


Please check the examination details below before entering your candidate information

Candidate surname	Other names
Pearson Edexcel	Centre Number
International GCSE	Candidate Number
Monday 17 June 2019	
Afternoon (Time: 2 hours)	Paper Reference 4PM1/01
Further Pure Mathematics	
Paper 1	
	
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

Mensuration

$$\text{Surface area of sphere} = 4\pi r^2$$

$$\text{Curved surface area of cone} = \pi r \times \text{slant height}$$

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

Series**Arithmetic series**

$$\text{Sum to } n \text{ terms, } S_n = \frac{n}{2}[2a + (n-1)d]$$

Geometric series

$$\text{Sum to } n \text{ terms, } S_n = \frac{a(1-r^n)}{(1-r)}$$

$$\text{Sum to infinity, } S_\infty = \frac{a}{1-r} \quad |r| < 1$$

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**

$$\text{In triangle } ABC: a^2 = b^2 + c^2 - 2bc \cos A$$

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

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

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

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

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

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

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

Logarithms

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

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- 2 Given that $\frac{4 + 2\sqrt{3}}{5 - 2\sqrt{3}}$ can be written in the form $\frac{a + b\sqrt{3}}{c}$ where a and b are integers and c is prime, find the value of a , the value of b and the value of c .

Show your working clearly.

(3)

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Question 2 continued

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(Total for Question 2 is 3 marks)



3 In triangle ABC , $AC = 7$ cm, $BC = 10$ cm and angle $BAC = 65^\circ$

(a) Find, to the nearest 0.1° , the size of angle ABC .

(3)

(b) Find, in cm^2 to 3 significant figures, the area of triangle ABC .

(3)

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Question 3 continued

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(Total for Question 3 is 6 marks)



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Question 4 continued

A large rectangular area with horizontal dotted lines for writing answers.

(Total for Question 4 is 6 marks)



5

$$f(x) = 3x^2 - 9x + 5$$

Given that $f(x)$ can be written in the form $a(x - b)^2 + c$, where a , b and c are constants, find

(a) the value of a , the value of b and the value of c . (3)

(b) Hence write down

(i) the minimum value of $f(x)$,

(ii) the value of x at which this minimum occurs. (2)

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Question 5 continued

Area with horizontal dotted lines for writing.

(Total for Question 5 is 5 marks)



Question 6 continued

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Area for writing answers, consisting of multiple horizontal dotted lines.



Question 6 continued

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(Total for Question 6 is 11 marks)



7 (a) Solve, in degrees to one decimal place,

$$(3 \cos \theta + 5)(5 \sin \theta - 3) = 0 \quad \text{for } 0 \leq \theta < 180^\circ \quad (2)$$

(b) Show that the equation

$$8 \sin(x - \alpha) = 3 \sin(x + \alpha)$$

can be written in the form

$$5 \tan x = 11 \tan \alpha \quad (5)$$

(c) Hence solve, to one decimal place,

$$8 \sin(2y - 30^\circ) = 3 \sin(2y + 30^\circ) \quad \text{for } 0 \leq y < 180^\circ \quad (5)$$

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Question 7 continued

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Question 7 continued

Area with horizontal dotted lines for writing answers.

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Question 7 continued

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(Total for Question 7 is 12 marks)



8 (a) Solve $5p^2 - 9p + 4 = 0$ (2)

(b) Hence solve $5^{2x+1} - 9(5^x) + 4 = 0$

Give your answers to 3 significant figures where appropriate. (4)

The curve with equation $y = 5^{2x+1} + 5^x$ intersects the curve with equation $y = 2(5^{x+1}) - 4$ at two points.

(c) Find the coordinates of each of these two points.
Give your answers to 3 significant figures where appropriate. (4)

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Question 8 continued

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Question 8 continued

Area with horizontal dotted lines for writing answers.

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Question 8 continued

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(Total for Question 8 is 10 marks)



9 (a) Solve the equation $2 \log_p 9 + 3 \log_3 p = 8$ (6)

Given that $\log_2 3 = \log_4 3^k$

(b) find the value of k (2)

(c) Show that

$$6x \log_4 x - 3x \log_2 3 - 5 \log_4 x + 10 \log_2 3 = \log_4 \left(\frac{x^{6x-5}}{3^{6x-20}} \right) \quad (4)$$

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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 12 marks)



10 (a) Expand $(1 + 2x^2)^{-\frac{1}{3}}$ in ascending powers of x up to and including the term in x^6 , expressing each coefficient as an exact fraction in its lowest terms. (3)

(b) State the range of values of x for which your expansion is valid. (1)

$$f(x) = \frac{2 + kx^2}{(1 + 2x^2)^{\frac{1}{3}}} \quad \text{where } k \neq 0$$

(c) Obtain a series expansion for $f(x)$ in ascending powers of x up to and including the term in x^6 . Give each coefficient in terms of k where appropriate. (3)

Given that the coefficient of x^4 in the series expansion of $f(x)$ is zero

(d) find the value of k . (2)

(e) Hence use algebraic integration to obtain an estimate, to 4 decimal places, of

$$\int_0^{0.5} f(x) dx \quad (5)$$

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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 14 marks)



11 The curve C has equation $3y = x^2 + 2$

The point P lies on C and has x coordinate 4

The line k is the tangent to C at P .

- (a) Find an equation for k , giving your answer in the form $ay = bx + c$ where a , b and c are integers.

(6)

The line l is the normal to C at P .

- (b) Find an equation for l , giving your answer in the form $dy = ex + f$ where d , e and f are integers.

(2)

- (c) Find the area of the triangle bounded by the line k , the line l and the x -axis.

(3)

The finite region bounded by C , the line l , the x -axis and the y -axis is rotated through 360° about the x -axis.

- (d) Use algebraic integration to find, to the nearest whole number, the volume of the solid generated.

(6)

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Question 11 continued

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Question 11 continued

Handwritten area with horizontal dotted lines for writing.

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Question 11 continued

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Question 11 continued

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(Total for Question 11 is 17 marks)

TOTAL FOR PAPER IS 100 MARKS

