

Please check the examination details below before entering your candidate information

Candidatesurname	Othernames
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Centre Number	Candidate Number
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Pearson Edexcel International GCSE

Time 2 hours	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">Paper reference</td> <td style="font-size: 24px; font-weight: bold; padding: 2px 5px;">4PM1/01</td> </tr> </table>	Paper reference	4PM1/01
Paper reference	4PM1/01		

Further Pure Mathematics

PAPER 1

Calculators may be used.	TotalMarks
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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 ►

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Q:1/1/1/1/



International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

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

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

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

Series**Arithmetic series**

$$\text{Sum to } n \text{ terms, } S_n = \frac{n}{2}[2a + (n-1)d]$$

Geometric series

$$\text{Sum to } n \text{ terms, } S_n = \frac{a(1-r^n)}{(1-r)}$$

$$\text{Sum to infinity, } S_\infty = \frac{a}{1-r} \quad |r| < 1$$

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**

$$\text{In triangle } ABC: a^2 = b^2 + c^2 - 2bc \cos A$$

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

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

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

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

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

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

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

Logarithms

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

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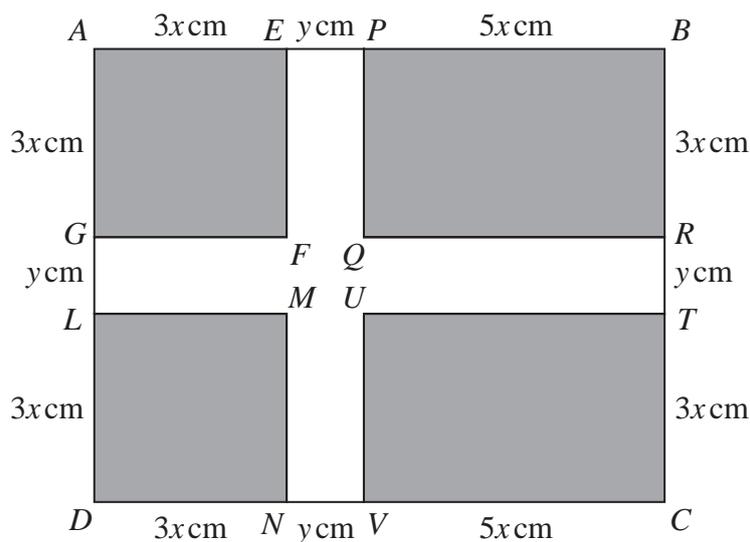


Figure 1

Figure 1 shows the design for a flag consisting of a white cross on a grey background.

$AEFG$ and $DLMN$ are squares with sides of length $3x$ cm.

$BPQR$ and $CTUV$ are rectangles with sides of length $5x$ cm and $3x$ cm.

The width of the cross is y cm.

The total area of the flag is H cm²

(a) Write down an expression, in terms of x and y , for H .

(1)

Given that the area of the cross is K cm²

(b) show that $K = 14xy + y^2$

(3)

The total area of the flag is to be 3432 cm² and the area of the cross is to be 1080 cm²

(c) Find the value of x and the value of y

(5)

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Question 2 continued

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Question 2 continued

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(Total for Question 2 is 9 marks)



Question 3 continued

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(Total for Question 3 is 7 marks)



Question 4 continued

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(Total for Question 4 is 7 marks)



Question 5 continued

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Question 5 continued

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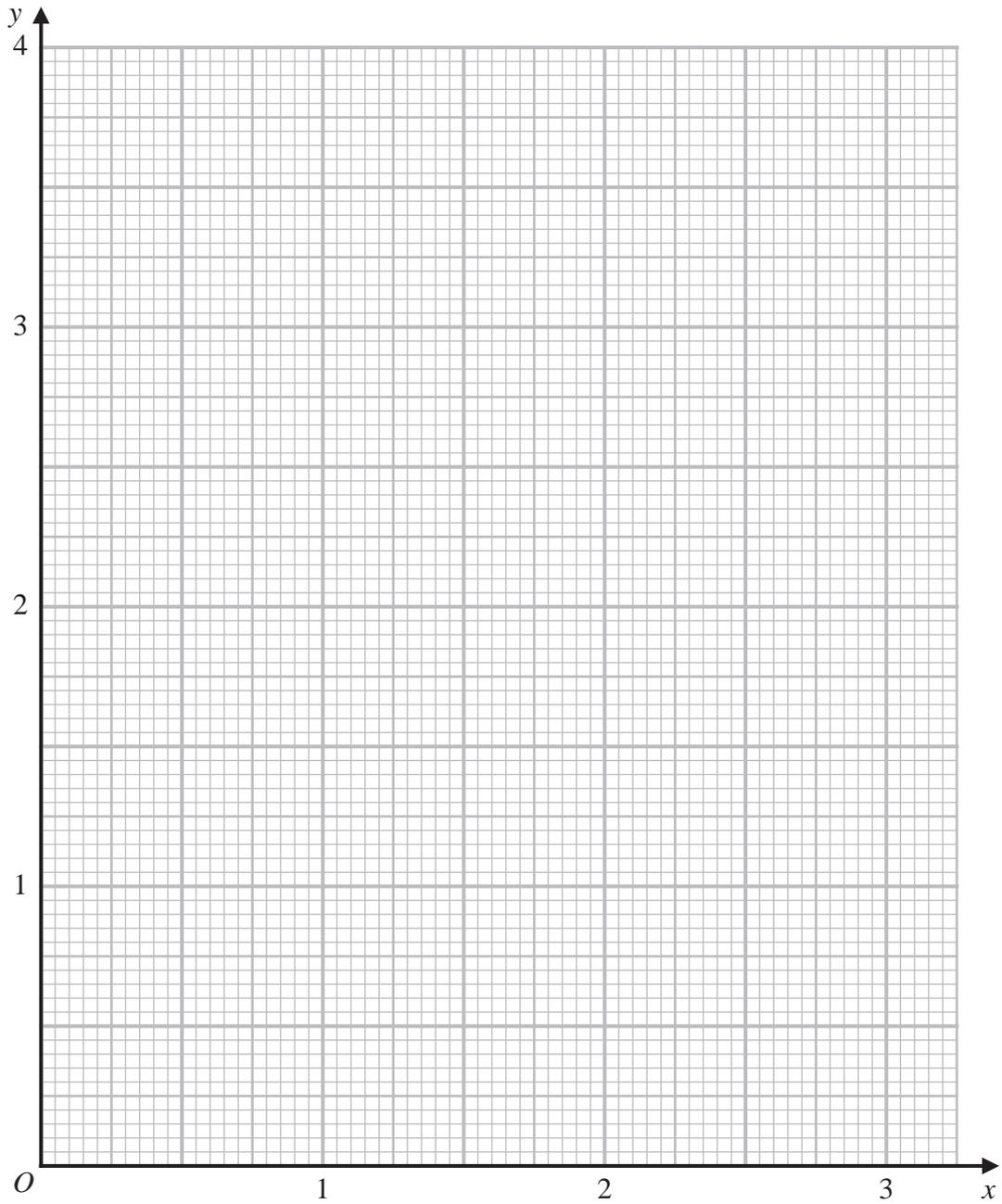
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(Total for Question 5 is 11 marks)



Question 6 continued



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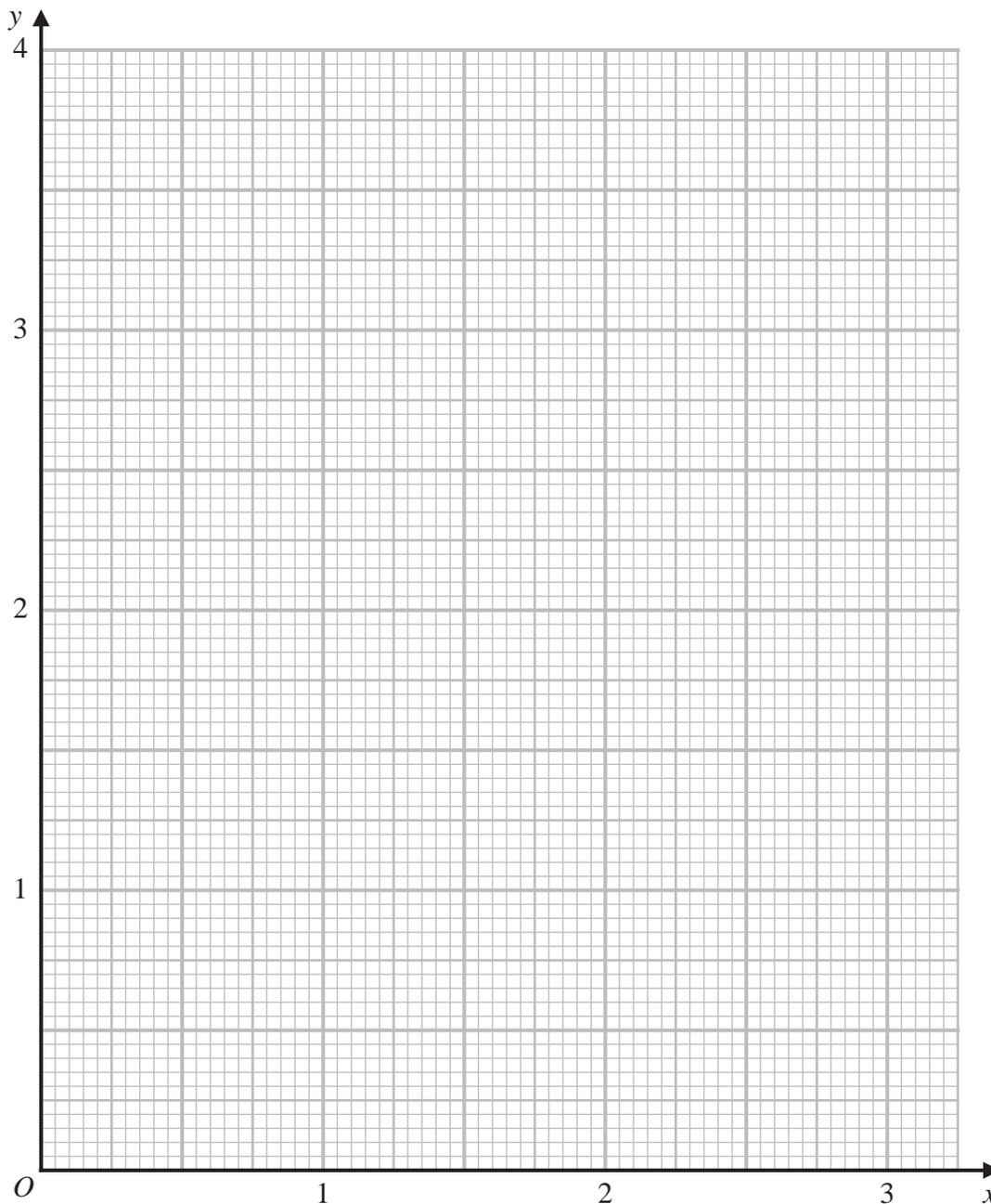
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Turn over for a spare grid if you need to redraw your graph.



Question 6 continued

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



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(Total for Question 6 is 11 marks)



Question 7 continued

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Question 7 continued

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(Total for Question 7 is 15 marks)



Question 8 continued

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(Total for Question 8 is 7 marks)



9

$$f(x) = 3x^4 + 4x^3 - 36x^2 + 64$$

Given that $f(x)$ can be written in the form $(x - 2)^2(ax^2 + bx + c)$

(a) find the value of a , the value of b and the value of c

(4)

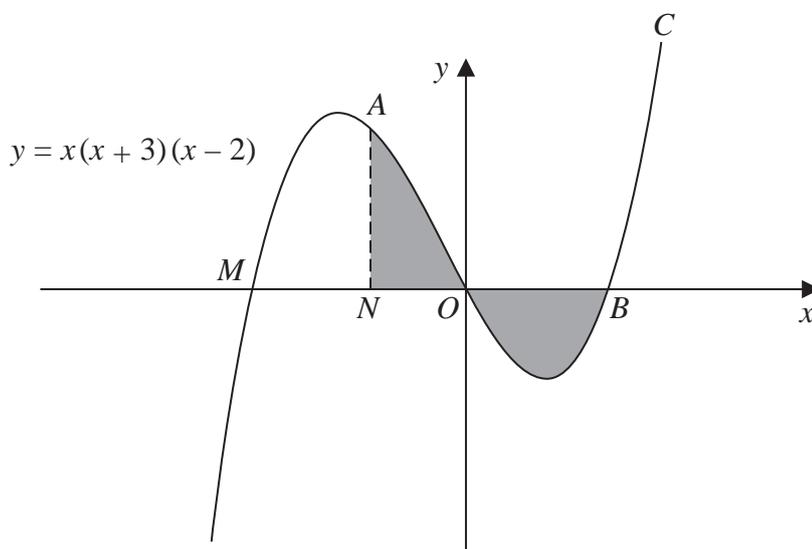


Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows a sketch of part of the curve C with equation $y = x(x + 3)(x - 2)$

The curve C crosses the x -axis at the point M , the origin and the point B .

The point N lies on the x -axis between M and O .

The point A lies on C such that AN is parallel to the y -axis.

The area of the shaded region bounded by the curve and OB is numerically equal to the area of the shaded region bounded by the curve, ON and NA .

Given that the coordinates of N are $(n, 0)$,

(b) use algebraic integration to show that n satisfies the equation

$$(x - 2)^2(3x^2 + 16x + 16) = 0 \tag{7}$$

(c) Hence find the exact coordinates of A .

(5)

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 16 marks)



10

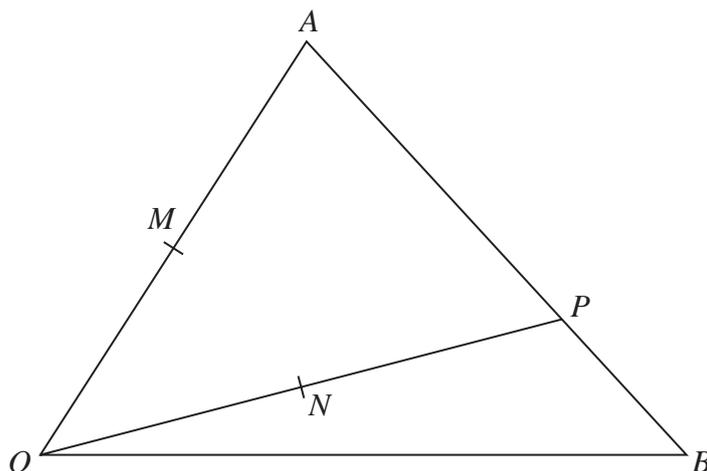


Diagram NOT accurately drawn

Figure 4

Figure 4 shows triangle OAB in which

$$\vec{OA} = \mathbf{a} \text{ and } \vec{OB} = \mathbf{b}$$

The point P lies on AB such that $AP:PB = 3:1$

The point M is the midpoint of OA and the point N is the midpoint of OP .

(a) Find, as simplified expressions in terms of \mathbf{a} and \mathbf{b} , the vector

- (i) \vec{OP} (ii) \vec{MN}

(4)

The point C lies on OB such that ANC is a straight line.

(b) Using a vector method, find the vector \vec{OC} as a simplified expression in terms of \mathbf{b}

(6)

Given that $\frac{\text{area of quadrilateral } AMNP}{\text{area of triangle } OAB} = K$

(c) find the exact value of K

(4)

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Question 10 continued

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