

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Pearson Edexcel International GCSE		Centre Number 	Candidate Number
Monday 15 June 2020			
Afternoon (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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International GCSE in Further Pure Mathematics Formulae sheet

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

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

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Question 1 continued

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Question 1 continued

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(Total for Question 1 is 7 marks)



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Question 2 continued

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Question 2 continued

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Question 2 continued

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(Total for Question 2 is 11 marks)



- 3 The n th term of an arithmetic series is u_n such that

$$u_n = \ln a + (n - 1) \ln b$$

where a and b are positive integers.

Given that $u_2 = \ln 12$ and that $u_5 = \ln 768$

find the value of a and the value of b .

(7)

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Question 3 continued

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(Total for Question 3 is 7 marks)



4 The curve C has equation

$$y = x^3 - 3x^2 - 24x + 6$$

- (a) Use calculus to find the coordinates of each of the stationary points on C .

(4)
- (b) Determine the nature of each of these stationary points.
Justify your answers.

(2)

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Question 4 continued

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(Total for Question 4 is 6 marks)



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Question 5 continued

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(Total for Question 5 is 8 marks)





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Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 7 marks)



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7 The length of each side of a cube S_1 is increasing at a constant rate of 0.1 m/s.

- (a) Find, in m^3/s , the rate of increase of the volume of the cube S_1 when the length of each side of the cube is 2 m. (4)

The total surface area of a different cube S_2 is increasing at a constant rate of $0.05 \text{ m}^2/\text{s}$.

- (b) Find in m^3/s , the rate of increase of the volume of the cube S_2 when the length of each side of the cube is 6 m. (5)

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 9 marks)



8

$$f(x) = 3x^2 - x + 4$$

$$g(x) = x^2 - px + q$$

The roots of the quadratic equation $f(x) = 0$ are α and β

The roots of the quadratic equation $g(x) = 0$ are $\left(\alpha + \frac{1}{\alpha}\right)$ and $\left(\beta + \frac{1}{\beta}\right)$

Without solving the equation $f(x) = 0$

(a) show that $p = \frac{7}{12}$ (3)

(b) Find the value of q (4)

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 7 marks)



9 Showing your working clearly, use algebra to solve the equations

$$\frac{16^x}{8^y} = \frac{1}{4}$$

$$4^x 2^y = 16$$

(7)

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Question 9 continued

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(Total for Question 9 is 7 marks)





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Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 11 marks)



11

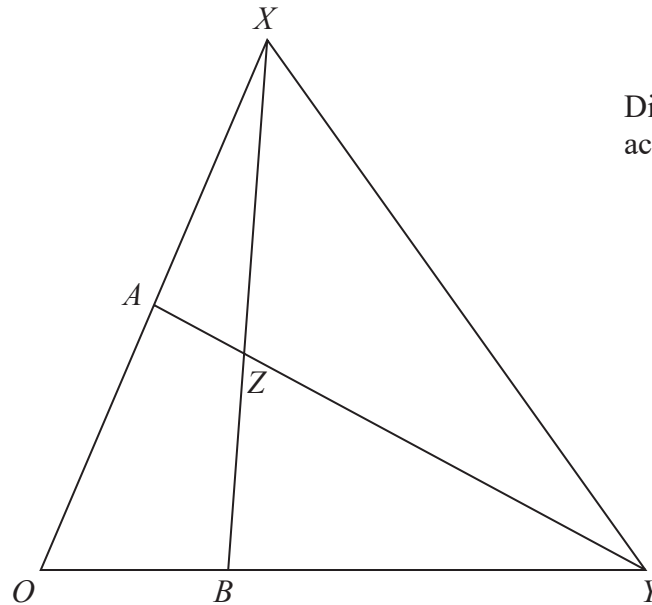
Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows a triangle OXY

$$\overrightarrow{OX} = 2\mathbf{a} \text{ and } \overrightarrow{OY} = 3\mathbf{b}$$

A is the midpoint of OX and B is the point on OY such that $OB : BY = 1 : 2$
 The lines XB and AY intersect at Z .

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

(1)

(b) Using a vector method, find $\overrightarrow{OZ}$ as a simplified expression in terms of $\mathbf{a}$ and $\mathbf{b}$

(9)

The point M on XY is such that O , Z and M are collinear.

