Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel GCE

Centre Number | Candidate Number

Tuesday 18 June 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **6665/01**

Core Mathematics C3

Advanced

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Candidates may use any calculator allowed by the regulations of Pearson. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need*.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 75.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P55802A

1/1/1/1/1/

P 5 5 8 0 2 A 0 1 3 2

Pearson

Leave blank

1. Given that

$$\frac{4x^3 - 6x^2 - 18x + 20}{x^2 - 4} \equiv ax + b + \frac{c}{x - 2} \qquad x \neq \pm 2$$

find the values of the constants a, b and c.

(4)

Leave blank

Question 1 continued

Q1

(Total 4 marks)

Leave blank

2. (i)

$$y = \frac{(2x-1)^3}{(3x-2)} \qquad x \neq \frac{2}{3}$$

(a) Find $\frac{dy}{dx}$ writing your answer as a single fraction in simplest form.

(4)

(b) Hence find the set of values of x for which $\frac{dy}{dx} \geqslant 0$

(2)

(ii) Given

$$y = \ln(1 + \cos 2x) \qquad x \neq (2n+1)\frac{\pi}{2} \quad n \in \mathbb{Z}$$

show that $\frac{dy}{dx} = C\tan x$, where C is a constant to be determined.

(You may assume the double angle formulae.)

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 2 continued

Leave blank

Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 2 continued

(Total 10 marks)

Q2

Leave blank

3. (a) Write $\cos\theta - 8\sin\theta$ in the form $R\cos(\theta + \alpha)$, where R and α are constants, $R > 0$ and $0 < \alpha \leqslant 90°$. Give the exact value of R and give the value of α to 2 decimal places.

(3)

The temperature of a cellar is modelled by the equation

$$f(t) = 13 + \frac{\cos(15t)° - 8\sin(15t)°}{10} \qquad 0 \leqslant t < 24$$

where $f(t)$ is the temperature of the cellar in degrees Celsius and t is the time measured in hours after midnight.

Find, according to the model,

(b) the maximum temperature of the cellar, giving your answer to 2 decimal places

(2)

(c) the times, after midnight, when the temperature of the cellar is 12.5 °C

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 3 continued

Leave blank

Question 3 continued

Leave blank

Question 3 continued

Q3

(Total 9 marks)

Leave blank

4. The function f is defined by

$$f : x \mapsto \frac{2x + 5}{x - 2} \qquad x \in \mathbb{R}, x \neq 2$$

(a) Find ff(x), giving your answer in its simplest form.

(3)

The function g is defined by

$$g : x \mapsto \ln x, \qquad x \in \mathbb{R}, x > e^2$$

(b) Solve the equation

$$fg(a) = g(a)$$

(4)

Leave blank

Question 4 continued

Q4

(Total 7 marks)

Leave blank

5. Given that a is a positive constant and

$$f(x) = |3x - a|, \quad x \in \mathbb{R}$$

(a) sketch the graph with equation $y = f(x)$, showing the coordinates of the points where the graph cuts or meets the coordinate axes.

(2)

Given that $x = 4$ is a solution to the equation $|3x - a| = \frac{1}{2}x + 2$

(b) find the two possible values of a.

(3)

For one of the values of a, $x = 4$ is the smaller of the two solutions. For this value of a,

(c) find the value of the larger solution.

(2)

Leave blank

Question 5 continued

Leave blank

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 5 continued

Q5

(Total 7 marks)

Leave blank

6.

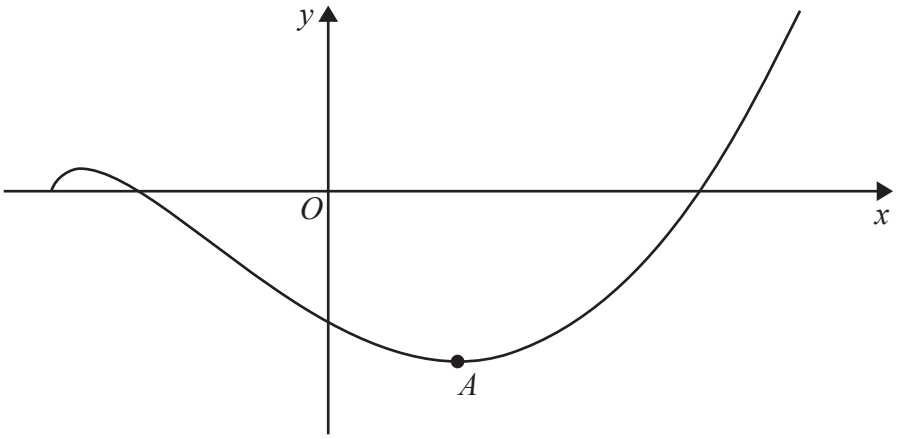

Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = f(x)$, where

$$f(x) = (x^2 - x - 12)\ln(x + 3), \qquad x \in \mathbb{R}, x > -3$$

(a) Find $f'(x)$.

(2)

The curve has a minimum turning point at A.

(b) Show that the x coordinate of A is a solution of the equation

$$x = \frac{\ln(x + 3) + 4}{2\ln(x + 3) + 1}$$

(3)

(c) Use the iteration formula

$$x_{n+1} = \frac{\ln(x_n + 3) + 4}{2\ln(x_n + 3) + 1}$$

with $x_0 = 1$ to find the values of x_1, x_2 and x_3 giving your answers to 3 decimal places.

(3)

A different curve with equation $y = 2f(x) + k$, where k is a constant, passes through the origin.

(d) Find the exact value of k.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

(Total 10 marks)

Q6

Leave blank

7. (a) Given $-90° < A < 90°$, prove that

$$2\cos(A - 30°)\sec A \equiv \tan A + k$$

where k is a constant to be determined.

(3)

(b) Hence or otherwise, solve, for $-90° < x < 90°$, the equation

$$2\cos(x - 30°) = \sec x$$

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(5)

Leave blank

Question 7 continued

Leave blank

Question 7 continued

Leave blank

Question 7 continued

Q7

(Total 8 marks)

Leave blank

8. A study is being carried out on two colonies of ants.

The number of ants N_A in colony A, t years after the start of the study, is modelled by the equation

$$N_A = 3000 + 600e^{0.12t} \qquad t \in \mathbb{R}, t \geqslant 0$$

Using the model,

(a) find the time taken, from the start of the study, for the number of ants in colony A to double. Give your answer, in years, to 2 decimal places.

(5)

(b) Show that $\frac{dN_A}{dt} = pN_A + q$, where p and q are constants to be determined.

(3)

The number of ants N_B in colony B, t years after the start of the study, is modelled by the equation

$$N_B = 2900 + Ce^{kt} \qquad t \in \mathbb{R}, t \geqslant 0$$

where C and k are positive constants.

According to this model, there will be 3100 ants in colony B one year after the start of the study and 3400 ants in colony B two years after the start of the study.

(c) (i) Show that $k = \ln\left(\frac{5}{2}\right)$

(ii) Find the value of C.

(4)

Leave blank

Question 8 continued

Leave blank

Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 8 continued

Q8

(Total 12 marks)

Leave blank

9. The curve C has equation

$$x = \frac{1}{1 + \cot y} \qquad 0 < y < \frac{3\pi}{4}$$

(a) Show that

$$\frac{\mathrm{d}x}{\mathrm{d}y} = 2x^2 - 2x + 1$$

(5)

The point A with y coordinate $\arctan\left(\frac{1}{3}\right)$ lies on C.

(b) Find the x coordinate of A.

(1)

(c) Find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ at A.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Question 9 continued

Leave blank

Question 9 continued

Q9

(Total 8 marks)

TOTAL FOR PAPER: 75 MARKS

END

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA