


Please check the examination details below before entering your candidate information

Candidates surname					Other names				
Centre Number					Candidate Number				
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**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 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**

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

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA





2 A particle  $P$  is moving along a straight line, which passes through the fixed point  $O$ .

At time  $t$  seconds ( $t \geq 0$ ), the velocity,  $v$  m/s, of  $P$  is given by

$$v = t^2 - 3t + 4$$

At time  $t$  seconds the acceleration of  $P$  is  $a$  m/s<sup>2</sup>

(a) Find an expression for  $a$  in terms of  $t$

(2)

The displacement of  $P$  from  $O$  is 7 m when  $t = 2$

(b) Find the exact displacement of  $P$  from  $O$  when  $t = 4$

(5)

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)**



3

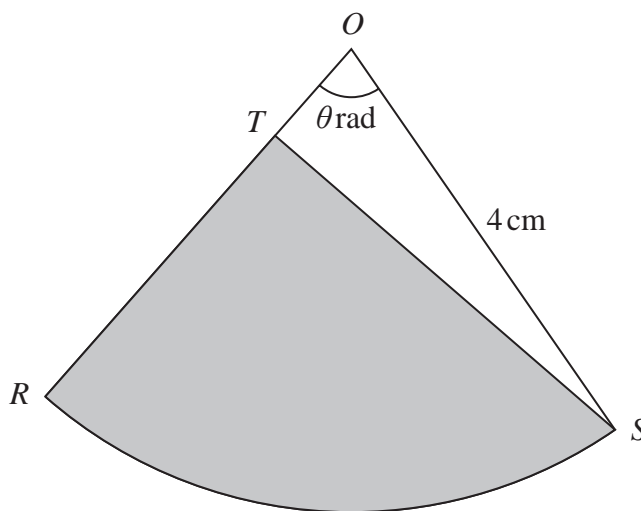


Diagram NOT accurately drawn

Figure 1

Figure 1 shows sector  $ORS$  of a circle with centre  $O$  and radius  $4\text{ cm}$ .  
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  $\text{cm}$  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

6



**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)**





**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 answers.

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



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)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**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 answers.

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



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)

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.





**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 answers.

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



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.

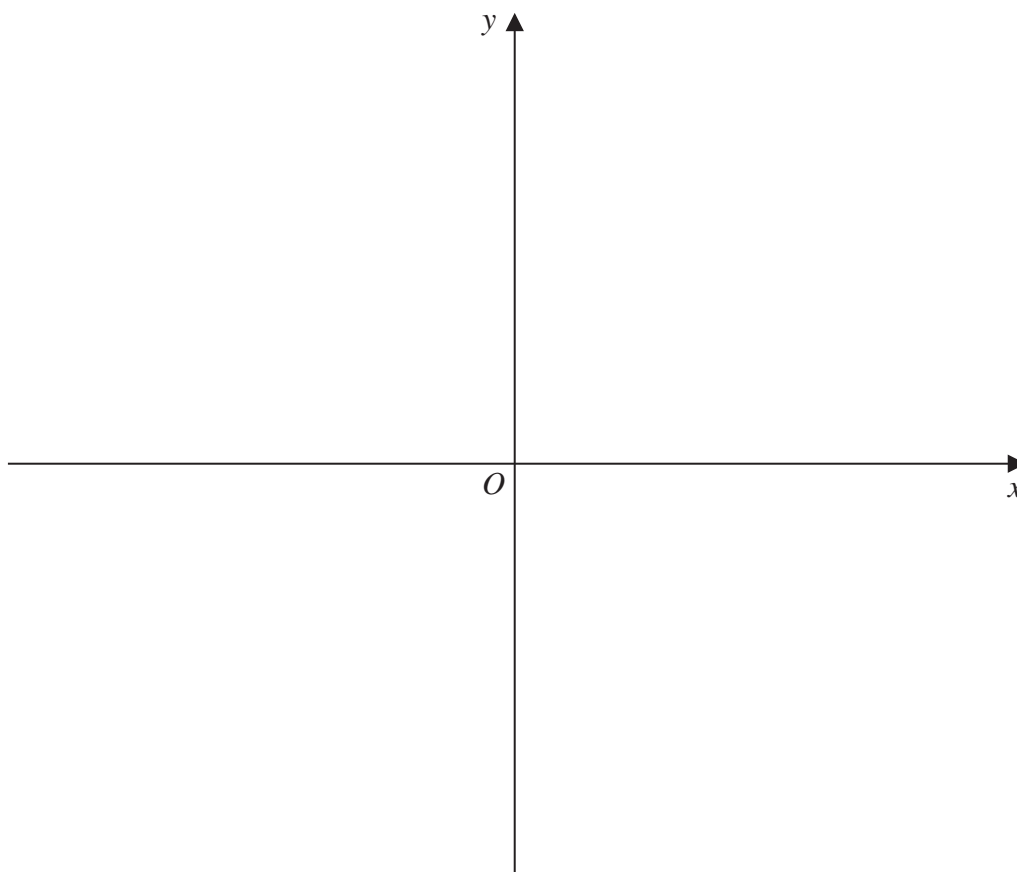
(2)

(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)



.....

.....

.....

.....

.....

.....

.....

.....

.....

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.





**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 answers.

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



- 8 (a) Using the binomial expansion, or otherwise, find the complete expansion of

$$(x + y)^3 \quad (1)$$

The quadratic equation

$$2x^2 + 3x + 4 = 0$$

has roots  $\alpha$  and  $\beta$

- (b) Without solving the equation, find the value of

$$\alpha^3 + \beta^3 \quad (4)$$

- (c) Hence, form a quadratic equation with integer coefficients that has roots

$$\frac{\alpha}{\beta^2} \text{ and } \frac{\beta}{\alpha^2} \quad (5)$$

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.





**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 answers.

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





**Question 9 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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





**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 answers.

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





**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.





**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 answers.

**(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.





**Question 11 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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



