

Please check the examination details below before entering your candidate information

Candidate surname	Other names
Pearson Edexcel	Centre Number
International GCSE	Candidate Number
Friday 10 January 2020	
Morning (Time: 2 hours)	Paper Reference 4PM1/01
<p style="text-align: center;">Further Pure Mathematics</p> <p style="text-align: center;">Level 2</p> <p style="text-align: center;">Paper 1</p> <div style="text-align: right; margin-top: 10px;">  </div>	
Calculators 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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **NOT** write anything on the formulae page.
Anything you write on the formulae page will gain **NO** credit.

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.

Turn over ►

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International GCSE in Further Pure Mathematics Formulae sheet

MensurationSurface area of sphere = $4\pi r^2$ Curved surface area of cone = $\pi r \times$ slant heightVolume of sphere = $\frac{4}{3}\pi r^3$ **Series****Arithmetic series**Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$ **Geometric series**Sum to n terms, $S_n = \frac{a(1-r^n)}{(1-r)}$ Sum to infinity, $S_\infty = \frac{a}{1-r}$ $|r| < 1$ **Binomial series** $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \dots + \frac{n(n-1)\dots(n-r+1)}{r!}x^r + \dots$ for $|x| < 1, n \in \mathbb{Q}$ **Calculus****Quotient rule (differentiation)**

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

Trigonometry**Cosine rule**In triangle ABC : $a^2 = b^2 + c^2 - 2bc \cos A$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Logarithms

$$\log_a x = \frac{\log_b x}{\log_b a}$$

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Question 1 continued

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Area for writing answers, consisting of multiple horizontal dotted lines.

(Total for Question 1 is 9 marks)



2 (a) On the grid below, draw the line with equation

(i) $5x + 2y = 10$ (ii) $y = x$

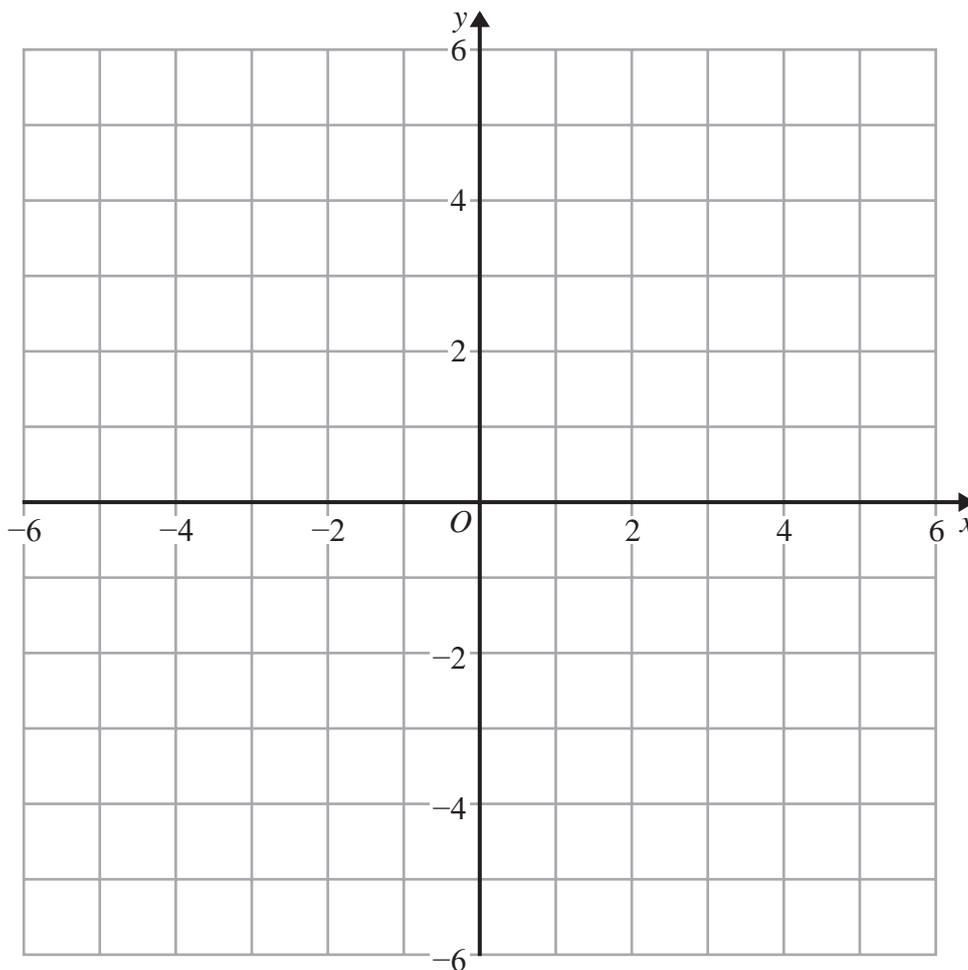
(2)

(b) Show, by shading on the grid, the region R defined by the inequalities

$y \leq x$ $5x + 2y \leq 10$ $y \geq -2$ $x \geq 1$

Label the region R .

(2)



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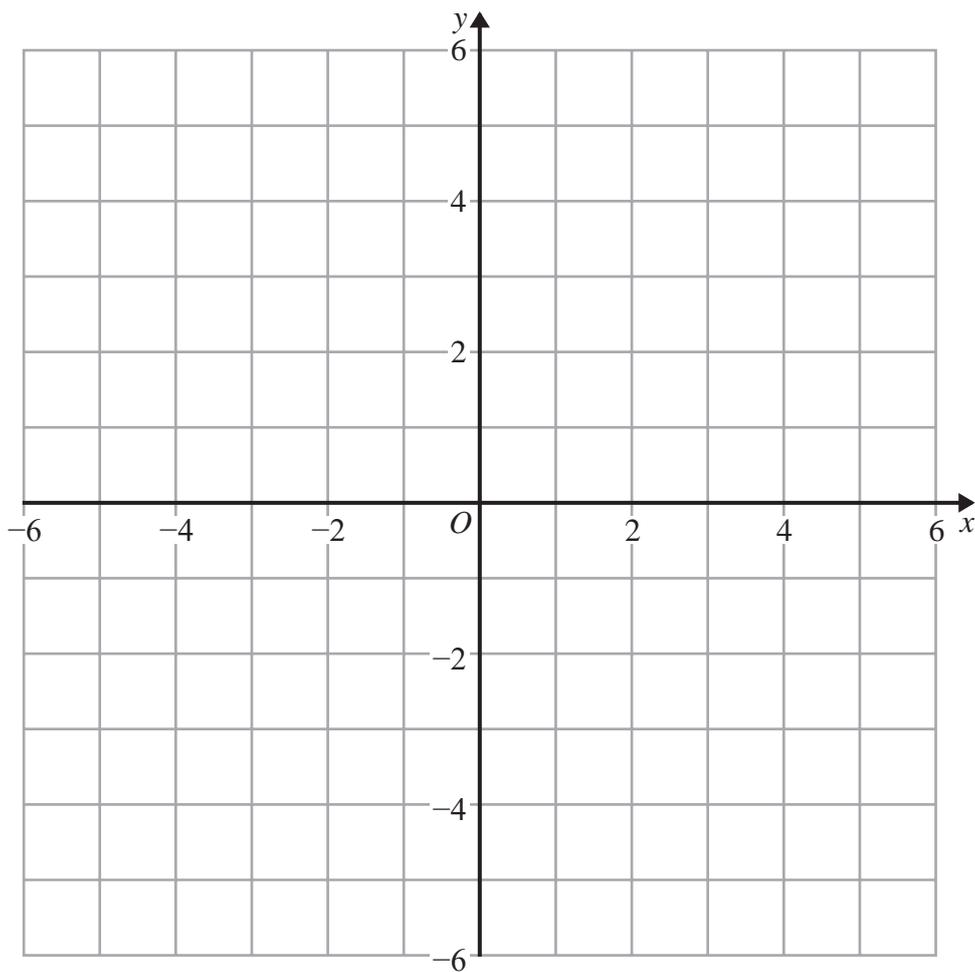
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Question 2 continued

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



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(Total for Question 2 is 4 marks)



Question 3 continued

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(Total for Question 3 is 6 marks)



Question 4 continued

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(Total for Question 4 is 6 marks)



5

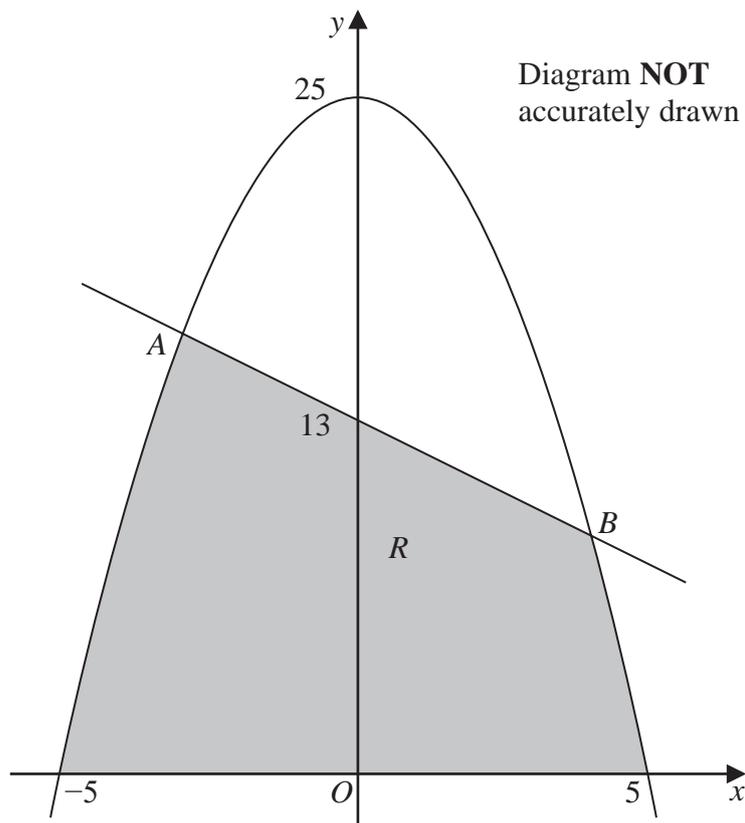


Figure 2

Figure 2 shows part of the curve with equation $y = 25 - x^2$ and part of the line with equation $y + x = 13$

The curve and the line intersect at the points A and B .

