

Please check the examination details below before entering your candidate information

Candidate surname	Other names
<b>Pearson Edexcel</b>	Centre Number
<b>International GCSE</b>	Candidate Number
<b>Thursday 18 June 2020</b>	
Morning (Time: 2 hours)	Paper Reference <b>4PM1/02R</b>
<b>Further Pure Mathematics</b>	
<b>Paper 2R</b>	
	
<b>Calculators may be used.</b>	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 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**

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

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**Question 2 continued**

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**(Total for Question 2 is 11 marks)**





**Question 3 continued**

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**(Total for Question 3 is 8 marks)**



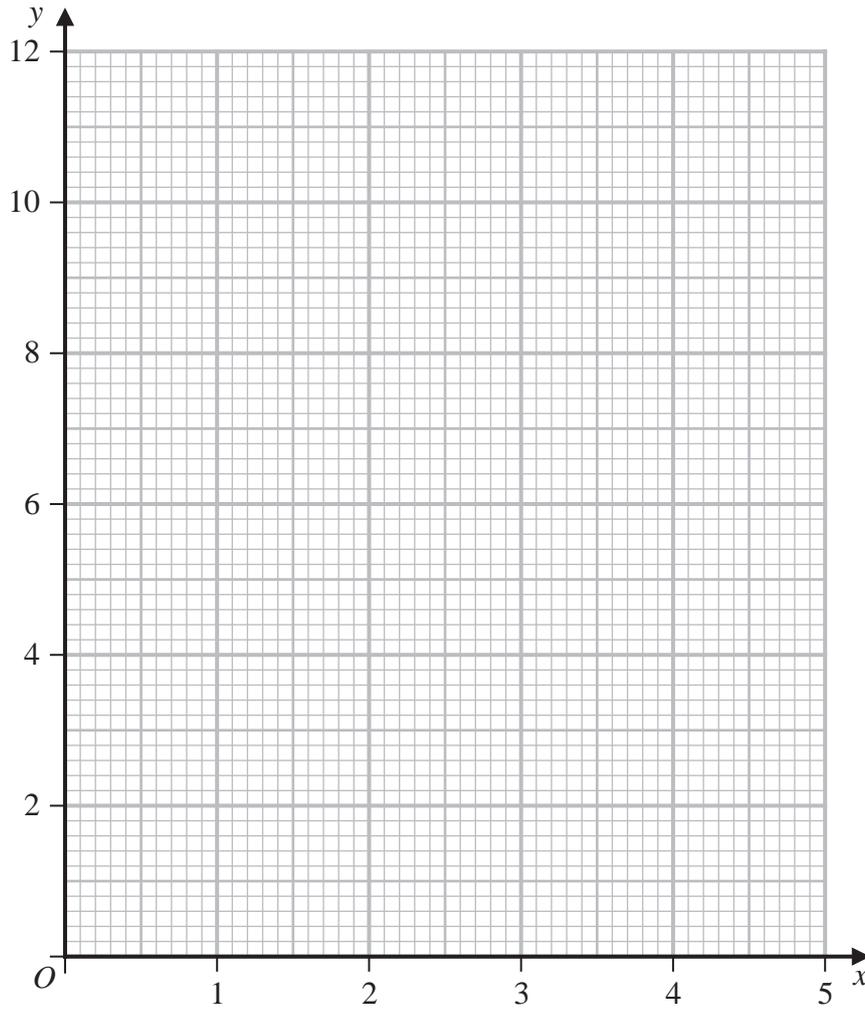


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**Question 4 continued**



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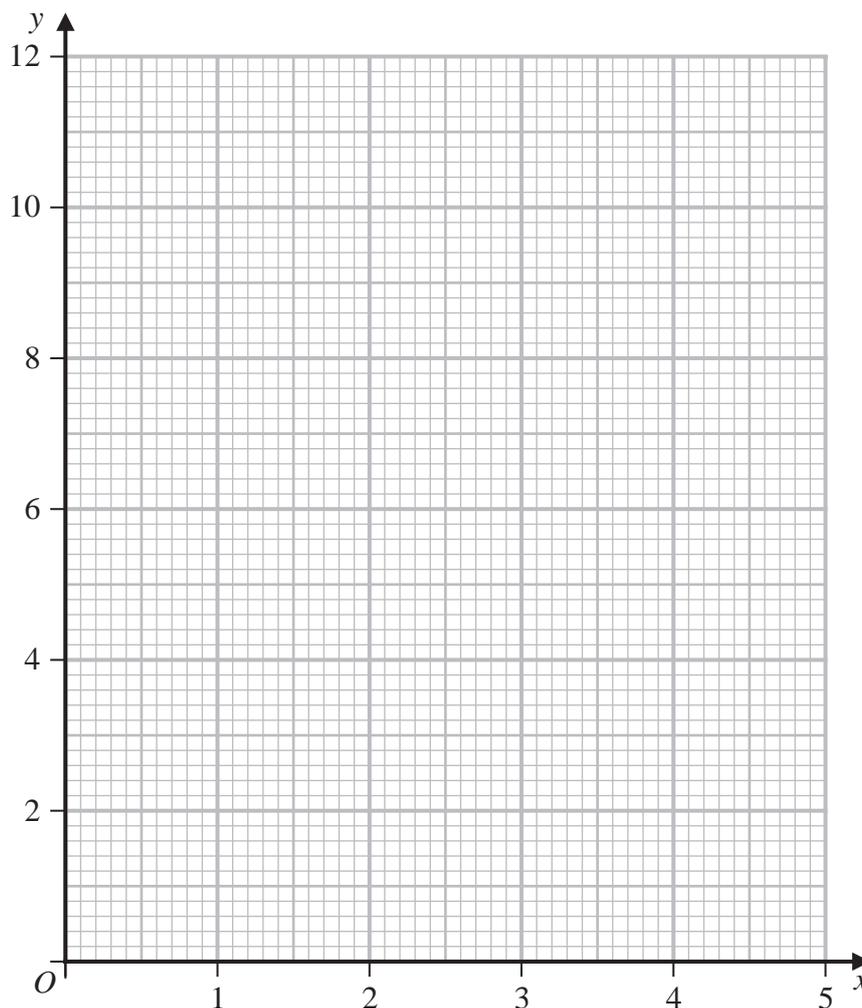
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**Question 4 continued**

