

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Pearson Edexcel International GCSE		Centre Number 	Candidate Number
Thursday 18 June 2020			
Morning (Time: 2 hours)		Paper Reference 4PM1/02	
Further Pure Mathematics Paper 2			
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, $S_\infty = \frac{a}{1-r} \quad |r| < 1$

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 : $a^2 = b^2 + c^2 - 2bc \cos A$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Logarithms

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

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Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 A particle P is moving in a straight line. At time t seconds, $t \geq 0$, the displacement, s metres, of P from a fixed point O of the line is given by

$$s = 3 + 8t + t^2 - \frac{1}{3}t^3$$

Find the distance of P from O when P is instantaneously at rest.

(4)

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(Total for Question 1 is 4 marks)



- 2 The region enclosed by the curve with equation $y = e^{3x}$, the x -axis, the y -axis and the line with equation $x = 3$ is rotated through 360° about the x -axis.

Use algebraic integration to find, in terms of π and e , the volume of the solid generated.

(4)

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3 (a) Expand

$$(1 + px)^{-5} \quad p \neq 0$$

in ascending powers of x , up to and including the term in x^4
Give each term in its simplest form.

(3)

The coefficient of x^r in the expansion is c_r

Given that $c_4 = 2c_3$

(b) find the value of p .

(2)

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Question 3 continued

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(Total for Question 3 is 5 marks)



(5)

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Question 4 continued

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(Total for Question 4 is 7 marks)



(c) find the value of n . (3)



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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 11 marks)



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7 A geometric series has first term $(x - 3)$, second term $(x + 1)$ and third term $(4x - 2)$.

- (a) Find the two possible values of x . (5)

Given that $x < 1$,

- (b) show that the series is convergent. (2)

The sum to infinity of the series is S .

- (c) Find the value of S . (2)

The sum of the first n terms of the series is S_n

Given that $\frac{S}{S_n} = \frac{256}{255}$

- (d) find the value of n . (3)

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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 12 marks)



8 The curve C_1 has equation $y = 5e^{-2x} + 4$

The curve C_2 has equation $y = e^{2x}$

The curves C_1 and C_2 intersect at the point A .

(a) Find the exact coordinates of A .

(4)

The tangent at A to C_1 intersects the x -axis at the point B .

(b) Show that the x coordinate of B is $\frac{1}{2}(5 + \ln 5)$

(5)

The tangent at A to C_2 intersects the x -axis at the point D .

(c) Find the area of $\triangle ABD$.

(6)

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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 15 marks)



9 A curve C has equation

$$y = \frac{2 + 4x - x^2}{2x + 1} \quad x \neq -\frac{1}{2}$$

(a) Write the equation of C in the form $ax^2 + (by - 4)x + (y - c) = 0$, where a , b and c are integers whose values are to be found.

(3)

(b) Hence show that x is real when $y \leq 2$ and when $y \geq 3$

(4)

(c) Find the coordinates of the stationary points on C .

(6)

(d) Sketch C showing clearly

(i) the exact coordinates of the points where C crosses the x -axis,

(ii) the asymptote to C that is parallel to the y -axis,

(iii) the coordinates of the stationary points.

(5)

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Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 18 marks)



10 (a) Show that

$$\cos(A + B) + \cos(A - B) = 2 \cos A \cos B \quad (2)$$

(b) Hence show that

$$\cos P + \cos Q = 2 \cos \frac{P + Q}{2} \cos \frac{P - Q}{2} \quad (3)$$

(c) Solve, for $0 \leq \theta \leq \frac{\pi}{2}$, the equation

$$\cos 5\theta + \cos 7\theta = 0$$

Give each solution in terms of π

(4)

(d) Show that

$$\cos 8x + 2 \cos 6x + \cos 4x = 4 \cos 6x \cos^2 x \quad (3)$$

(e) Use calculus to find the exact value of

$$\int_0^{\frac{\pi}{3}} \cos 6x \cos^2 x \, dx \quad (4)$$

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS

