Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | Candidate Number

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 ▶

1/1/1/

P 6 0 4 7 5 A 0 1 3 6

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

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \ldots + \frac{n(n-1)\ldots(n-r+1)}{r!}x^r + \ldots \quad \text{for} \quad |x| < 1, n \in \mathbb{Q}$$

Calculus

Quotient rule (differentiation)

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{\mathrm{f}(x)}{\mathrm{g}(x)}\right) = \frac{\mathrm{f}'(x)\mathrm{g}(x) - \mathrm{f}(x)\mathrm{g}'(x)}{[\mathrm{g}(x)]^2}$$

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 ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Given that $\dfrac{a+\sqrt{3}}{2-\sqrt{3}} = 11 + b\sqrt{3}$ where a and b are integers,

find the value of a and the value of b.

(4)

(Total for Question 1 is 4 marks)

2 $$f(x) = 7 + 4x - x^2$$

(a) Write $f(x)$ in the form $a - b(x + c)^2$ where a, b and c are integers to be found.

(3)

(b) Hence, or otherwise, find

(i) the maximum value of $f(x)$

(ii) the value of x for which this maximum occurs.

(2)

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Question 2 continued

(Total for Question 2 is 5 marks)

3 Given that $y = e^{2x}(x^2 + 1)$

(a) find $\dfrac{dy}{dx}$

(3)

The straight line l is the tangent to the curve with equation $y = e^{2x}(x^2 + 1)$ at the point on the curve where $x = 0$

(b) Find an equation for l in the form $y = mx + c$

(3)

Question 3 continued

(Total for Question 3 is 6 marks)

4 $$f(x) = 2x^3 + ax^2 + bx + 18 \quad \text{where } a \text{ and } b \text{ are constants}$$

When $f'(x)$ is divided by $(x - 2)$ the remainder is 5

Given that $(x - 2)$ is a factor of $f(x)$

(a) find the value of a and the value of b.

(6)

(b) Express $f(x)$ as a product of linear factors.

(3)

(c) Hence use algebra to solve the equation $f(x) = 0$

(2)

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Question 4 continued

(Total for Question 4 is 11 marks)

5 (a) Show that $\log_4 32 = \frac{5}{2}$

(2)

(b) Hence, or otherwise, find the exact solutions of the equation

$$\log_2 x - \log_4 32 + \frac{1}{4}\log_x 16 = 0$$

(7)

Question 5 continued

(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 $y = x - \dfrac{3}{x^2}$ for $0.5 \leqslant x \leqslant 6$

(2)

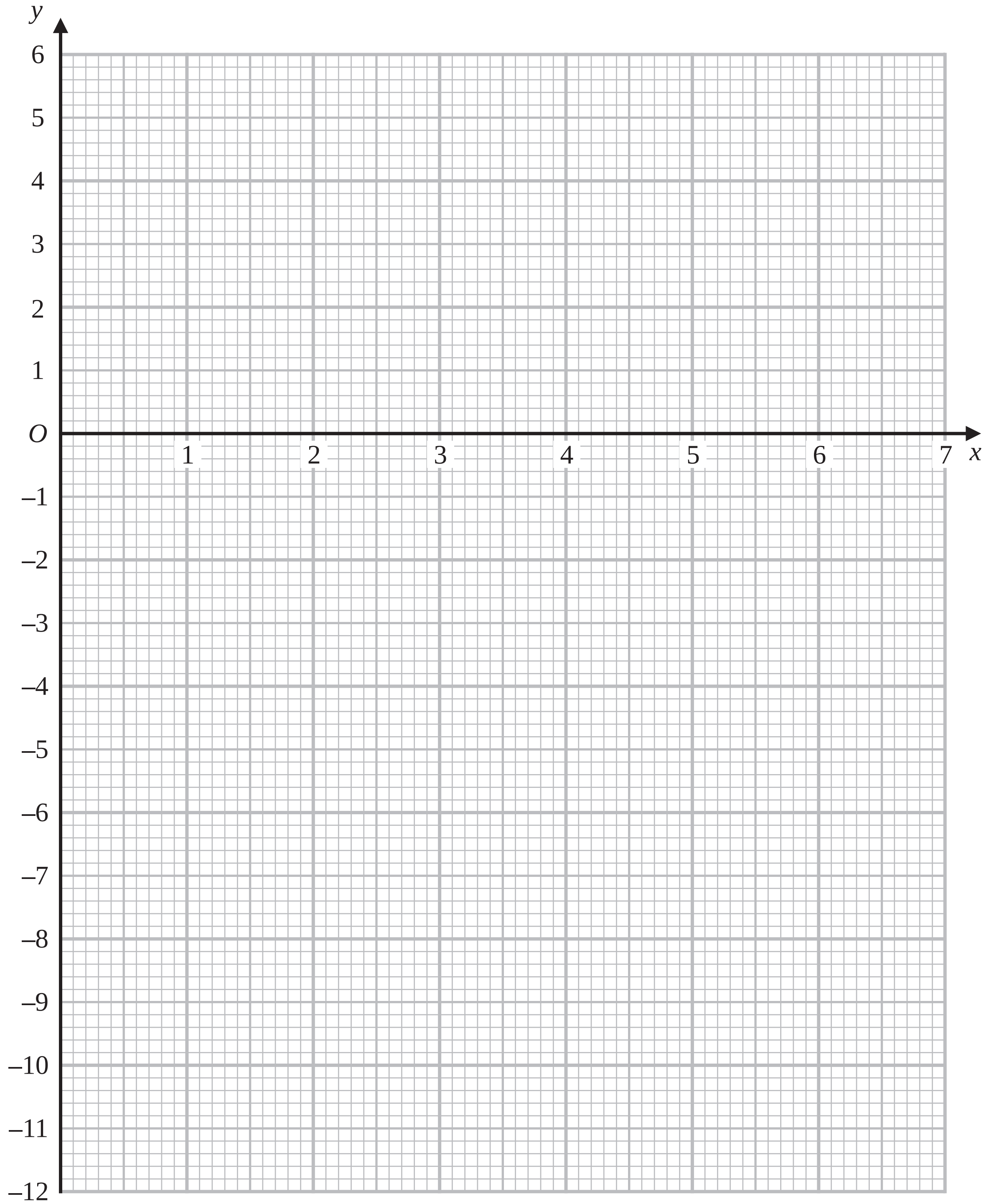
(c) By drawing a suitable straight line on the grid, obtain estimates, to one decimal place, of each of the two roots of the equation

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

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

(5)

Question 6 continued



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

Question 6 continued

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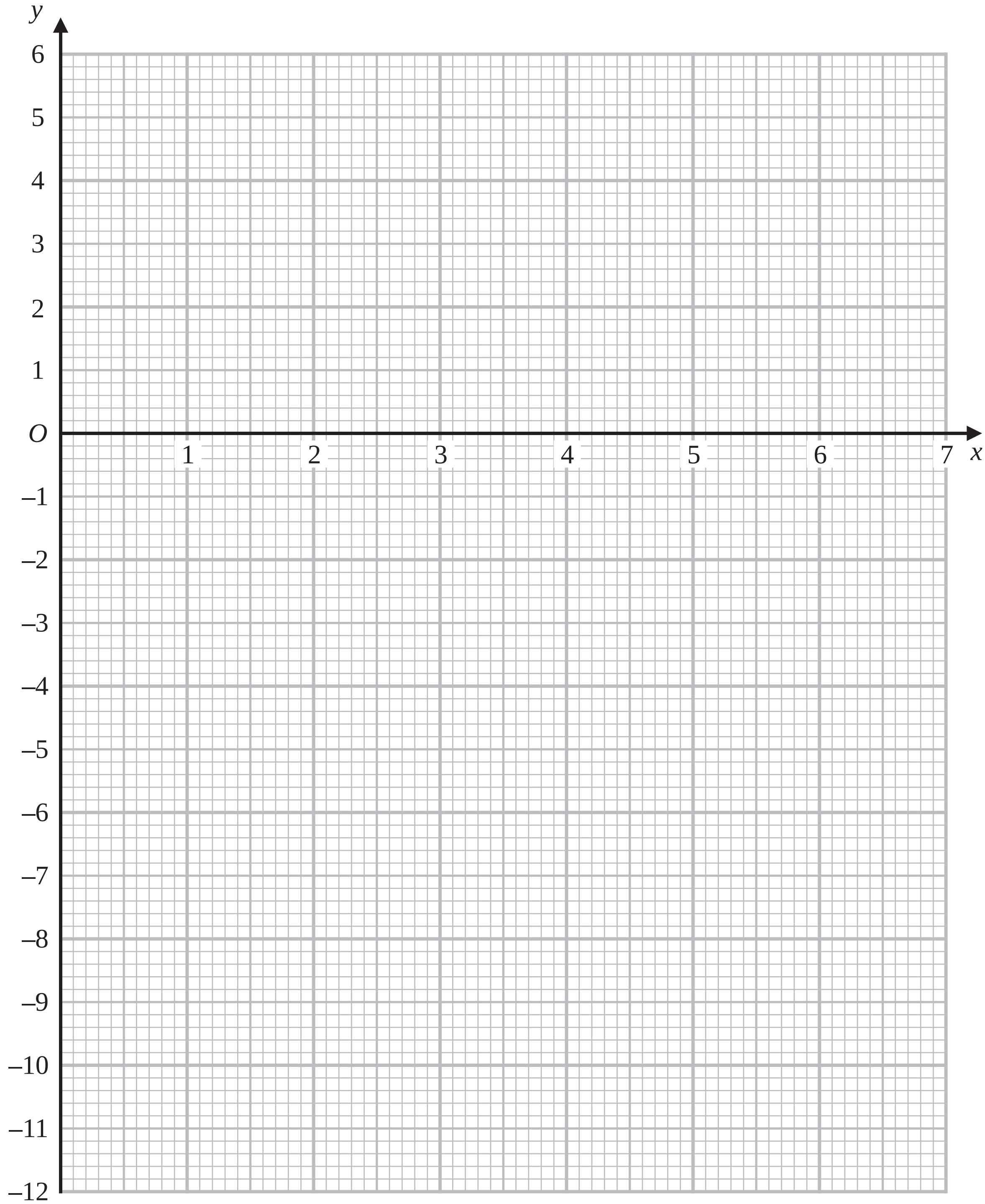
Question 6 continued

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



(Total for Question 6 is 9 marks)

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

7 An arithmetic series P has first term a, common difference d and nth 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)

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Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 11 marks)

8 A particle P moves along the positive x-axis. At time t seconds ($t \geqslant 0$) 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

Question 8 continued

Question 8 continued

(Total for Question 8 is 8 marks)

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

Question 9 continued

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Question 9 continued

(Total for Question 9 is 15 marks)

