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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Wednesday 13 January 2021

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

Mathematics B

Paper 2



You must have: Ruler graduated in centimetres and millimetres, protractor, pair of 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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Answer ALL TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The following formula can be used to change a temperature f degrees Fahrenheit to a temperature c degrees Celsius.

$$c = \frac{5(f - 32)}{9}$$

(a) Make f the subject of $c = \frac{5(f - 32)}{9}$

(3)

Sean and Kate measure the temperature of a heated iron bar.

Sean measures the temperature of the iron bar as x degrees Fahrenheit.
Kate measures the temperature of the iron bar as y degrees Celsius.

Given that $x = 2y$,

(b) find the temperature, in degrees Fahrenheit, of the iron bar.

(2)

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Question 1 continued

(Total for Question 1 is 5 marks)

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2 The Earth is assumed to move around the Sun in a circular orbit of radius 1.5×10^8 km.

Assuming that the Earth takes 365 days to complete one orbit of the Sun,

calculate the average speed, in m/s to 3 significant figures, of the Earth as it orbits the Sun.

(4)

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Question 2 continued

(Total for Question 2 is 4 marks)

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3

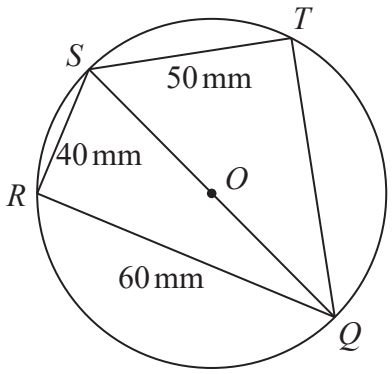

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows circle $QRST$ with centre O.
SQ is a diameter of the circle.

$QR = 60\,\text{mm}$ $RS = 40\,\text{mm}$ $ST = 50\,\text{mm}$

Without using a calculator, find the exact length, in mm, of QT.

Give your answer in the form $a\sqrt{b}$ where a is an integer and b is a prime number.
Show your working clearly.

(5)

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Question 3 continued

(Total for Question 3 is 5 marks)

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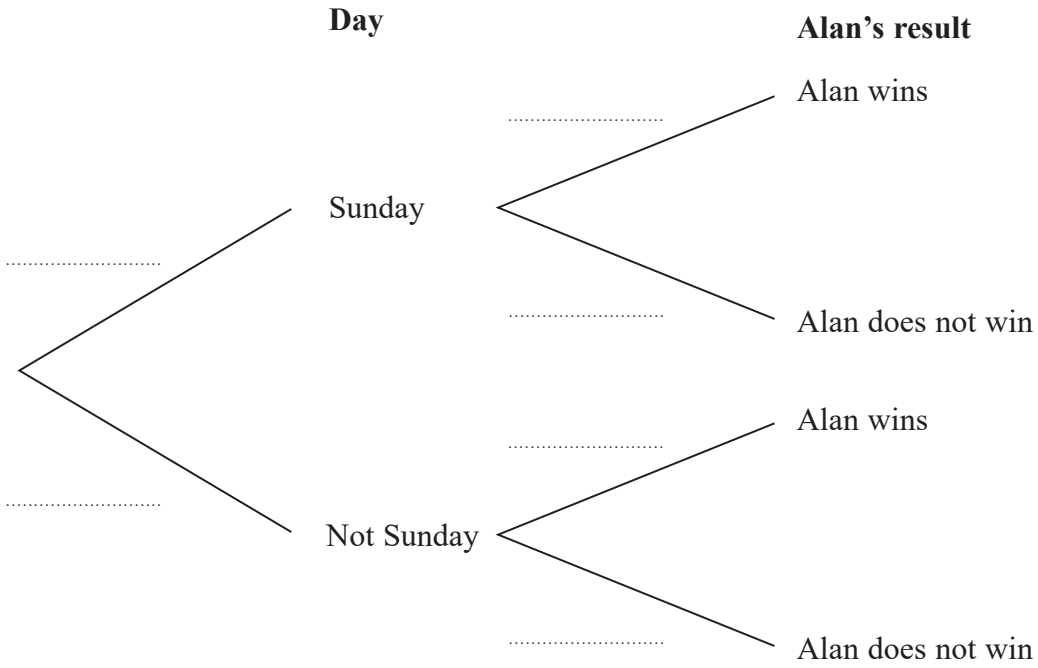
4 Over the course of a week of seven days, Alan plays a series of games.
He plays exactly one game each day.

On Sunday, the probability that Alan wins his game is $\frac{1}{2}$

On a day other than Sunday, the probability that Alan wins his game is $\frac{1}{3}$

The incomplete probability tree diagram below is to give information about Alan's result on a randomly chosen day in a week of seven days.

(a) Complete the probability tree diagram below.



(3)

(b) Find the expected number of games Alan will win in a week of seven days.

(2)

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Question 4 continued

(Total for Question 4 is 5 marks)

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5 $\mathscr{E}$ is the universal set and A, B and C are three sets.

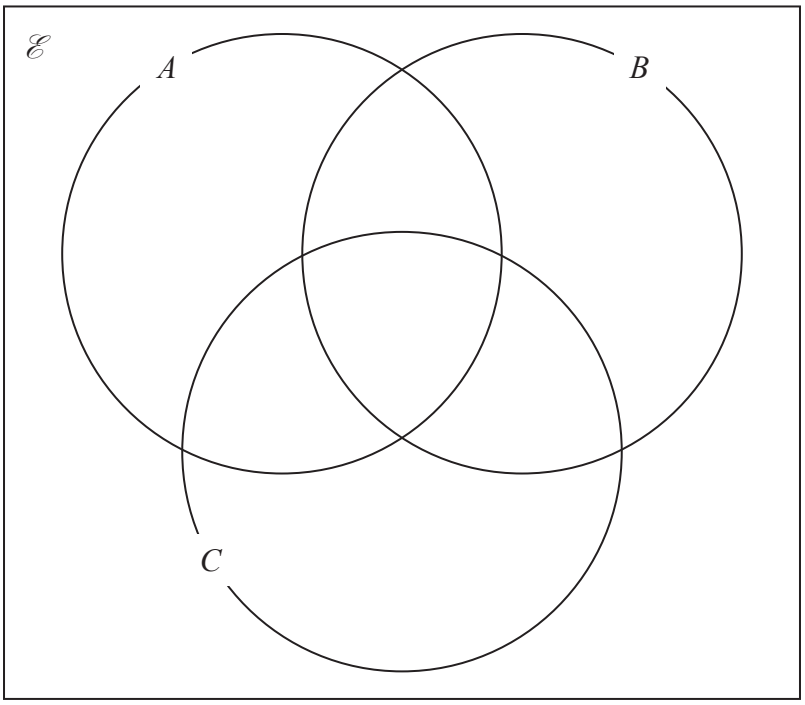
Here is information about these sets.

$n(A) = 45$ $\quad n(B) = 48$ $\quad n(C) = 55$

$n(A \cap B) = 24$ $\quad n(A \cap C) = 25$ $\quad n(B \cap C) = 27$

$n(A \cap B \cap C) = x$ $\quad n(A' \cap B' \cap C') = y$

(a) Show all this information on the Venn diagram, giving the number of elements in each appropriate subset, in terms of x or y.



(3)

Given that $n(\mathscr{E}) = 100$

(b) find an expression for y in terms of x.
Give your answer in its simplest form.

(2)

(c) Using your Venn diagram and your answer to part (b), find the greatest possible value of x.
Give reasons for your answer.

(3)

An element is selected at random from the 100 elements in the universal set.

(d) Find the probability that this element is in the set $(B \cap C') \cup (B' \cap C)$.

(2)

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Question 5 continued

(Total for Question 5 is 10 marks)

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6 (a) (i) Solve the inequality $3x + 5 > 7x - 9$

(2)

(ii) Represent your solution on the number line on the next page.

(1)

(b) (i) Solve the inequality $x^2 + 5x - 6 \geqslant 0$

(3)

(ii) Represent your solution on the number line on the next page.

(1)

(c) Write down the set of values for which

both $3x + 5 > 7x - 9$ **and** $x^2 + 5x - 6 \geqslant 0$

(2)

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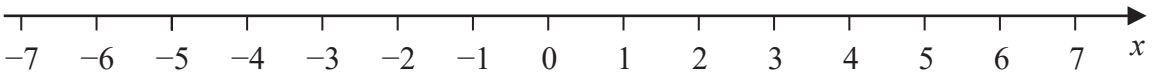
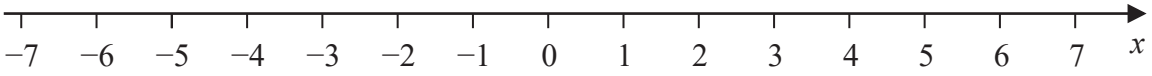
Question 6 continued

(a) (ii)



(b) (ii)



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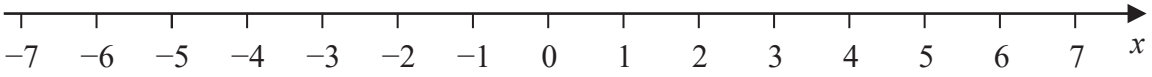

(Total for Question 6 is 9 marks)

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7 Given that

a is inversely proportional to $\sqrt{b}$ **and** b is inversely proportional to c^3

complete the following table.

a	c
16	240
250	
	135

(6)

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Question 7 continued

(Total for Question 7 is 6 marks)

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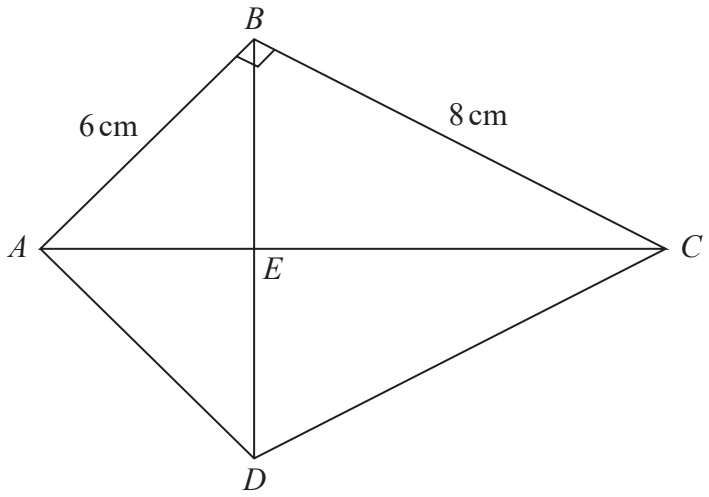

Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a kite $ABCD$ in which

$AB = 6\,\text{cm}$ $BC = 8\,\text{cm}$ $\angle ABC = 90°$

AEC and BED are straight lines.

(a) Calculate the length, in cm, of AC.

(2)

(b) Calculate the area, in cm^2, of $ABCD$.

(2)

(c) Show that $BE = 4.8\,\text{cm}$

(2)

(d) Prove that triangle ABE is similar to triangle BCE.

(3)

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Question 8 continued

(Total for Question 8 is 9 marks)

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

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

(1)

Triangle B is the image of triangle A under a reflection in the line with equation $y = -x$

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

(2)

Triangle C is the image of triangle A under the transformation with the matrix **M** where

$$\mathbf{M} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

(c) Find the matrix product $\mathbf{M}\begin{pmatrix} 1 & 1 & 3 \\ 2 & 5 & 2 \end{pmatrix}$

(2)

(d) Hence, on the grid, draw and label triangle C.

(1)

(e) Describe fully the **single** transformation that maps triangle B onto triangle C.

(2)

The single transformation that maps triangle B onto triangle C is represented by the matrix **N**

(f) State, giving a reason, the matrix $\mathbf{N}^2$

(2)

