

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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**Friday 10 January 2020**

Morning (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 ►

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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,  $S_\infty = \frac{a}{1 - r}$   $|r| < 1$

#### 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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**Question 2 continued**

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





**Question 3 continued**

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







**Question 4 continued**

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





**Question 5 continued**

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



- 6 (a) Complete the table of values for

$$y = x - \frac{3}{x^2}$$

giving your answers to one decimal place where appropriate.

$x$	0.5	1	1.5	2	3	4	5	6
$y$	-11.5			1.3	2.7			5.9

(2)

- (b) On the grid opposite, draw the graph of  $y = x - \frac{3}{x^2}$  for  $0.5 \leq x \leq 6$

(2)

- (c) By drawing a suitable straight line on the grid, obtain estimates, to one decimal place, of each of the two roots of the equation

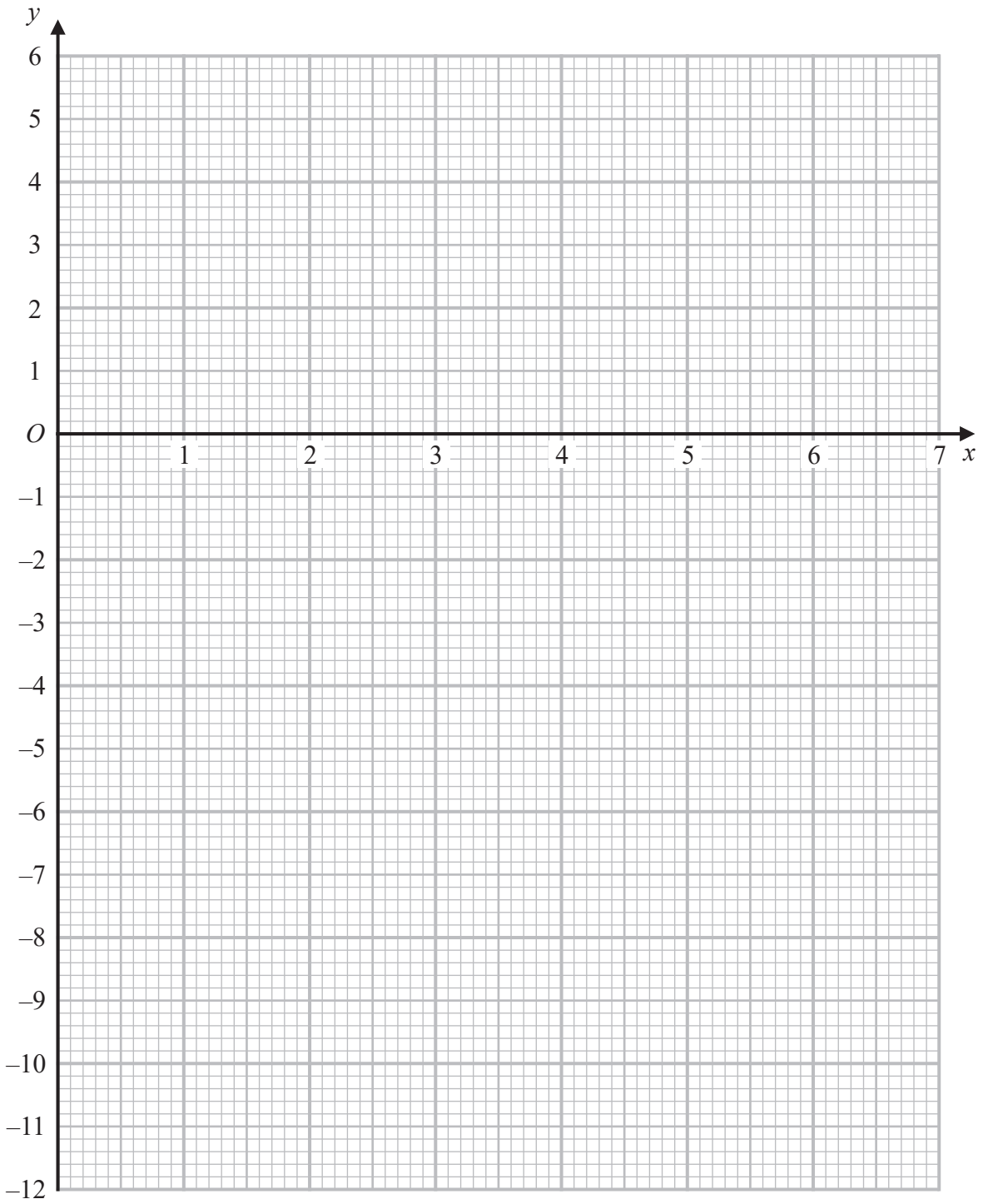
$$2x^3 - 6x^2 + 3 = 0$$

in the interval  $0.5 \leq x \leq 6$

(5)