PMT

10

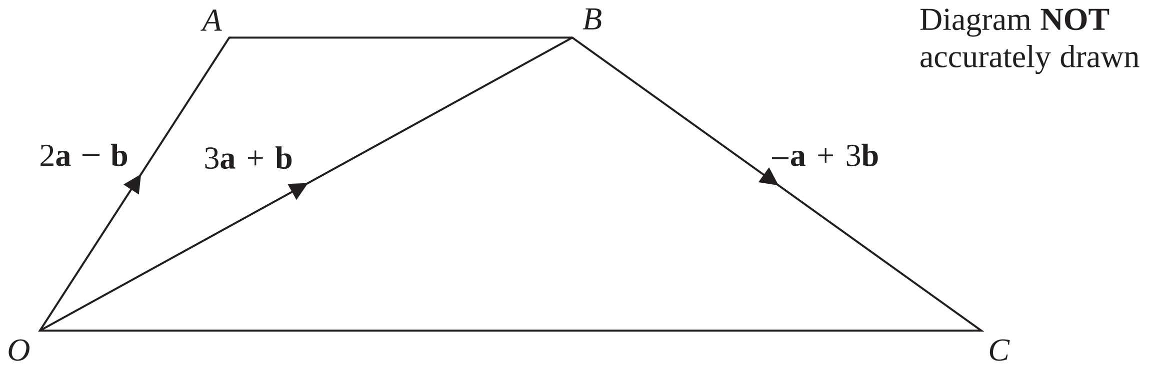

Figure 1

Figure 1 shows quadrilateral *OABC* with

$$\overrightarrow{OA} = 2\mathbf{a} - \mathbf{b} \qquad \overrightarrow{OB} = 3\mathbf{a} + \mathbf{b} \qquad \overrightarrow{BC} = -\mathbf{a} + 3\mathbf{b}$$

(a) Find $\overrightarrow{AB}$ as a simplified expression in terms of **a** and **b**.

(2)

(b) Prove that $\overrightarrow{OC}$ is parallel to $\overrightarrow{AB}$

(2)

The diagonals, *OB* and *AC*, intersect at the point *X*.

(c) Using a vector method find the ratio $AX : XC$

(7)

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Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 11 marks)

11

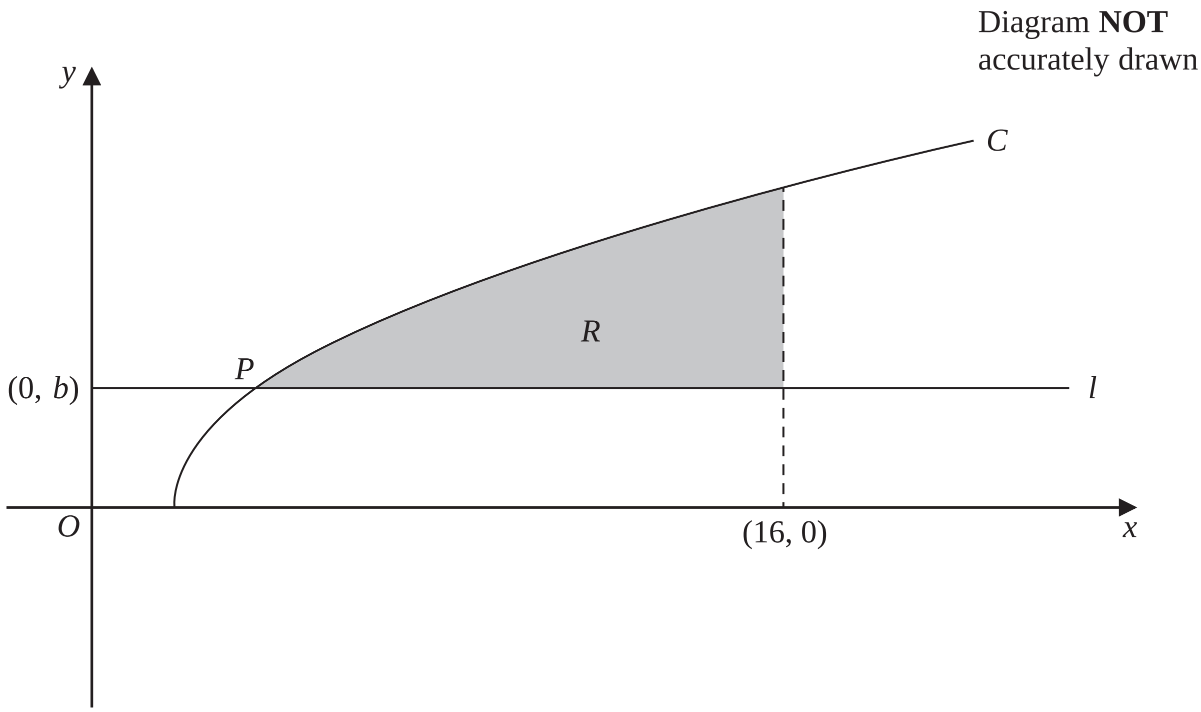

Figure 2

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° about the x-axis to form a solid S.

Given that the volume of the solid formed is 50π

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

(9)

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Question 11 continued

Question 11 continued

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Question 11 continued

Question 11 continued

(Total for Question 11 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS