

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

--	--	--	--	--

--	--	--	--

## Pearson Edexcel International GCSE

Time 2 hours

Paper  
reference

**4PM1/01R**

### Further Pure Mathematics PAPER 1R



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 ►

P71641A

©2022 Pearson Education Ltd.

Q:1/1/1/1



  
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

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

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA







**Question 2 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 2 is 7 marks)**



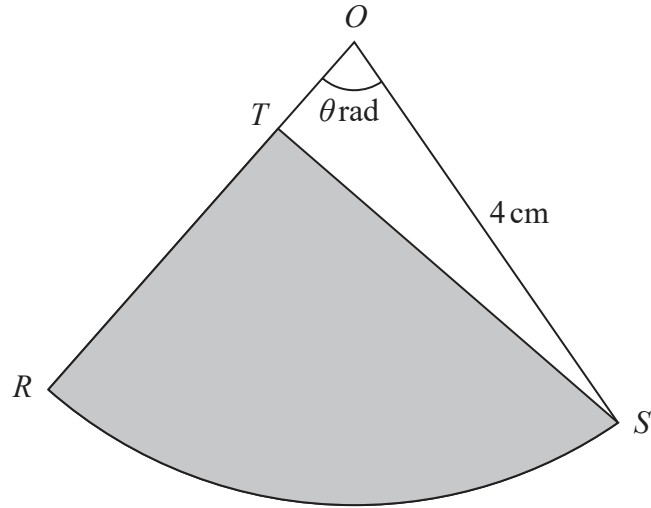


Diagram NOT accurately drawn

Figure 1

Figure 1 shows sector  $ORS$  of a circle with centre  $O$  and radius 4 cm. The size of angle  $ROS$  is  $\theta$  radians.

The area of sector  $ORS$  is  $2\pi \text{ cm}^2$

(a) Find the exact value of  $\theta$  (2)

(b) Find the perimeter, in cm to 3 significant figures, of the sector  $ORS$ . (2)

The point  $T$  lies on  $OR$  such that  $OT : TR = 1 : 3$

The region shown shaded in Figure 1 is bounded by the line  $TR$ , the line  $TS$  and the arc  $RS$  of the sector.

The area of this region is  $A \text{ cm}^2$

(c) Find the exact value of  $A$  (2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 3 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 3 is 6 marks)**



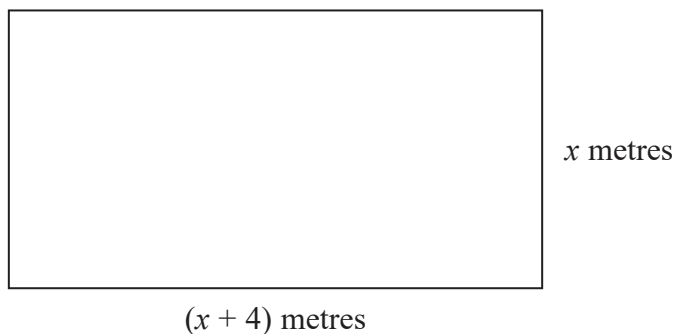


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a rectangle with width  $x$  metres and length  $(x + 4)$  metres.

The perimeter of the rectangle is  $P$  metres and the area of the rectangle is  $A$  m<sup>2</sup>

(a) Find, in terms of  $x$ , an expression for

- (i)  $P$
- (ii)  $A$

(2)

The perimeter of the rectangle has to be less than 30 metres.

The area of the rectangle has to be greater than 12 m<sup>2</sup>

(b) Find the set of possible values for  $x$

Give your answer in the form  $a < x < b$

(5)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA





**Question 4 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 4 is 7 marks)**



P 7 1 6 4 1 A 0 9 3 6

5 Differentiate with respect to  $x$

(a)  $e^{4x}(6x + 2)^{\frac{3}{2}}$

Give your answer in the form  $e^{4x}(\sqrt{6x + 2})(Ax + B)$  where  $A$  and  $B$  are integers.

(5)

(b)  $\frac{\sin 3x}{(2x - 4)^3}$

(3)

[Dotted lines for working out]



**Question 5 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 5 is 8 marks)**



P 7 1 6 4 1 A 0 1 1 3 6

6 Given that  $\frac{a + \sqrt{5}}{\sqrt{5} - 2} = 11 + 5\sqrt{5}$

- (a) without using a calculator, find the value of  $a$   
Show your working clearly.

(2)

Triangle  $PQR$  is such that

$$PR = (x + 3) \text{ cm} \quad QR = x \text{ cm} \quad \text{angle } QPR = 30^\circ \quad \text{angle } PQR = 45^\circ$$

- (b) Show that  $x = 3 + 3\sqrt{2}$

(3)

Given that  $\sin 105^\circ = \frac{\sqrt{6} + \sqrt{2}}{4}$  and that the area of triangle  $PQR$  is  $A \text{ cm}^2$

- (c) find the exact value of  $A$  in the form  $\frac{9}{8}(p\sqrt{6} + q\sqrt{2} + r\sqrt{3} + s)$   
where  $p, q, r$  and  $s$  are integers.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



**Question 6 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Handwriting practice area with 25 horizontal dotted lines.



P 7 1 6 4 1 A 0 1 3 3 6

Question 6 continued

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 6 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 6 is 8 marks)**



P 7 1 6 4 1 A 0 1 5 3 6

7 A curve  $C$  has equation  $y = \log_{10}(x + 2)$

(a) Using the axes below, sketch the graph of  $C$ .

Label the coordinates of the points of intersection of  $C$  with the coordinate axes.

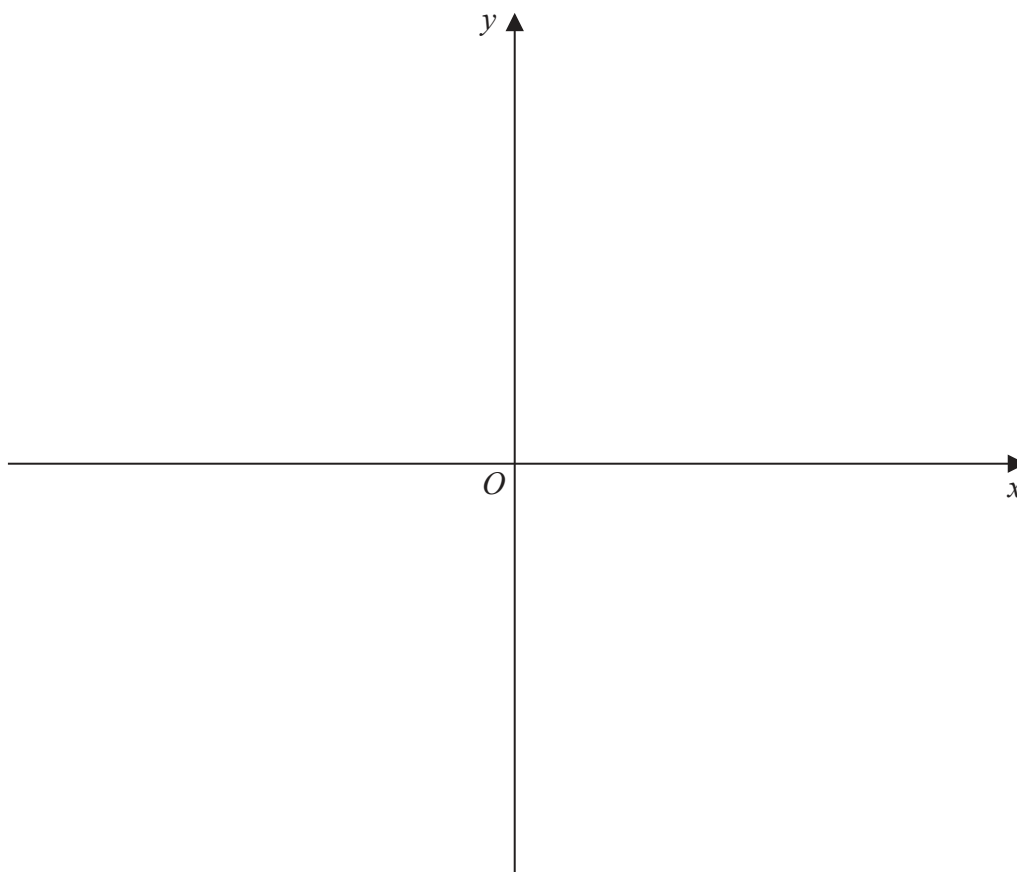
(2)

(b) Solve the equation  $2(\log_a 4 + \log_a 16) = 1$

(3)

(c) Solve the equation  $5\log_q 16 + 4\log_2 q = 24$

(6)



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





**Question 7 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Handwriting practice area with 25 horizontal dotted lines.



P 7 1 6 4 1 A 0 1 7 3 6

**Question 7 continued**

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 7 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 7 is 11 marks)**



P 7 1 6 4 1 A 0 1 9 3 6



**Question 8 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



P 7 1 6 4 1 A 0 2 1 3 6

**Question 8 continued**

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 8 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 8 is 10 marks)**



P 7 1 6 4 1 A 0 2 3 3 6





**Question 9 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



P 7 1 6 4 1 A 0 2 5 3 6

**Question 9 continued**

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 9 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 9 is 10 marks)**



P 7 1 6 4 1 A 0 2 7 3 6

10 Using suitable results for  $\sin(A + B)$  and  $\sin(A - B)$  from the formulae page,

(a) show that  $2 \sin 4x \cos x = \sin 5x + \sin 3x$

(3)

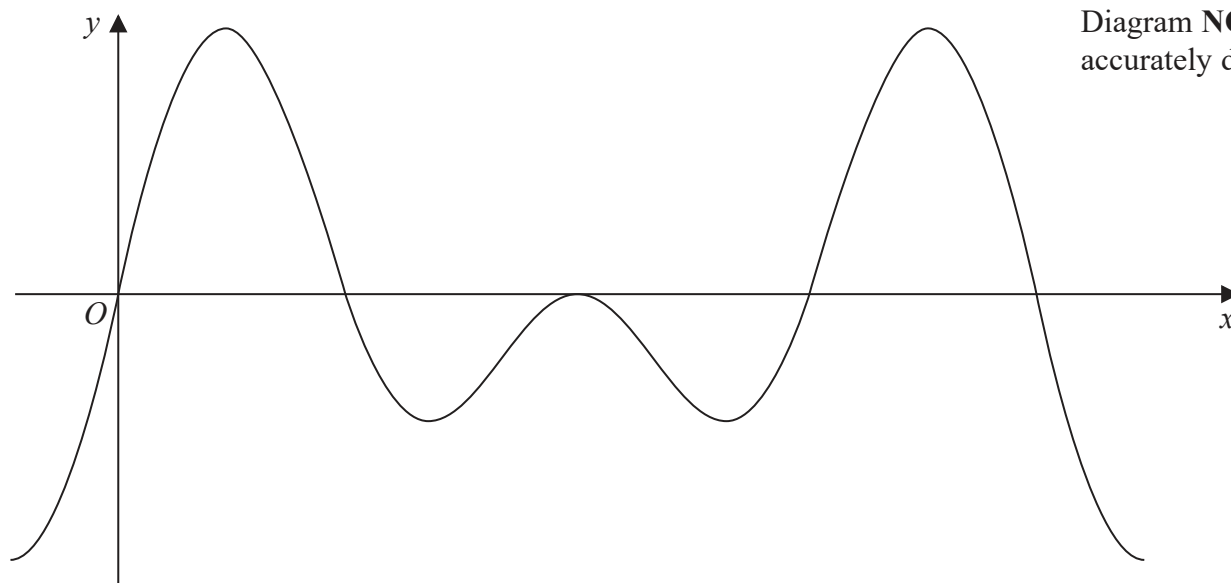


Diagram **NOT**  
accurately drawn

**Figure 4**

Figure 4 shows part of a sketch of the curve  $y = 6 \sin 4x \cos x$

(b) Using calculus, find the total area bounded by the curve and the  $x$ -axis between

$$x = 0 \text{ and } x = \frac{\pi}{2}$$

Give your answer to 3 significant figures.

(8)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



**Question 10 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Handwriting practice area with 20 horizontal dotted lines.



P 7 1 6 4 1 A 0 2 9 3 6

**Question 10 continued**

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 10 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

**(Total for Question 10 is 11 marks)**







**Question 11 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



P 7 1 6 4 1 A 0 3 3 3 6

**Question 11 continued**

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 11 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



**Question 11 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

---

**(Total for Question 11 is 17 marks)**

---

**TOTAL FOR PAPER IS 100 MARKS**