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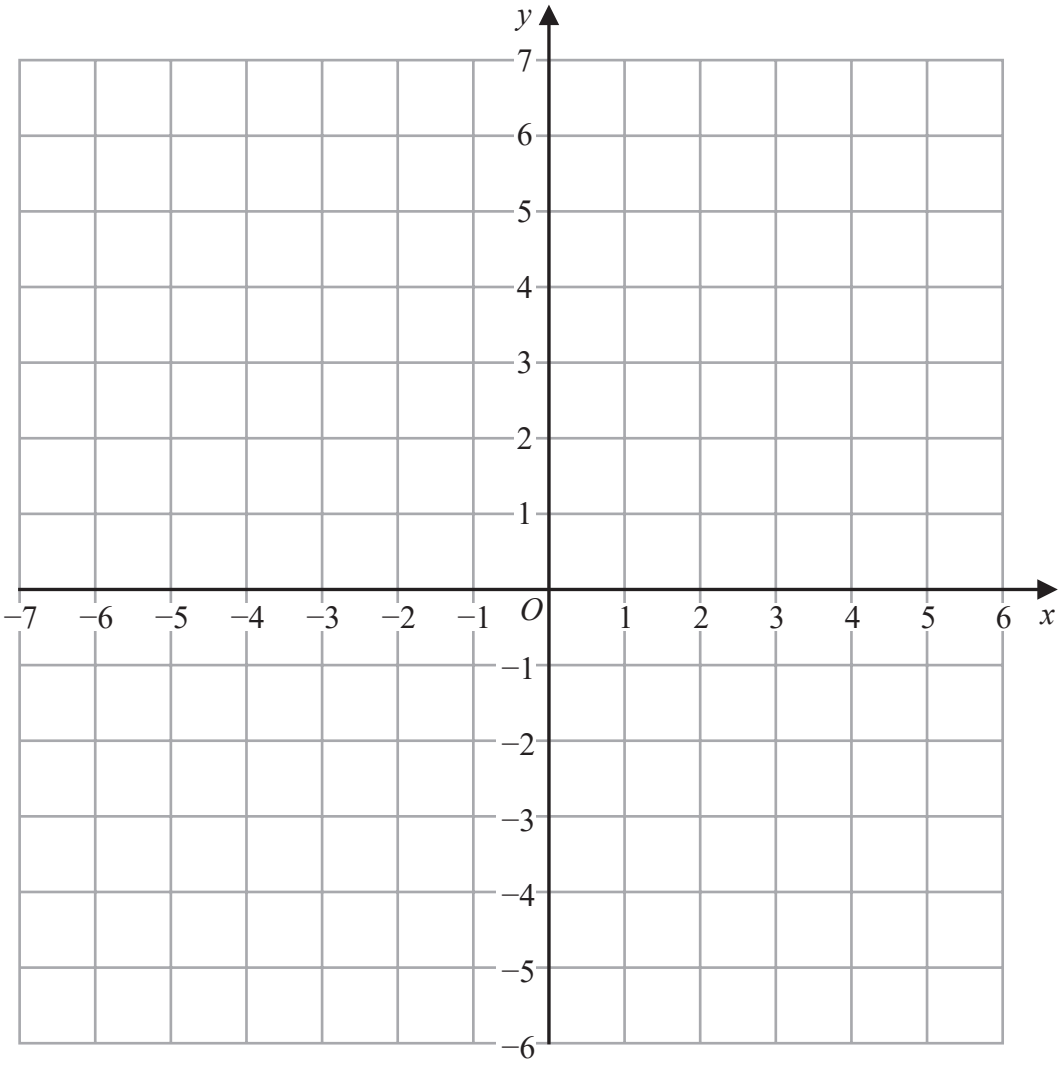
Question 9 continued