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



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**(Total for Question 4 is 11 marks)**





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**Question 5 continued**

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



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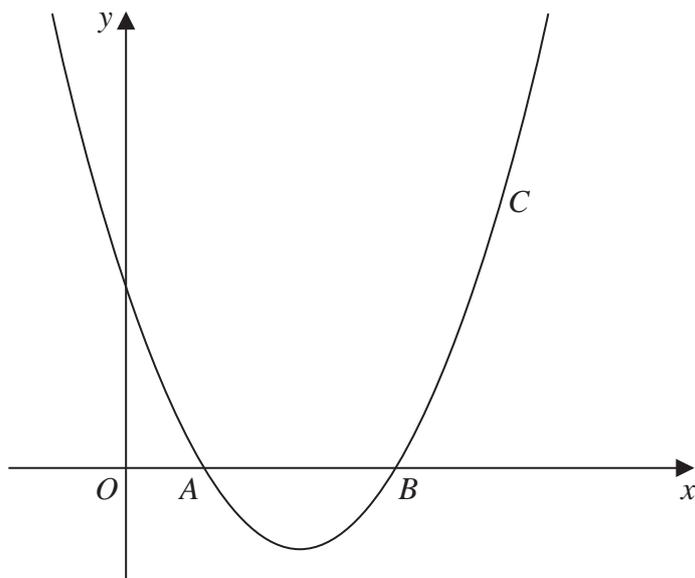


Diagram **NOT** accurately drawn

**Figure 3**

The curve  $C$  with equation  $y = x^2 - 5x + 4$  crosses the  $x$ -axis at the points  $A$  and  $B$ , as shown in Figure 3

- (a) Find the coordinates of  $A$  and the coordinates of  $B$ . (3)

The tangent to  $C$  at  $A$  meets the tangent to  $C$  at  $B$  at the point  $T$ .

- (b) Find the coordinates of  $T$ . (6)

The normal to  $C$  at  $A$  meets the normal to  $C$  at  $B$  at the point  $N$ .

- (c) Find the coordinates of  $N$ . (3)

- (d) Find the area of the quadrilateral  $ATBN$ . (3)

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**Question 6 continued**

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**Question 6 continued**

Area with horizontal dotted lines for writing answers.

**(Total for Question 6 is 15 marks)**





**Question 7 continued**

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8 Solve the equation  $\log_3 x - 2\log_x 3 = 1$

(7)

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**Question 8 continued**

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**(Total for Question 8 is 7 marks)**



9 Given that

$$x = e^{-t} \sin 2t$$

show that

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = 0 \tag{8}$$

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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)**

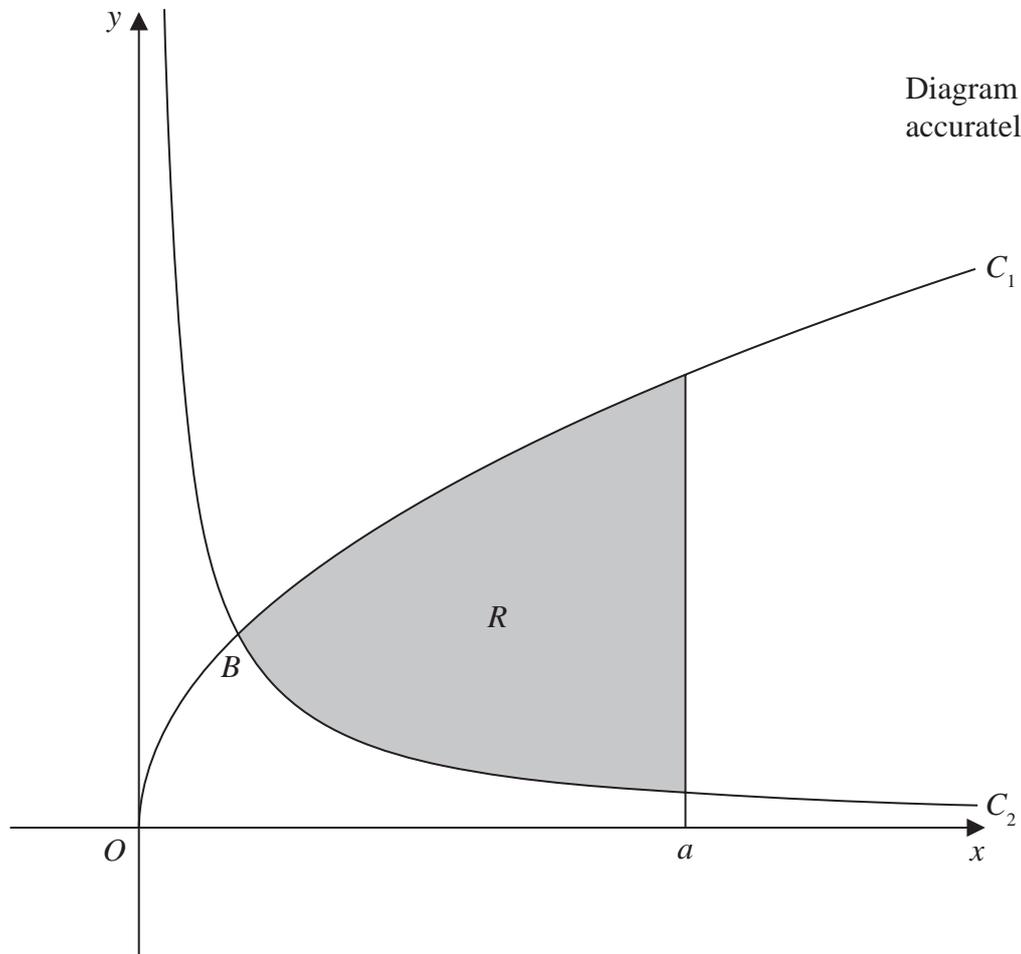


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$$f(x) = 32x^3 - 33x + 1$$

(a) Show that  $f(1) = 0$  (1)

(b) Hence using an algebraic method solve  $f(x) = 0$  (4)



**Figure 4**

The region  $R$ , shown shaded in Figure 4, is bounded by the curve  $C_1$  with equation  $y = \sqrt{x}$ , by the curve  $C_2$  with equation  $y = \frac{1}{8x}$  and by the line with equation  $x = a$

The curves  $C_1$  and  $C_2$  intersect at the point  $B$ , with  $x$  coordinate  $p$ , where  $p < a$

(c) Find the value of  $p$ . (2)

The region  $R$  is rotated through  $360^\circ$  about the  $x$ -axis to generate a solid with volume  $\frac{27\pi}{64}$

(d) Use algebraic integration to find the value of  $a$ . (7)

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**Question 10 continued**

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**Question 10 continued**

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