- (a) Use algebra to find the coordinates of A and the coordinates of B . (4)

The region R , shown shaded in Figure 2, is bounded by the curve, the straight line and the x -axis.

- (b) Use algebraic integration to find the area of R . (7)

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Question 5 continued

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A large rectangular area with rounded corners, containing numerous horizontal dotted lines for writing.



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Question 5 continued

Area with horizontal dotted lines for writing answers.

(Total for Question 5 is 11 marks)



Question 6 continued

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Question 6 continued

Area with horizontal dotted lines for writing answers.

(Total for Question 6 is 14 marks)



7 Solve the equation

$$\log_7(8x^2 - 6x + 3) - \log_{49}x^2 = 3\log_7 2$$

(5)

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Question 7 continued

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(Total for Question 7 is 5 marks)



Question 8 continued

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Question 8 continued

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Area with horizontal dotted lines for writing answers.

(Total for Question 8 is 11 marks)



Question 9 continued

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Question 9 continued

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Area with horizontal dotted lines for writing.

(Total for Question 9 is 8 marks)



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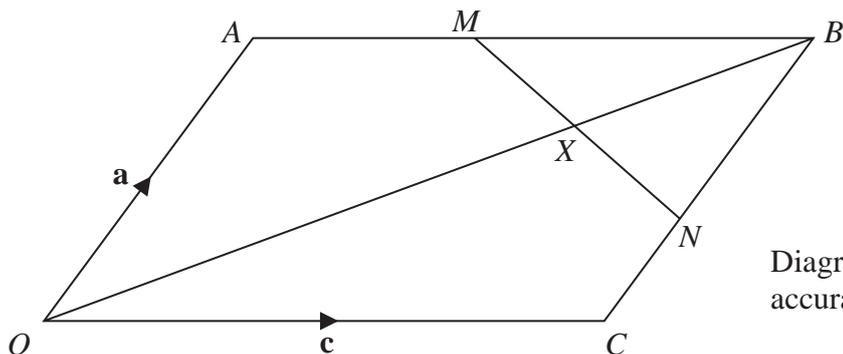


Diagram NOT accurately drawn

Figure 3

Figure 3 shows the parallelogram $OABC$

$$\vec{OA} = \mathbf{a} \quad \vec{OC} = \mathbf{c}$$

The midpoint of AB is M and the midpoint of BC is N .

The line OB intersects MN at the point X .

(a) Find in terms of \mathbf{a} and \mathbf{c} ,

(i) \vec{OB}

(ii) \vec{MN}

(2)

Given $\vec{MX} = \lambda \vec{MN}$ and that $\vec{OX} = \mu \vec{OB}$,

(b) use a vector method to find the value of λ and the value of μ .

(8)

(c) Hence find, in its simplest form, the ratio

Area of quadrilateral $OXNC$: Area of parallelogram $OABC$.

(3)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 13 marks)



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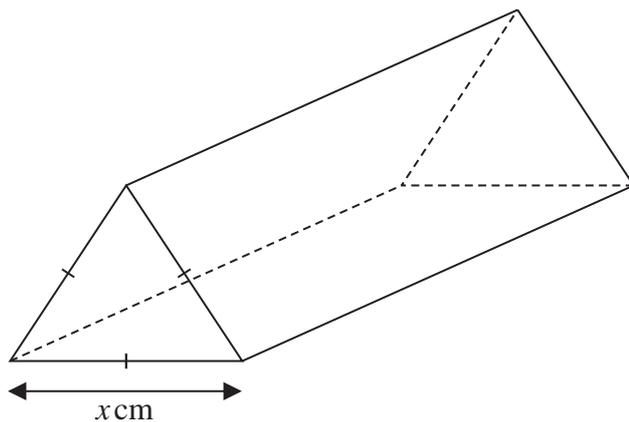


Diagram NOT accurately drawn

Figure 4

A company manufactures chocolate bars that are inside packaging that is in the shape of a right triangular prism.

The cross section of the prism is an equilateral triangle with sides of length x cm, as shown in Figure 4.

The volume of the prism is 72 cm^3

The total surface area of the prism is $S \text{ cm}^2$

(a) Show that

$$S = \frac{\sqrt{3}x^2}{2} + \frac{288\sqrt{3}}{x} \tag{6}$$

Given that x can vary,

(b) use calculus to find, to 4 significant figures, the value of x for which S is a minimum, justifying that this value gives a minimum value of S . (5)

(c) Find, to 3 significant figures, the minimum value of S . (2)

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Question 11 continued

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