

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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**Pearson Edexcel International GCSE**

Time 2 hours

Paper  
reference

**4PM1/02**

# Further Pure Mathematics

## PAPER 2



**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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Pearson

## 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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Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

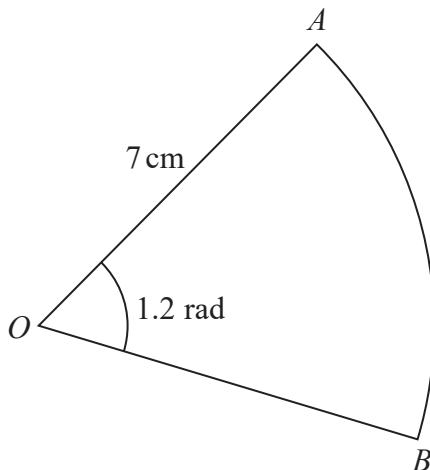


Diagram NOT  
accurately drawn

Figure 1

Figure 1 shows sector  $AOB$  of a circle with centre  $O$  and radius  $7\text{ cm}$ .

The angle  $AOB$  is  $1.2$  radians.

Calculate

- (a) the area of sector  $AOB$  (2)
- (b) the perimeter of sector  $AOB$  (2)

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(Total for Question 1 is 4 marks)



P 6 6 3 0 8 A 0 3 3 6

2 Solve the equation

$$\sin(2\theta - 20)^\circ - \sqrt{3} \cos(2\theta - 20)^\circ = 0 \quad \text{for } 0 \leq \theta \leq 180 \quad (5)$$

Handwriting practice area consisting of 20 horizontal dotted lines.

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**Question 2 continued**

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**(Total for Question 2 is 5 marks)**





**Question 3 continued**

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Handwriting practice area consisting of 25 horizontal dotted lines.

**(Total for Question 3 is 5 marks)**







**Question 4 continued**

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Area with horizontal dotted lines for writing.



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**Question 4 continued**

Area with horizontal dotted lines for writing.

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**Question 4 continued**

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**(Total for Question 4 is 9 marks)**





**Question 5 continued**

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Handwriting practice area with 25 horizontal dotted lines.



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**Question 5 continued**

Area with horizontal dotted lines for writing.

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**Question 5 continued**

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Handwriting practice area with 28 horizontal dotted lines.

**(Total for Question 5 is 9 marks)**







**Question 6 continued**

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Handwriting practice area with 25 horizontal dotted lines.



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Question 6 continued

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**Question 6 continued**

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Area with horizontal dotted lines for writing.

**(Total for Question 6 is 13 marks)**





**Question 7 continued**

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Handwriting practice area with 25 horizontal dotted lines.



P 6 6 3 0 8 A 0 2 1 3 6

**Question 7 continued**

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**Question 7 continued**

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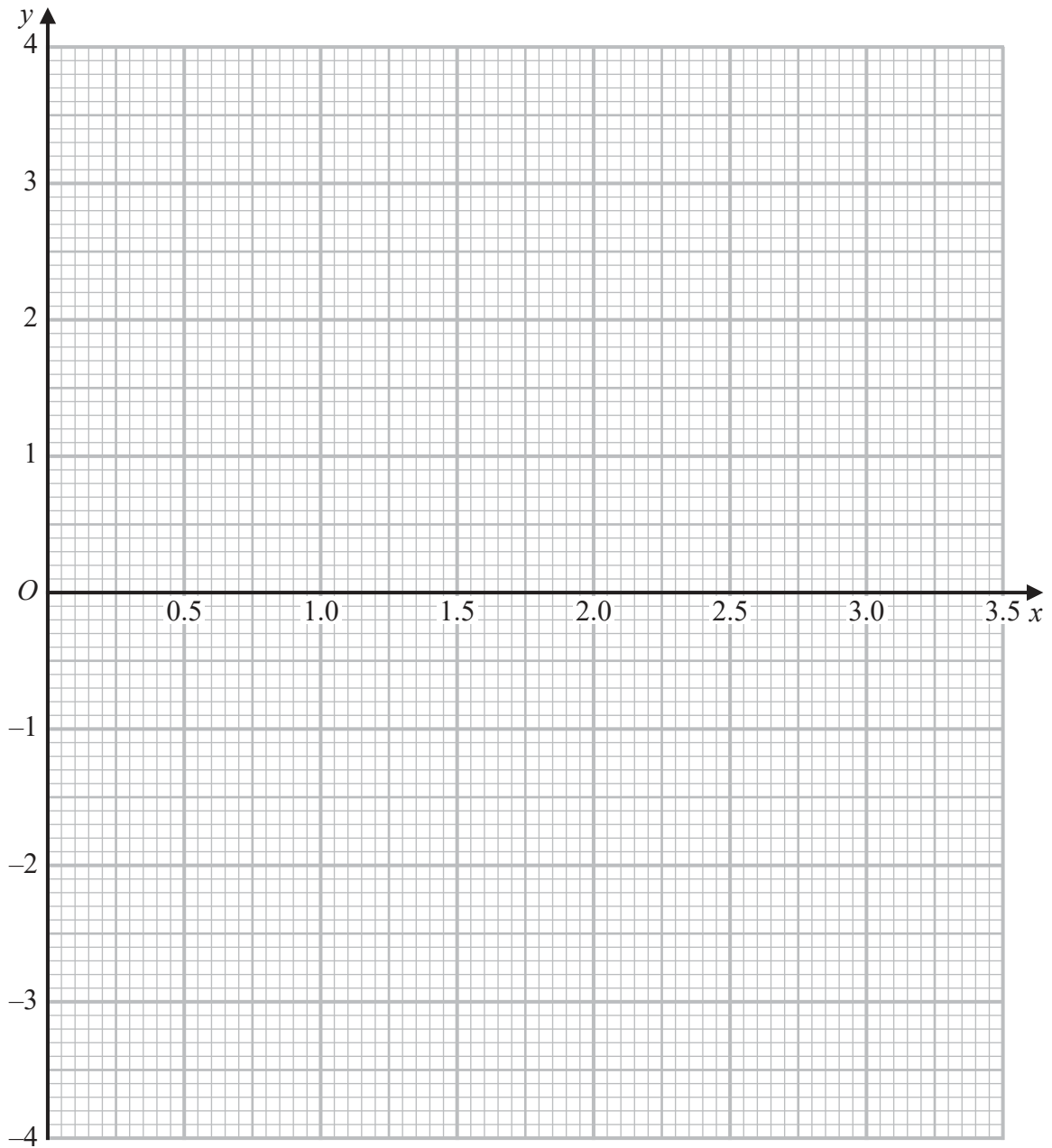
**(Total for Question 7 is 13 marks)**







Question 8 continued



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



**Question 8 continued**

Area with horizontal dotted lines for writing.

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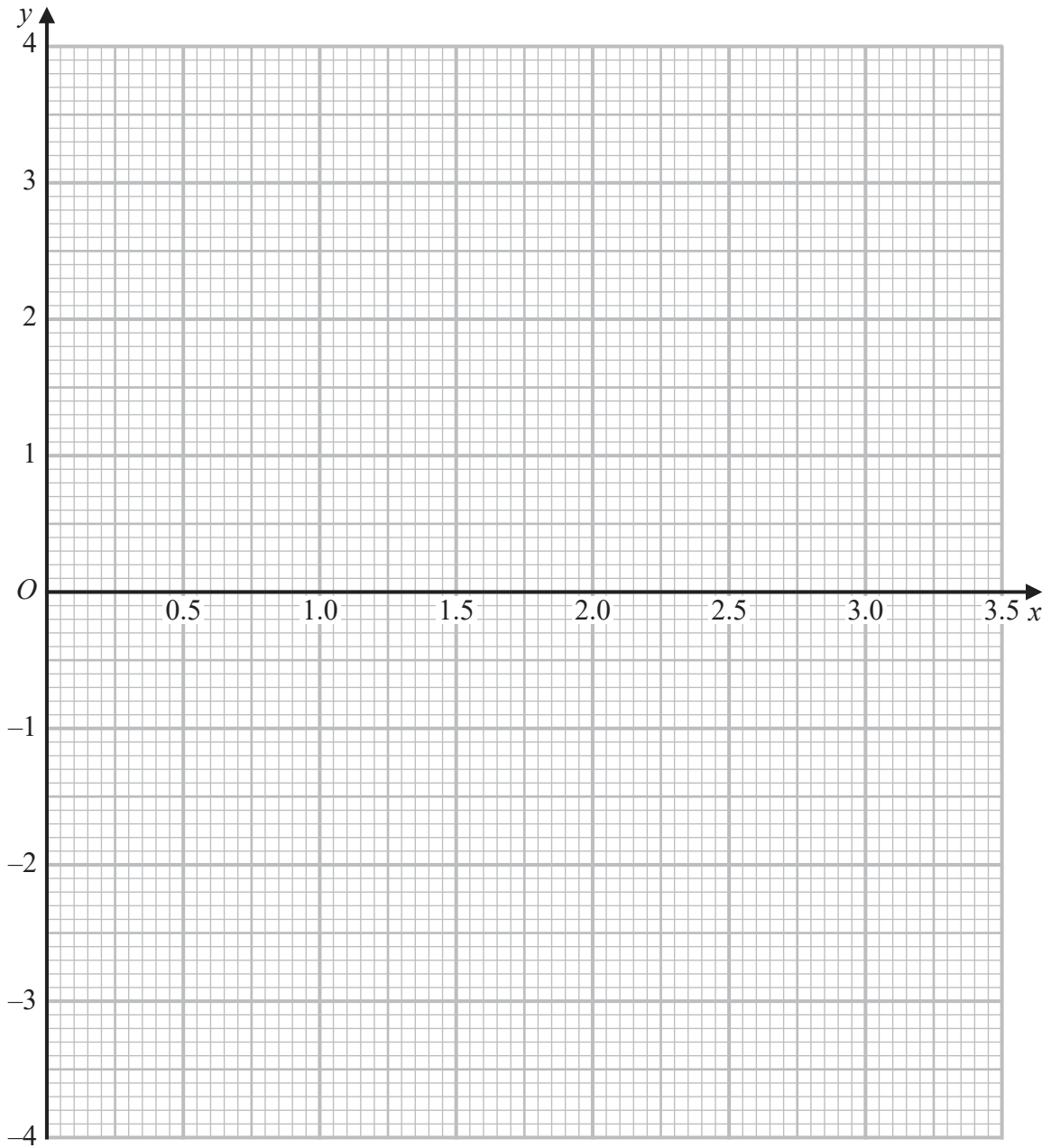
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Question 8 continued

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(Total for Question 8 is 11 marks)



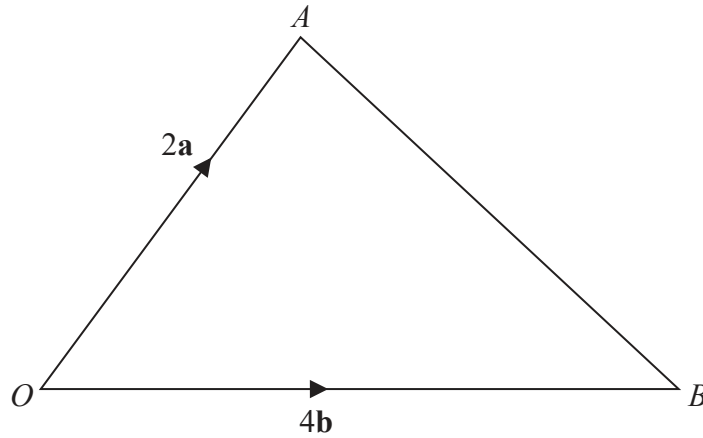


Diagram NOT accurately drawn

Figure 3

Figure 3 shows the triangle  $OAB$  with

$$\vec{OA} = 2\mathbf{a} \text{ and } \vec{OB} = 4\mathbf{b}$$

- (a) Find  $\vec{AB}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (2)

The point  $P$  is the midpoint of  $AB$

- (b) Find  $\vec{OP}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (2)

The point  $Q$  lies on  $OP$  such that  $OQ : QP = 3 : 1$

- (c) Find  $\vec{AQ}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (3)

The point  $R$  lies on  $OB$  such that  $AQR$  is a straight line.

- (d) Find in its simplest form the ratio  $OR : RB$  (6)

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**Question 9 continued**

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Handwriting practice area with 25 horizontal dotted lines.



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Question 9 continued

Area with horizontal dotted lines for writing.

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**Question 9 continued**

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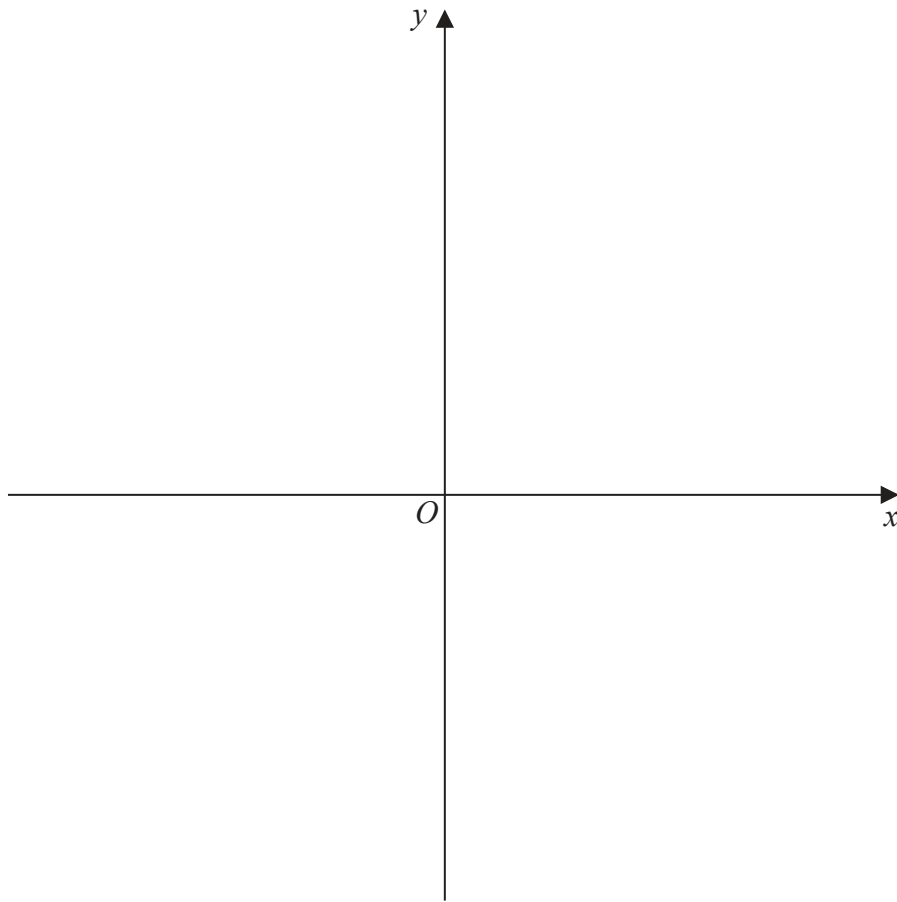
**(Total for Question 9 is 13 marks)**







Question 10 continued



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Turn over for spare axes if you need to redraw your sketch.



**Question 10 continued**

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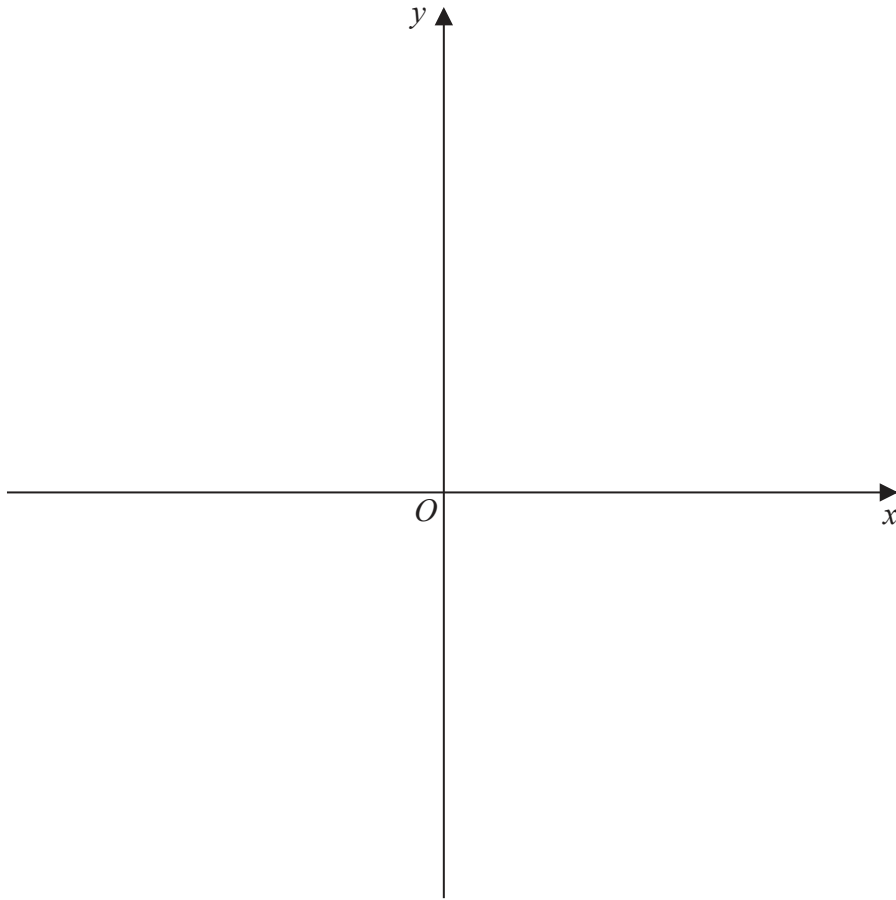
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Question 10 continued

Only use these axes if you need to redraw your sketch.



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Area with horizontal dotted lines for writing.