Question 6 continued



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**Question 6 continued**

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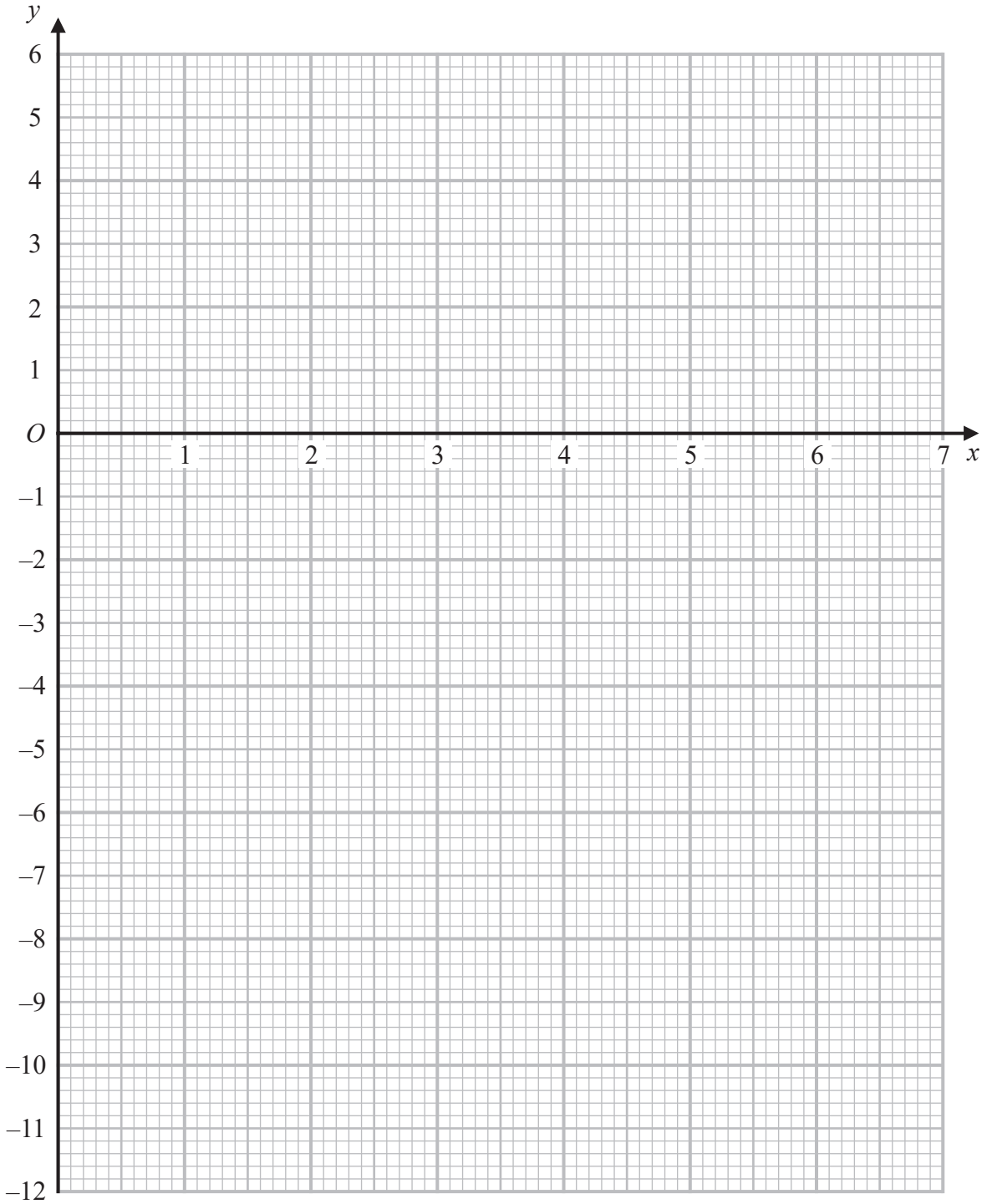
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Question 6 continued

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(Total for Question 6 is 9 marks)



7 An arithmetic series  $P$  has first term  $a$ , common difference  $d$  and  $n$ th term  $u_n$

Given that  $u_5 = 4x + 6$  and that  $u_8 = 7x + 3$

(a) (i) show that  $d = x - 1$

(ii) find the value of  $a$

(4)

Given further that  $u_9 = 42$

(b) find the value of  $x$

(2)

The sum of the first  $n$  terms of  $P$  is  $S_n$

(c) Find the value of  $n$  for which  $S_{(n+1)} = 12u_n + 18$

(5)





**Question 7 continued**

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**Question 7 continued**

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**Question 7 continued**

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



- 8 A particle  $P$  moves along the positive  $x$ -axis. At time  $t$  seconds ( $t \geq 0$ ) the velocity,  $v$  m/s, of  $P$  is given by  $v = 3 + 5t - 2t^2$

At time  $t$  seconds,  $P$  is at the point with coordinates  $(x, 0)$ .

Given that at time  $t = 0$ ,  $P$  is at the point with coordinates  $(5, 0)$ , find the maximum value of  $x$ , justifying that this is a maximum value.

(8)



**Question 8 continued**

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**Question 8 continued**

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**Question 8 continued**

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



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9 The line  $l_1$  with equation  $y + 2x - 4 = 0$  passes through the point  $P$  with coordinates  $(a, 6)$  and the point  $Q$  with coordinates  $(3, b)$ .

(a) Find the value of  $a$  and the value of  $b$ . (2)

The line  $l_2$  passes through point  $P$  and is perpendicular to  $l_1$

The point  $R$ , with coordinates  $(e, f)$  lies on  $l_2$  such that  $PR = 6\sqrt{5}$

(b) Find the two possible pairs of values of  $e$  and  $f$ . (8)

Given that  $e < 0$ ,

(c) find the area of triangle  $PQR$ . (3)

The points  $P$ ,  $Q$  and  $R$  lie on a circle  $C$ .

(d) Find the coordinates of the centre of  $C$ . (2)





**Question 9 continued**

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**Question 9 continued**

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**Question 9 continued**

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**Question 10 continued**

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**Question 10 continued**

Handwriting practice area consisting of 20 horizontal dotted lines.

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**Question 10 continued**

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Diagram NOT accurately drawn

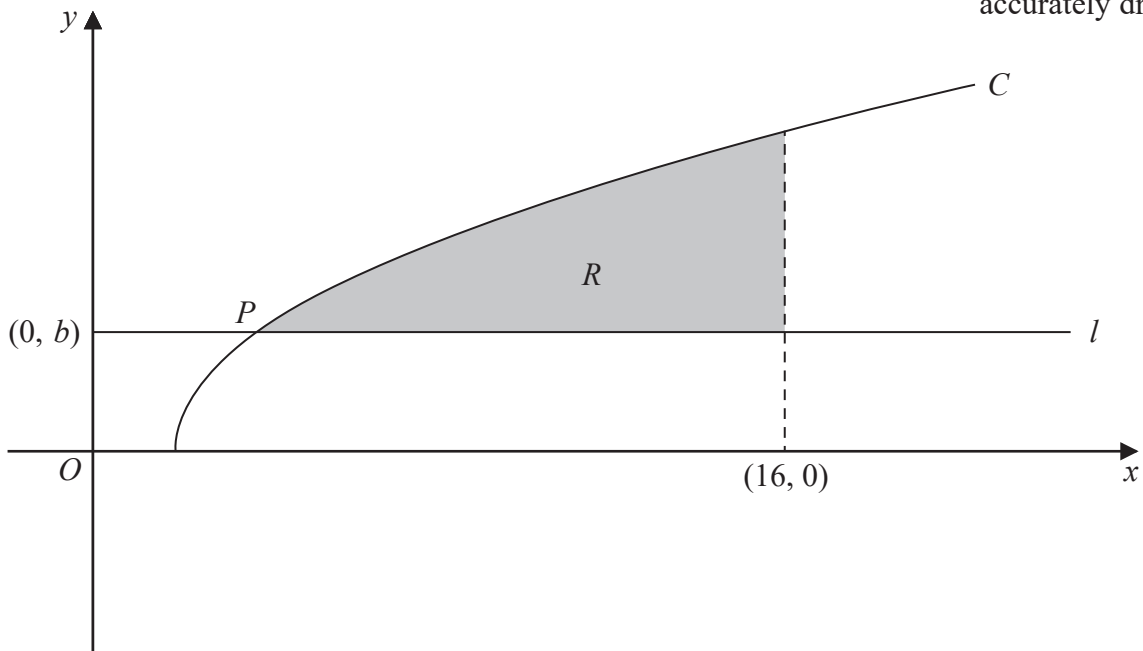


Figure 2

Figure 2 shows part of the curve  $C$  with equation  $y = \sqrt{x - 2}$

Figure 2 also shows the straight line  $l$  with equation  $y = b$  for  $x > 0$  where  $b > 0$

Given that  $C$  and  $l$  intersect at the point  $P$  with coordinates  $(a, b)$ , where  $2 < a < 16$

(a) show that  $b^2 = a - 2$  (2)

The finite region  $R$  bounded by  $C$ , the straight line with equation  $x = 16$  and  $l$ , shown shaded in Figure 2, is rotated through  $360^\circ$  about the  $x$ -axis to form a solid  $S$ .

Given that the volume of the solid formed is  $50\pi$

(b) use algebraic integration to find the value of  $a$  and the value of  $b$ . (9)

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**Question 11 continued**

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**Question 11 continued**

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

**TOTAL FOR PAPER IS 100 MARKS**

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