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

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Question 9 continued

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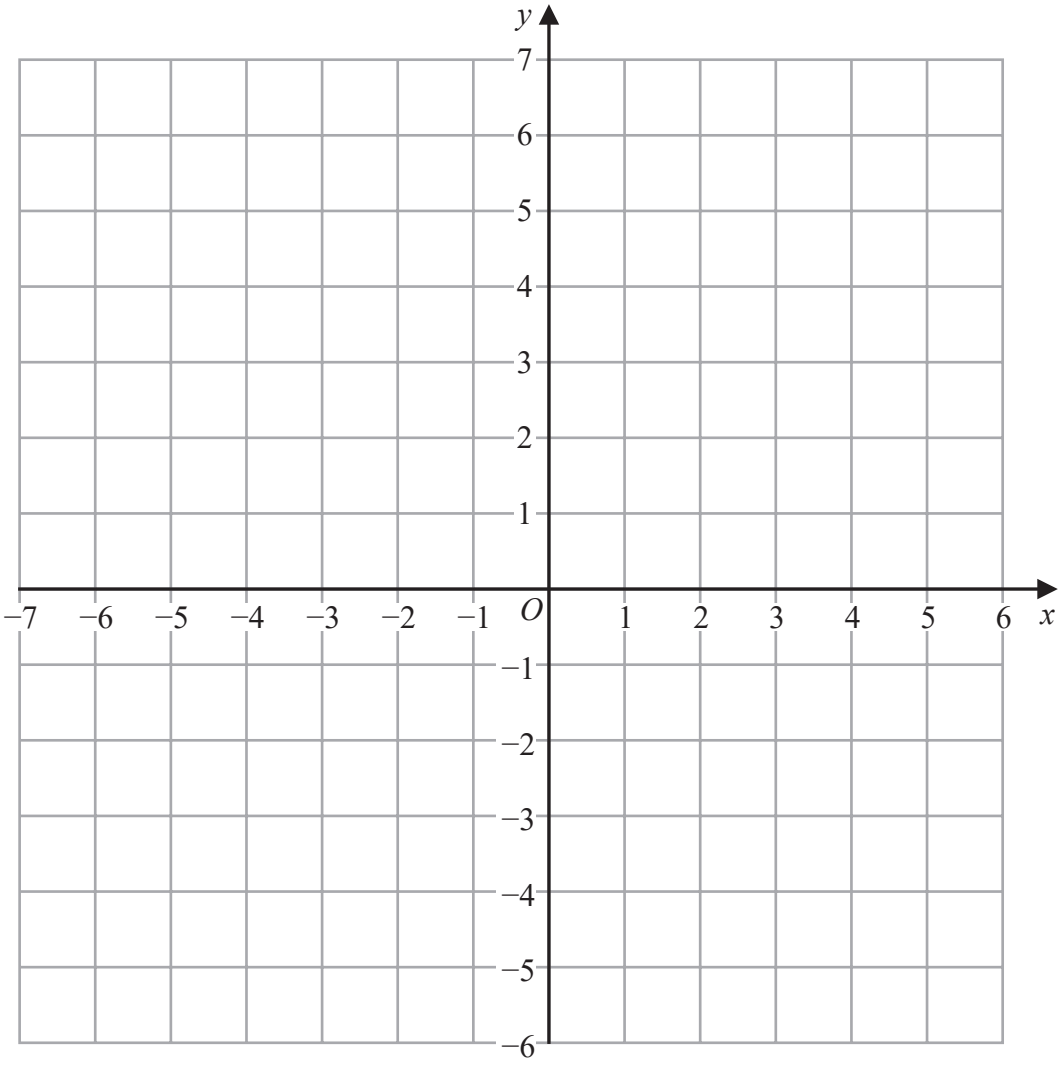

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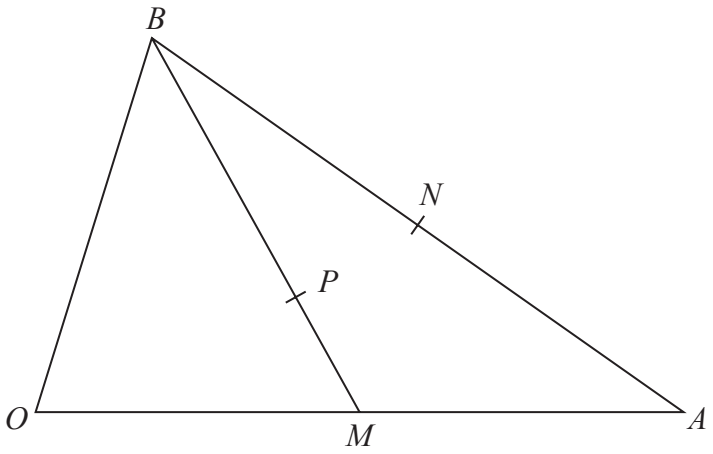

Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows the triangle OAB where $\overrightarrow{OA} = 12\mathbf{a}$ and $\overrightarrow{OB} = 6\mathbf{b}$
M is the midpoint of OA and N is the midpoint of AB.

The point P on BM is such that $BP : BM = 2 : 3$

(a) Simplifying your answer, find, in terms of **a** and **b**

(i) $\overrightarrow{BM}$ (ii) $\overrightarrow{OP}$

(3)

(b) Hence show that O, P and N are collinear.

(4)

Given that $|\mathbf{a}| = |\mathbf{b}| = 1\,\text{cm}$ and that $\angle AOB = 70°$

(c) find the length, in cm to 3 significant figures, of OP.

(3)

[Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$]

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Question 10 continued

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Question 10 continued

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Question 10 continued

(Total for Question 10 is 10 marks)

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11 The equation of a curve is $y = f(x)$ where $f(x) = x^3 - 10x^2 + 20$

(a) Complete the table of values for $y = x^3 - 10x^2 + 20$
Give your values of y to one decimal place where necessary.

x	−2	−1.5	−1	−0.5	0	0.5	1	1.5	2	2.5	3
y	−28	−5.9		17.4	20		11	0.9	−12		−43

(3)

(b) On the grid opposite, plot the points from your completed table and join them to form a smooth curve.

(3)

A curve C has equation $y = g(x)$ where $B = g(x)$ and $\frac{dB}{dx} = f(x)$

The curve C has two turning points in $-2 \leqslant x \leqslant 3$

(c) Using your graph, find the x coordinates of these two turning points on the curve C.

(3)

(d) Referring to your graph, determine which of these two turning points is a maximum and which is a minimum.
You should explain your reasoning clearly.

(4)

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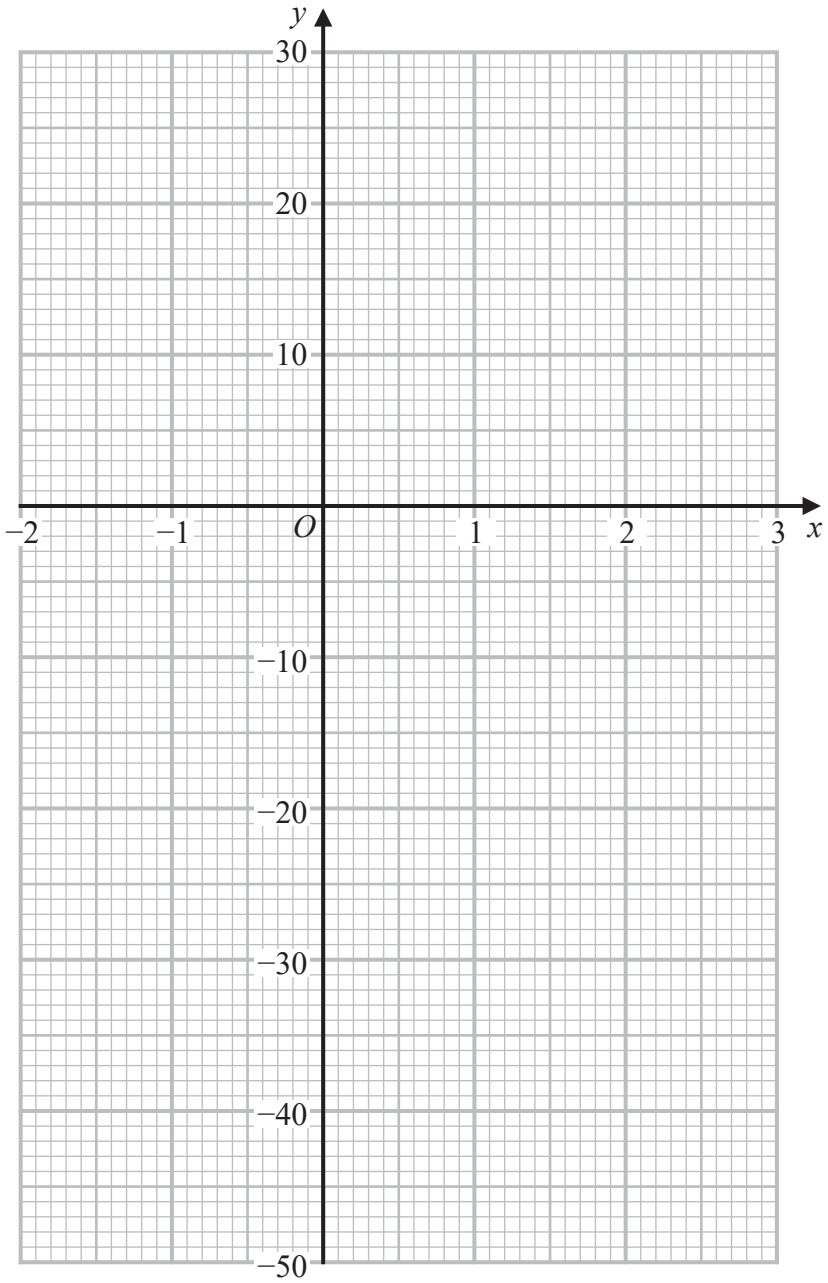
Question 11 continued



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

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Question 11 continued

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Question 11 continued

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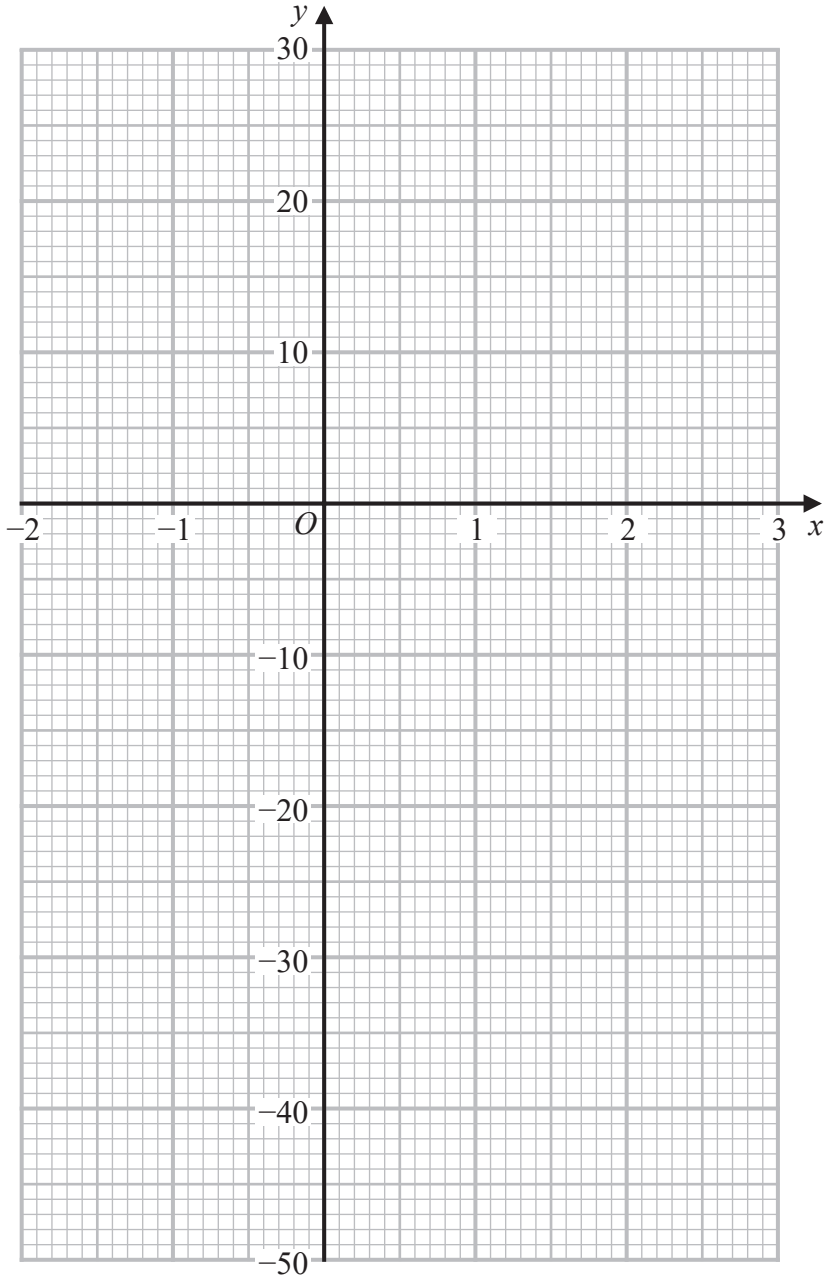

(Total for Question 11 is 13 marks)

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12 Indre buys 1000 Hungarian dolls in Budapest to sell in Austria.
She pays in Hungarian forints.

Indre pays 1900 forints for each small doll she buys.
She pays 10 300 forints for each large doll she buys.

The number of small dolls that Indre buys is 4 times the number of large dolls that she buys.

(a) Calculate the total cost, in forints, of the 1000 dolls that Indre buys.

(3)

Indre has to pay 100 euros to transport the dolls from Hungary so that she can sell them in Austria.

Initially the price of each small doll that Indre sells is 8 euros and the price of each large doll that Indre sells is 40 euros.

She sells 80% of the small dolls and $\frac{7}{8}$ of the large dolls at these prices.

Indre then reduces the price of each of her remaining dolls by 40%
She sells all of the remaining dolls.

When Indre bought the dolls, the exchange rate was 1 euro = 327.6 forints.

(b) Calculate the total profit, in euros to 2 decimal places, that Indre made by selling all 1000 dolls.

(8)

(c) (i) Calculate the percentage profit, to 3 significant figures, that Indre made.

(2)

(ii) State how the percentage profit in part (c) (i) would be affected if the total profit calculated in part (b) had been in forints.

(1)

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Question 12 continued

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Question 12 continued

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