Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 2

Wednesday 20 June 2018 – Afternoon
Time: 2 hours

Paper Reference
4PM0/02

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.*

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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P 5 3 3 9 2 R A 0 1 3 2

Pearson

Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 In triangle ABC, $AB = 9\,\text{cm}$, $BC = 6\,\text{cm}$ and $CA = 8\,\text{cm}$.

Find, in degrees to the nearest 0.1°, the size of angle BAC.

(3)

Question 1 continued

(Total for Question 1 is 3 marks)

2 Differentiate with respect to x

(a) $e^{3x} \cos 2x$

(3)

(b) $\dfrac{2e^{x}}{(2x^{2} - 1)}$

(3)

Question 2 continued

(Total for Question 2 is 6 marks)

3 The volume of liquid in a container is $V\,\text{cm}^3$ when the depth of the liquid is $h\,\text{cm}$. Liquid is leaking from the container at a rate of $24\,\text{cm}^3/\text{s}$.

Given that $V = 5h^3$, find the rate, in cm/s, at which the depth of the liquid is decreasing when $V = 800$
Give your answer to 2 significant figures.

(7)

Question 3 continued

(Total for Question 3 is 7 marks)

4 (a) Find the exact value of the root of the equation $e^{3x} = 8$

Give your answer in the form $\ln a$, where a is an integer.

(2)

The curve C_1 has equation $y = 2e^{3x}$ and the curve C_2 has equation $y = (e^{3x} - 4)^2$

The curves C_1 and C_2 intersect at the points P and Q.

(b) Use algebra to find the exact coordinates of the points P and Q.

(5)

(c) Find, to 3 decimal places, the length of PQ.

(2)

Question 4 continued

Question 4 continued

Question 4 continued

(Total for Question 4 is 9 marks)

5 The sum of the first term and the third term of a geometric series is 75

The sum of the second term and the third term is 45

(a) Find the two possible values of the common ratio of the series.

(5)

Given that the series is convergent with sum to infinity S,

(b) find the value of S.

(3)

Question 5 continued

(Total for Question 5 is 8 marks)

6

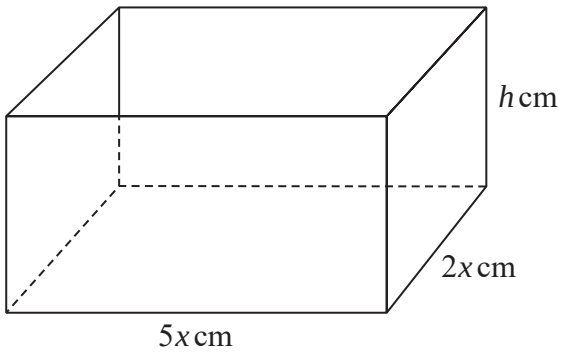

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a rectangular box with length $5x$ cm, width $2x$ cm and height h cm. The box has a base but no top. The volume of the box is $1000\,\text{cm}^3$ and the total external surface area of the box is $S\,\text{cm}^2$

(a) Show that $S = 10x^2 + \dfrac{1400}{x}$

(4)

Given that x can vary,

(b) find, to 3 significant figures, the minimum value of S.

(5)

(c) Verify that your answer to part (b) does give the minimum value of S.

(2)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 11 marks)

7 (a) Expand $\left(1+\frac{2x}{5}\right)^{\frac{1}{2}}$ in ascending powers of x up to and including the term in x^3, giving each coefficient as an exact fraction in its lowest terms.

(3)

(b) Expand $\left(1-\frac{2x}{5}\right)^{-\frac{1}{2}}$ in ascending powers of x up to and including the term in x^3, giving each coefficient as an exact fraction in its lowest terms.

(3)

(c) Write down the range of values of x for which both of your expansions are valid.

(1)

(d) Expand $\left(\frac{5+2x}{5-2x}\right)^{\frac{1}{2}}$ in ascending powers of x up to and including the term in x^2, giving each coefficient as an exact fraction in its lowest terms.

(3)

(e) Hence use algebraic integration to obtain an estimate of

$$\int_{0.1}^{0.3}\left(\frac{5+2x}{5-2x}\right)^{\frac{1}{2}}\mathrm{d}x$$

Give your answer to 4 significant figures.

(4)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 14 marks)

8

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

Using the above identities

(a) show that (i) $\cos 2\theta = 1 - 2\sin^2\theta$

(ii) $\sin 2\theta = 2\sin\theta\cos\theta$

(3)

$$f(\theta) = \cos 4\theta + 2\cos 2\theta$$

(b) Show that $f(\theta) = 8\sin^4\theta - 12\sin^2\theta + 3$

(4)

(c) Solve, giving your solutions to 3 significant figures, the equation

$$4\sin^4 x° - 6\sin^2 x° - \cos 2x° + 1.2 = 0 \qquad 0 \leqslant x < 90$$

(4)

(d) (i) Find $\int (2\sin^4\theta - 3\sin^2\theta)\,d\theta$

(ii) Hence find the exact value of $\int_0^{\frac{\pi}{3}} (2\sin^4\theta - 3\sin^2\theta)\,d\theta$

Give your answer in the form $a\sqrt{b} - c\pi$ where a and c are rational numbers and b is a prime number.

(5)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 16 marks)

9 The points A, B and C have coordinates $(-4, 4)$, $(1, 6)$ and $(-2, -1)$ respectively.

(a) Show, by calculation, that AB is perpendicular to AC.

(4)

(b) Find an equation for BC in the form $px + qy + r = 0$, where p, q and r are integers.

(3)

The line l is the perpendicular bisector of AB.

(c) Find an equation for l.

(4)

The line l and the line BC intersect at the point E.

(d) Find the coordinates of E.

(2)

(e) Calculate the area of triangle AEC.

(4)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 17 marks)

10 The curve C has equation $y^2 = 16x$ where $y \geqslant 0$

Given that the point A with coordinates $(a, 2a)$ where $a \neq 0$ lies on C,

(a) find the value of a.

(2)

The line l passes through A and has gradient -2

Given that l crosses the x-axis at the point B,

(b) find the x coordinate of B.

(2)

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

(c) Using algebraic integration, find, to 3 significant figures, the volume of the solid generated.

(5)

Question 10 continued

Question 10 continued

(Total for Question 10 is 9 marks)

TOTAL FOR PAPER IS 100 MARKS