

Please check the examination details below before entering your candidate information

Candidate surname	Other names
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**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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**Friday 10 January 2020**

Morning (Time: 2 hours)	Paper Reference <b>4PM1/01</b>
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**Further Pure Mathematics**  
**Level 2**  
**Paper 1**



**Calculators may be used.**

Total Marks

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### 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 ►



International GCSE in Further Pure Mathematics Formulae sheet

**Mensuration**

Surface area of sphere =  $4\pi r^2$

Curved surface area of cone =  $\pi r \times$  slant height

Volume 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,  $S_\infty = \frac{a}{1 - r} \quad |r| < 1$

**Binomial series**

$(1 + x)^n = 1 + nx + \frac{n(n - 1)}{2!}x^2 + \dots + \frac{n(n - 1)\dots(n - r + 1)}{r!}x^r + \dots \quad \text{for } |x| < 1, n \in \mathbb{Q}$

**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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Question 1 continued

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(Total for Question 1 is 9 marks)



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

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

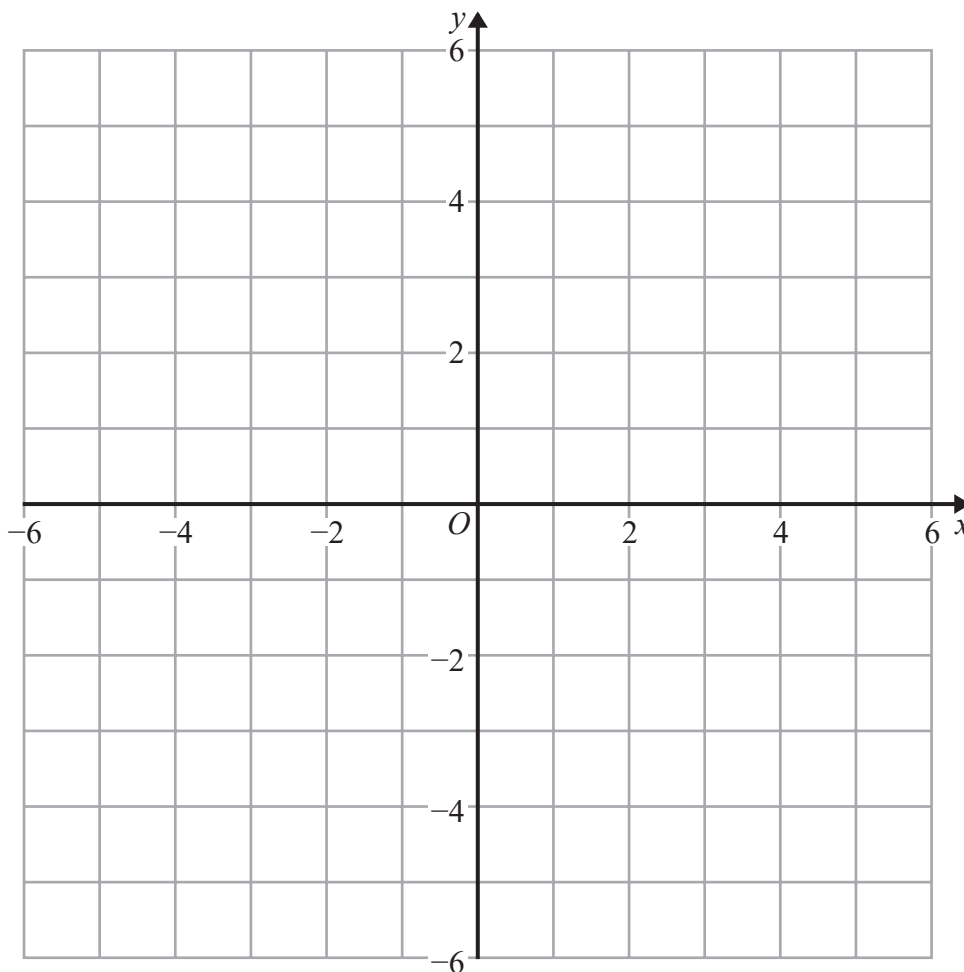
(2)

(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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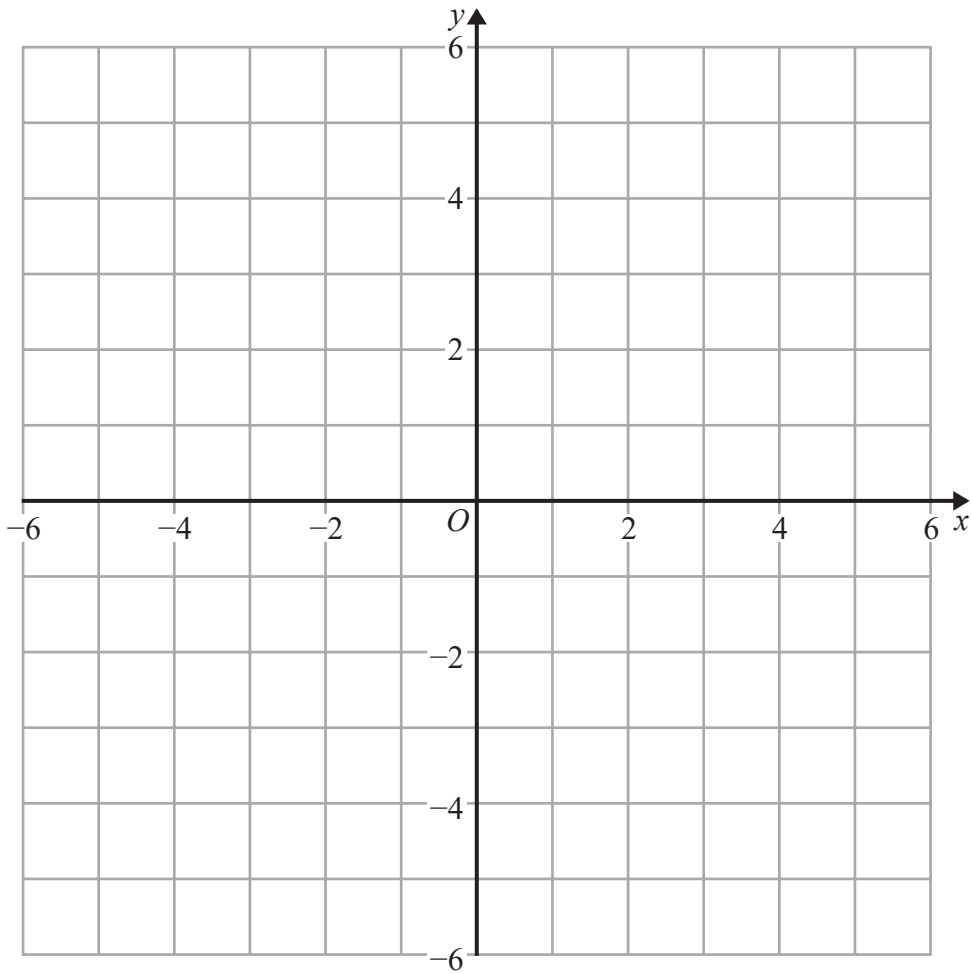
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Question 2 continued

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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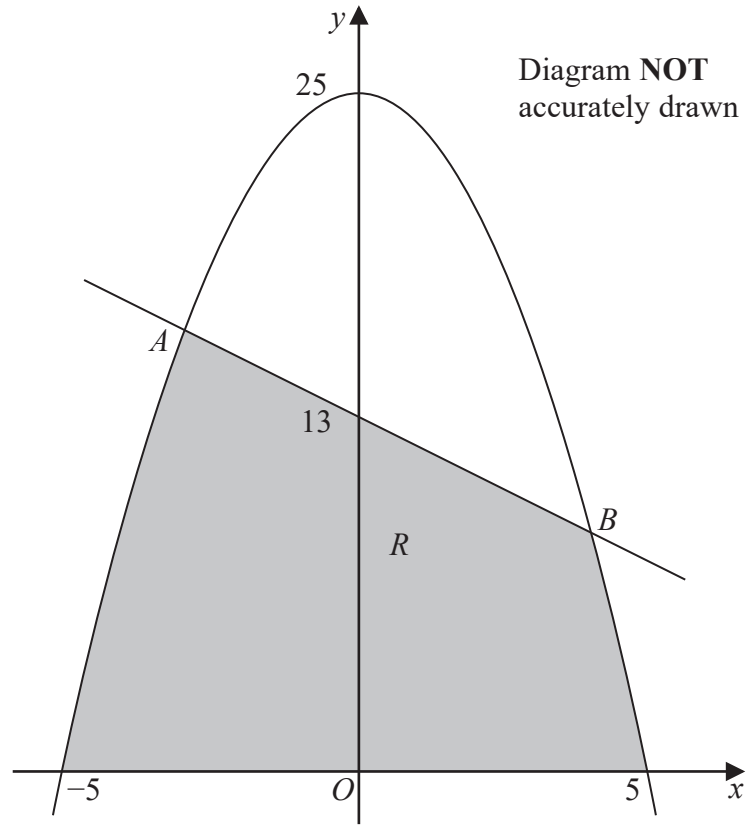
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(Total for Question 4 is 6 marks)





**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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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 11 marks)







Question 6 continued

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Question 6 continued

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Question 6 continued

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(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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Question 8 continued

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(Total for Question 8 is 11 marks)





Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 8 marks)



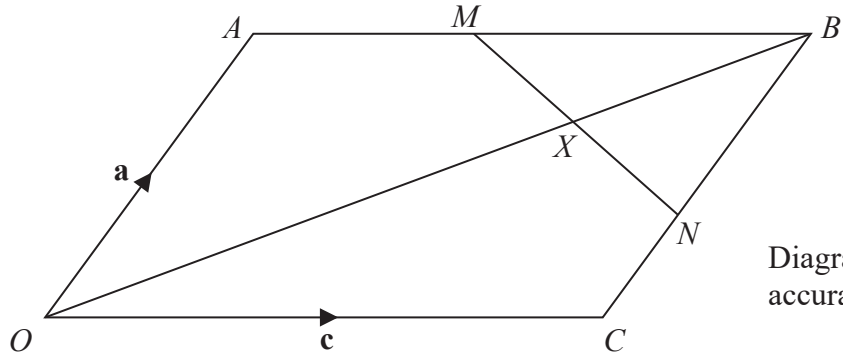


Diagram NOT accurately drawn

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  $\lambda$  and the value of  $\mu$ .

(8)

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

$$\text{Area of quadrilateral } OXNC : \text{Area of parallelogram } OABC.$$

(3)

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Question 10 continued

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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)



11

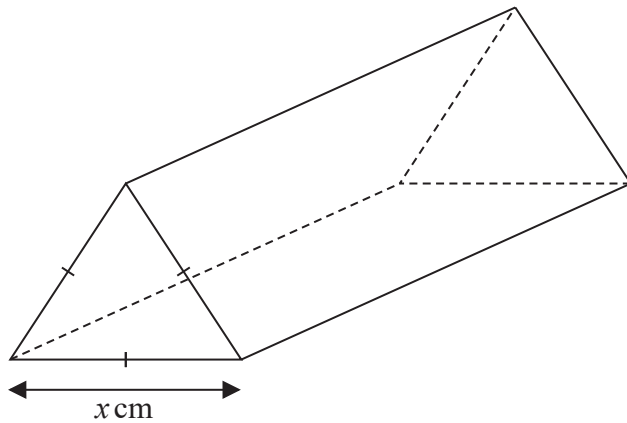


Diagram NOT accurately drawn

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  $72 \text{ cm}^3$

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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