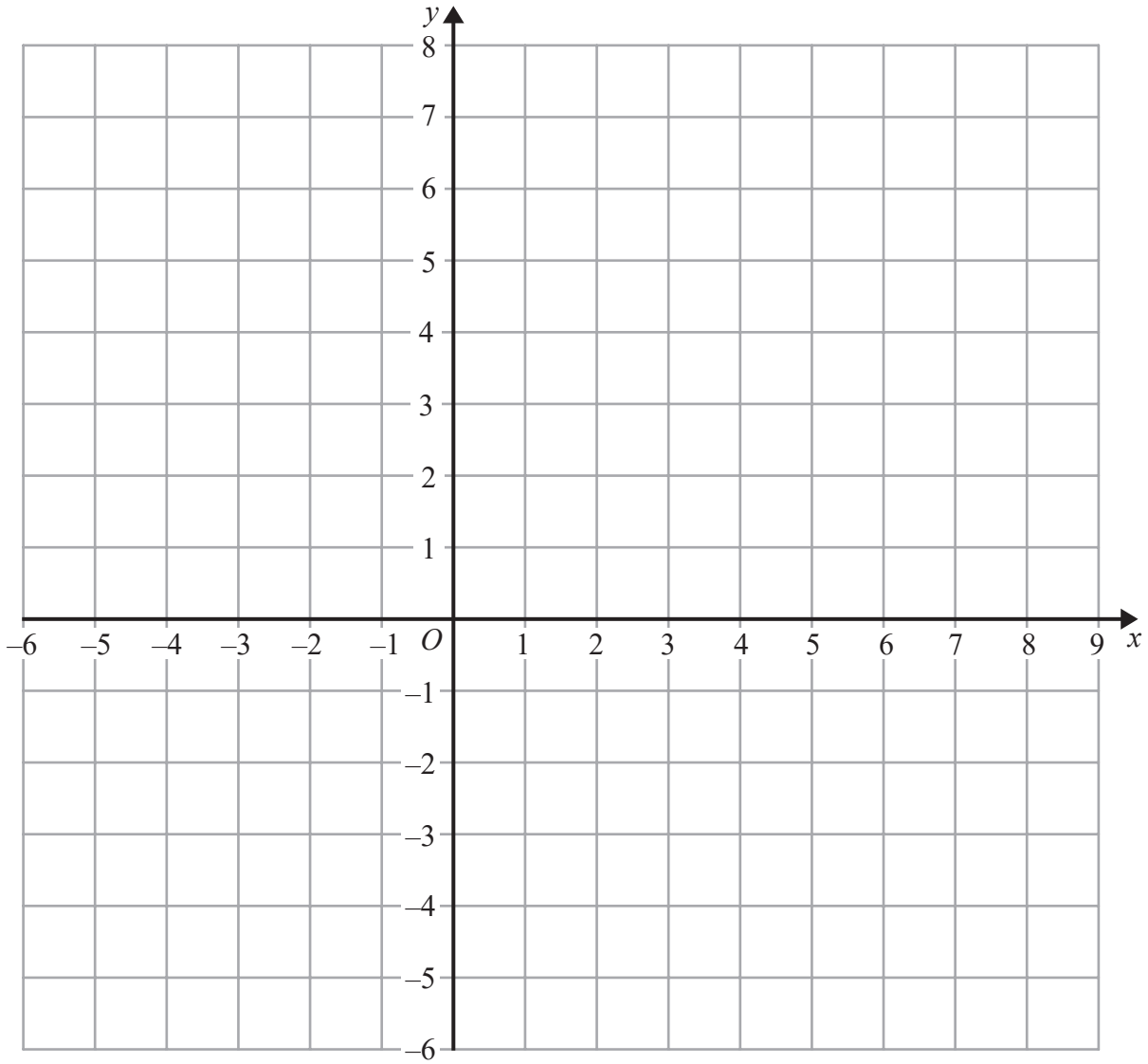
(2)

Parallelogram C is transformed to parallelogram D by a rotation through 90° anticlockwise about the point with coordinates (–5, 0)

(d) On the grid, draw and label parallelogram D.

(2)

Question 2 continued



Turn over for a spare grid if you need to redraw your parallelograms.