(c) Find $\overrightarrow{OM}$ as a simplified expression in terms of $\mathbf{a}$ and $\mathbf{b}$

(3)



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Question 11 continued

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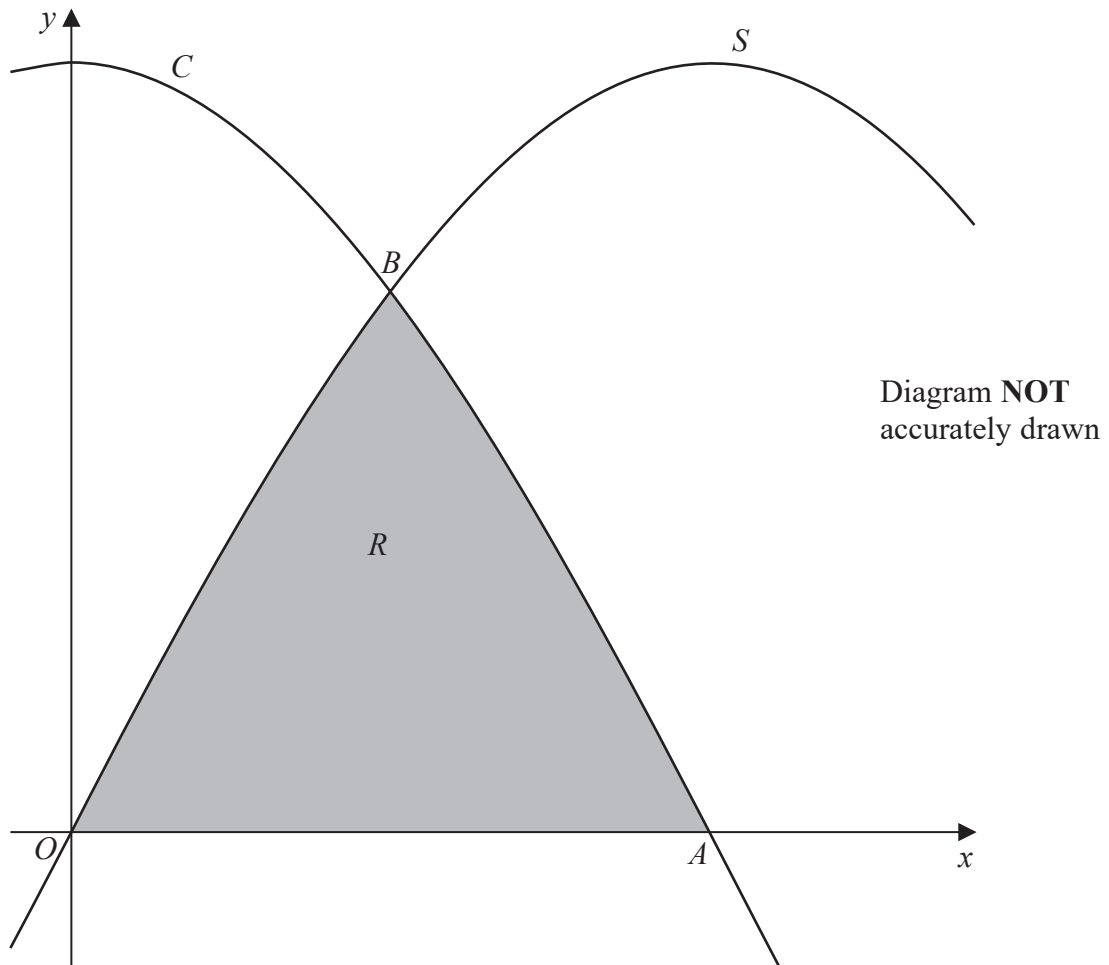
Question 11 continued

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(Total for Question 11 is 13 marks)



12

**Figure 2**

The region R , shown shaded in Figure 2, is bounded by the x -axis, the curve S with equation $y = 2\sin x$ and the curve C with equation $y = 2\cos x$. As shown in Figure 2, C crosses the x -axis at the point A .

- (a) Write down the x coordinate of A .

(1)

As shown in Figure 2, C and S intersect at the point B .

- (b) Find the x coordinate of B .

(2)

- (c) Using calculus, find the area of the shaded region R .

Give your answer in the form $a - \sqrt{b}$ where a and b are integers.

(4)

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Question 12 continued

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Question 12 continued

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(Total for Question 12 is 7 marks)

TOTAL FOR PAPER IS 100 MARKS

