IYGB GCE

Core Mathematics C3

Advanced

Practice Paper B

Difficulty Rating: 3.1067/1.3825

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the Regulations of the Joint Council for Qualifications.

Information for Candidates

This practice paper follows the Edexcel Syllabus.
The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 9 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

Given that

$$\frac{2x^3+x-2}{x^2+1} \equiv Ax+B+\frac{Cx+D}{x^2+1},$$

use polynomial division, or another appropriate method, to find the value of each of the constants A, B, C and D.

(4)

Question 2

The function f is given by

$$f : x \mapsto \frac{x}{x+3}, \ x \in \mathbb{R}, \ x \neq -3.$$

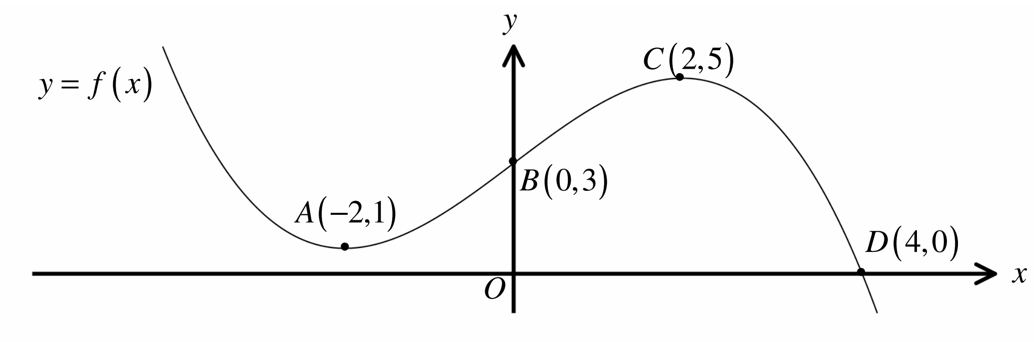
a) Find an expression for $f^{-1}(x)$. **(4)**

The function g is defined as

$$g : x \mapsto \frac{2}{x}, \ x \in \mathbb{R}, \ x \neq 0.$$

b) Evaluate $fg\left(\frac{2}{3}\right)$. **(2)**

Question 3



The figure above shows part of the graph of the curve with equation $y = f(x)$.

The graph meets the coordinate axes at $B(0,3)$ and $D(4,0)$ and has stationary points at $A(-2,1)$ and $C(2,5)$.

Sketch on separate diagrams the graph of …

a) … $y = |f(x)|$ **(2)**

b) … $y = f(|x|)$ **(3)**

c) … $y = f(3x-2)$ **(3)**

Indicate the new coordinates of the points A, B, C and D in these graphs.

Question 4

$$y \equiv \sqrt{2}\cos\theta - \sqrt{6}\sin\theta,\ 0 < \theta < 360°.$$

a) Express y in the form $R\cos(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. **(4)**

b) Solve the equation $y = 2$. **(5)**

c) Write down the minimum value of …

i. … y^2. **(1)**

ii. … $\frac{1}{y^2}$. **(1)**

Question 5

A new antibiotic is tested by spraying it on a lab dish covered in bacteria.

Initially 12000 bacteria were placed on the dish and 24 hours later this number has fallen to 2000.

The number of bacteria N on this lab dish reduces according to the equation

$$N = A\mathrm{e}^{-kt},\ t \geq 0,$$

where t is the time in hours since the bacteria were first placed on the dish and, A and k are positive constants.

a) Show that $k = 0.07466$, correct to 4 significant figures. **(6)**

b) Find the value of t when the bacteria will reach 1000. **(4)**

Question 6

The curve C has equation given by

$$y = \frac{x}{y^2 + \ln y}, \quad y > 0.$$

Show that an equation of the normal to C at the point $(1,1)$ is

$$4x + y = 5. \qquad \textbf{(10)}$$

Question 7

$$\sin A = \frac{12}{13} \quad \text{and} \quad \cos B = \frac{4}{5}.$$

If A is obtuse and B is acute, show clearly that

$$\sin(A+B) = \frac{33}{65}. \qquad \textbf{(4)}$$

Question 8

The curve C has equation

$$y = e^{2x} - 4e^{x} - 16x.$$

a) Show that the x coordinates of the stationary points of C satisfy the equation

$$e^{2x} - 2e^{x} - 8 = 0.$$ **(4)**

b) Hence determine the exact coordinates of the stationary point of C, giving the answer in terms of $\ln 2$. **(5)**

Question 9

The curve C has equation

$$y = \frac{3x+1}{x^3 - x^2 + 5}.$$

The curve has a single stationary point at M, with approximate coordinates $(1.4, 0.9)$.

a) Show that the x coordinate of M is a solution of the equation **(8)**

$$x = \sqrt[3]{\frac{1}{3}x + \frac{5}{2}}.$$

b) By using an iterative formula based on the equation of part **(a)**, determine the coordinates of M correct to three decimal places. **(5)**