Question 2 continued

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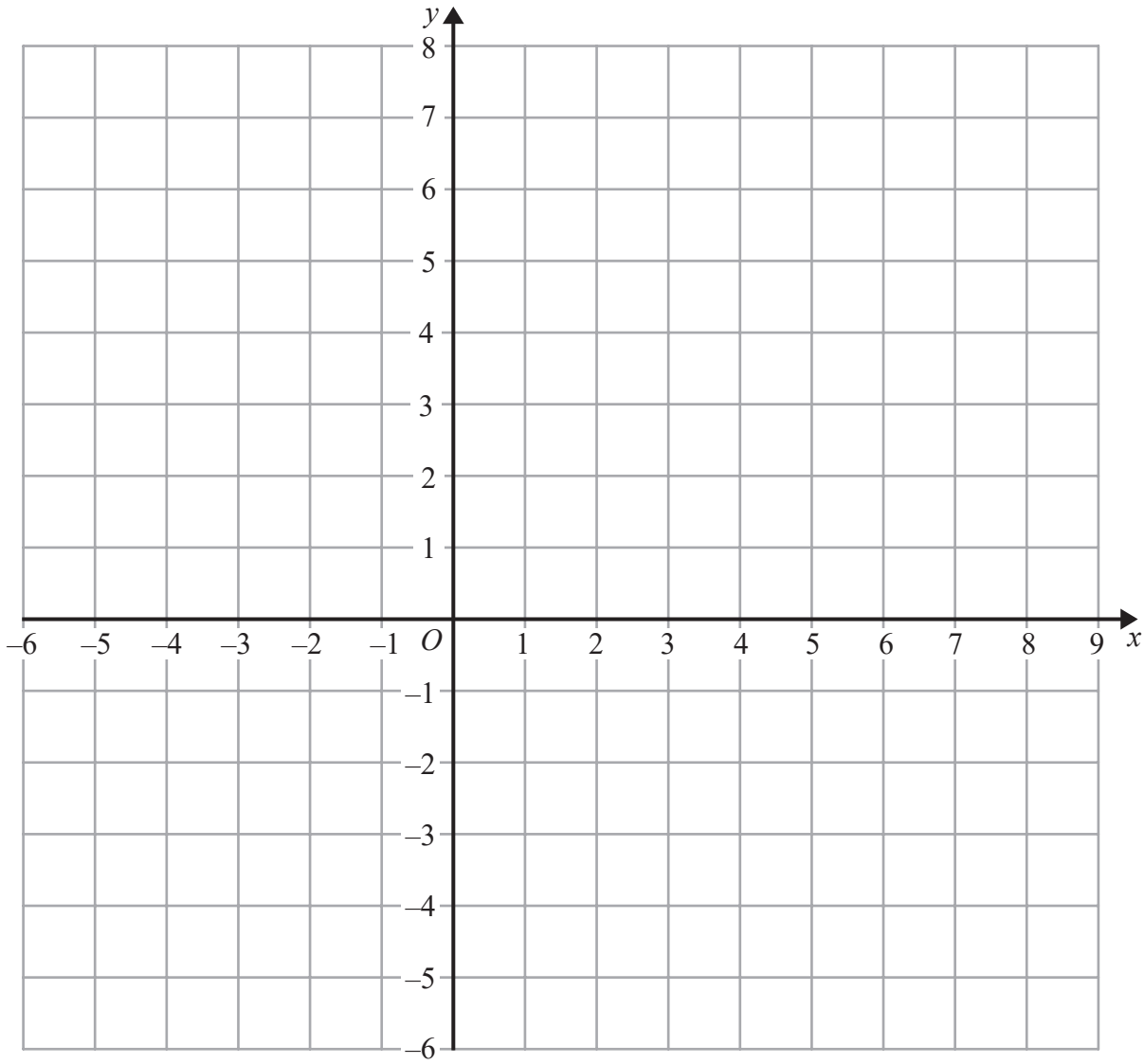
Question 2 continued

Only use this grid if you need to redraw your parallelograms.



(Total for Question 2 is 7 marks)

3

Diagram **NOT** accurately drawn

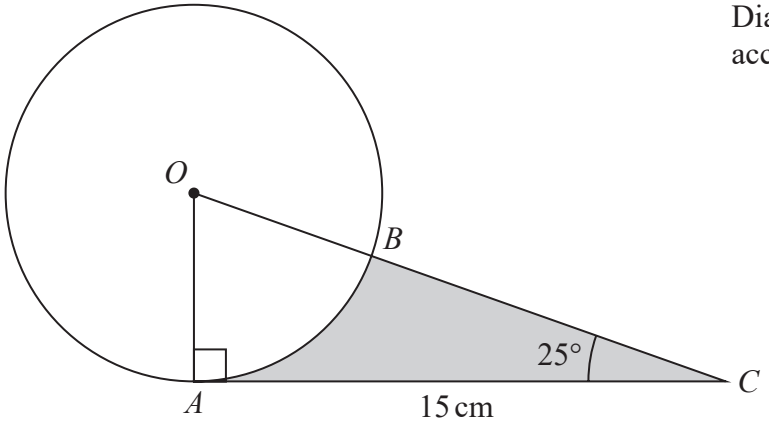


Figure 1

In Figure 1, A and B are two points on a circle with centre O. The line AC is the tangent to the circle at A and OBC is a straight line.

$$AC = 15\,\text{cm} \quad \text{and} \quad \angle OCA = 25°$$

(a) Calculate the area, in cm^2 to 3 significant figures, of the circle.

(3)

The region inside triangle OAC but outside the circle is shown shaded in Figure 1

(b) Calculate the area, in cm^2 to 3 significant figures, of this shaded region.

(4)

Question 3 continued

(Total for Question 3 is 7 marks)

4 In a race, Akaash ran a distance of $(8x^2 - 105)$ metres in $(6x + 1)$ seconds.

His average speed for the race was x m/s.

(a) Show that x satisfies the equation $2x^2 - x - 105 = 0$

(2)

(b) Hence calculate the distance, in metres, that Akaash ran in the race.
Show clear algebraic working.

(4)

Question 4 continued

(Total for Question 4 is 6 marks)

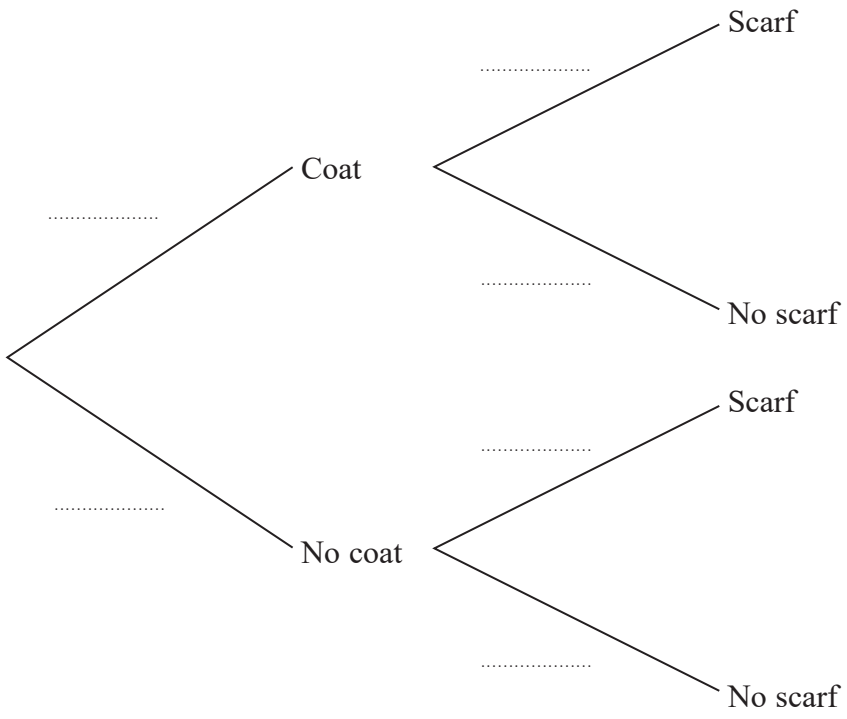
5 When Joe goes to school in winter, the probability that he wears a coat is $\frac{5}{8}$

If he wears a coat, the probability that he wears a scarf is $\frac{1}{4}$

If he does not wear a coat, the probability that he wears a scarf is $\frac{1}{6}$

(a) Complete the probability tree diagram.

(3)



On a day Joe goes to school in winter, calculate the probability that

(b) he is not wearing a coat and is not wearing a scarf,

(2)

(c) he is wearing a coat or he is wearing a scarf but he is not wearing both a coat and a scarf.

(2)

On a day Joe goes to school in winter, if he is wearing a coat and a scarf then the probability that he is also wearing a hat is $\frac{3}{5}$

(d) Calculate the probability, that on a day Joe goes to school in winter, he is not wearing all three of a coat, a scarf and a hat.

(3)

Question 5 continued

(Total for Question 5 is 10 marks)

6 f and g are two functions such that

$$f: x \mapsto x^2 + x - 6 \qquad \text{where } x \geqslant -\frac{1}{2}$$

$$g: x \mapsto \frac{2x - 24}{3 - 2x}$$

(a) State the value of x that must be excluded from any domain of g

(1)

(b) Find the value of a and the value of b such that

$$f(x) = (x + a)^2 + b$$

(2)

(c) Hence write down the range of f

(1)

(d) Find the value of c for which $g^{-1}(0) = c$

(2)

Given that $f(x) = g(x)$

(e) show that $2x^3 - x^2 - 13x - 6 = 0$

Show clear algebraic working.

(3)

(f) Use the factor theorem to show that $(2x + 1)$ is a factor of $2x^3 - x^2 - 13x - 6$

(2)

The curve with equation $y = f(x)$ intersects the curve with equation $y = g(x)$ at the point A with coordinates (p, q), where $p > -\frac{1}{2}$

(g) Find the coordinates of A.

(4)

Question 6 continued

Question 6 continued

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Question 6 continued

(Total for Question 6 is 15 marks)

7

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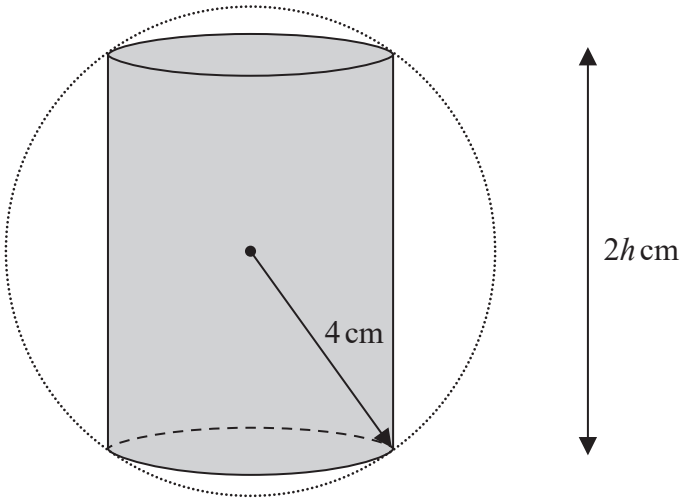


Figure 2

Figure 2 shows a right circular cylinder cut from a solid sphere of radius 4 cm. The height of the cylinder is $2h$ cm.

The volume of the cylinder is V cm^3

(a) Show that $V = 32\pi h - 2\pi h^3$

(3)

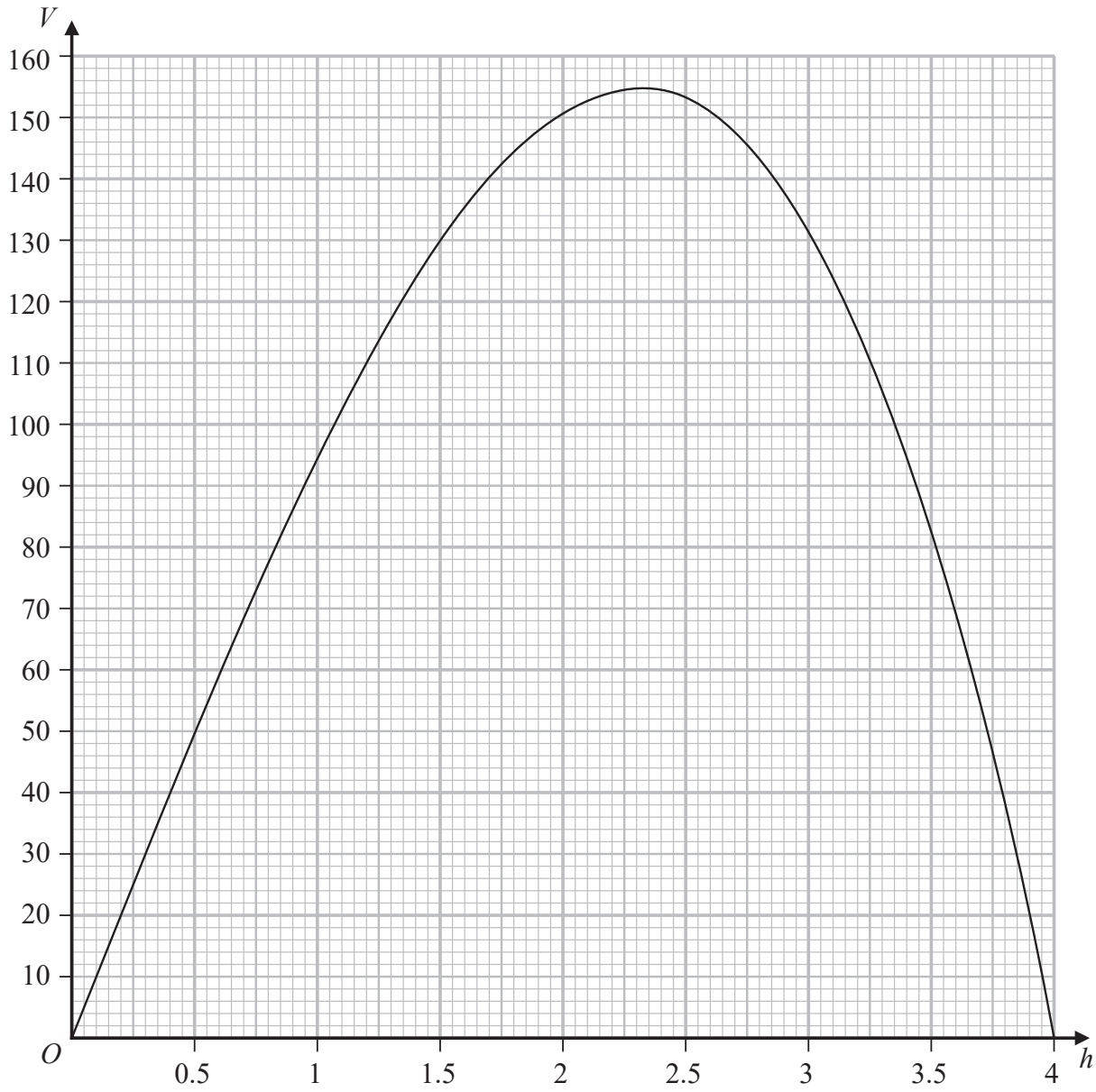
(b) Using calculus, find the stationary value, to 3 significant figures, of V.
Show your working clearly.

(4)

$\left[\text{Volume of cylinder} = \pi r^2 h\right]$

Question 7 continued

Part of the curve with equation $V = 32\pi h - 2\pi h^3$ is drawn on the grid.



(c) Find an estimate, to one decimal place, of each of the two values of h for which the volume of the cylinder is $100\,\text{cm}^3$

(2)

Question 7 continued

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Question 7 continued

(Total for Question 7 is 9 marks)

8

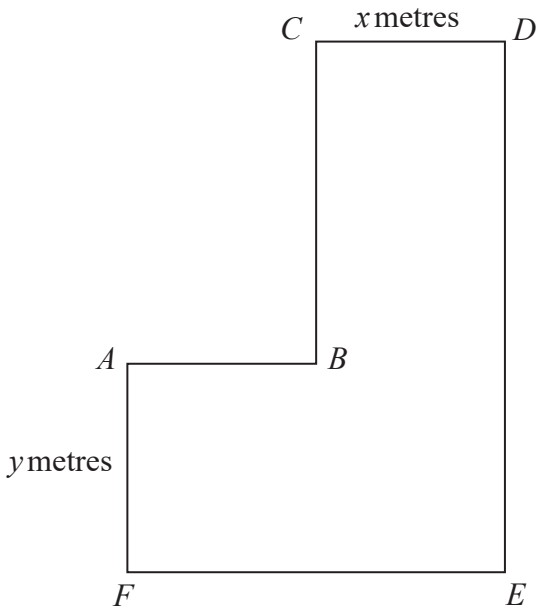

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Figure 3

Figure 3 shows the plan of a floor $ABCDEF$ in which all the corners are right angles and

$CD = x$ metres $\quad AF = y$ metres

The length of DE is twice the length of CD.
The length of FE is twice the length of AF.

The perimeter of the floor plan is 68 metres.

(a) Find and simplify an equation in terms of x and y for this information.

(2)

The area of the floor plan is 248 m^2

(b) Show that $2y^2 + 2x^2 - xy = 248$

(3)

(c) Find the possible lengths of AB.
Show clear algebraic working.

(5)

Question 8 continued

Question 8 continued

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Question 8 continued

(Total for Question 8 is 10 marks)

9 $\mathbf{A} = \begin{pmatrix} 3 & 4 \\ -1 & 2 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 3 & -1 \\ 2 & -2 \end{pmatrix}$

The transformation with matrix **A** is equivalent to the transformation with matrix **B** followed by the transformation with matrix **C**, where **C** is a 2×2 matrix.

Find matrix **C**.

(5)

$\left[\text{The inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ is } \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}\right]$

Question 9 continued

(Total for Question 9 is 5 marks)

10 Triangle ABC has sides $AB = 10\,\text{cm}$, $BC = 7\,\text{cm}$ and $CA = 6\,\text{cm}$.

(a) Calculate the area, in cm^2 to 3 significant figures, of triangle ABC.

(5)

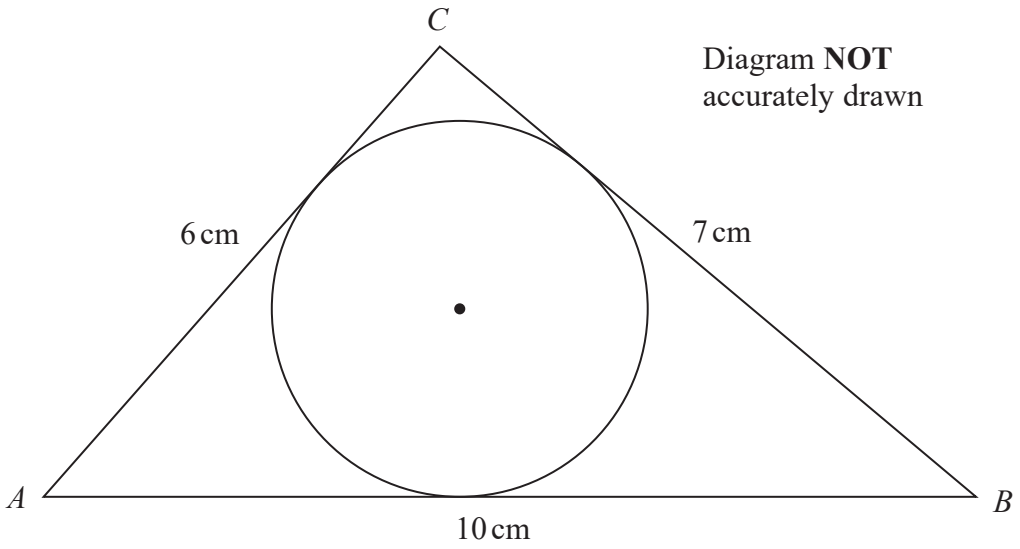

Figure 4

Figure 4 shows triangle ABC and a circle inside the triangle so that each side of the triangle is a tangent to the circle.

(b) Calculate the radius, in cm to 2 significant figures, of the circle.

(3)

$$\left[\begin{array}{c}\text{Cosine rule: } a^2 = b^2 + c^2 - 2bc\cos A \\ \text{Area of triangle} = \frac{1}{2}ab\sin C\end{array}\right]$$

Question 10 continued

Question 10 continued

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Question 10 continued

(Total for Question 10 is 8 marks)

11 Find the range of values of x for which both

$$2x + 3(4 - 3x) < 8x \quad \textbf{and} \quad 6x - 5 \leqslant (2x - 3)^2$$

Show clear algebraic working.

(7)

Question 11 continued

(Total for Question 11 is 7 marks)

12 A company produces bird food made with sunflower seeds, corn and millet.

The weights of sunflower seeds, corn and millet in each bag of the bird food are in the ratios

sunflower seeds : corn : millet = 8 : 3 : 1

The total weight of the bird food in each bag is 30 kg.

(a) Calculate the weight, in kg, of corn in each bag of the bird food.

(2)

Tom buys bags of the bird food from the company and sells them in his shop.

He sells each bag for $15.04
He makes a profit of 17.5% on each bag he sells.

(b) Calculate, in $, how much Tom pays the company for each bag of the bird food he buys.

(2)

The bags are filled with the bird food at a rate of 530 grams per second.

(c) Calculate the number of bags of the bird food that are filled completely in 6 hours.

(4)

Sunflower seeds cost £150.75 for 30 kg from farmer *A*.
Sunflower seeds cost $162.35 for 25 kg from farmer *B*.

Using an exchange rate of £1 = $1.315

(d) find which of the two farmers, *A* or *B*, sells sunflower seeds at the cheaper cost per kilogram.
You must give a reason for your answer.

(3)

Question 12 continued

Question 12 continued

(Total for Question 12 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS