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IYGB GCE

Core Mathematics C3

Advanced

Practice Paper A

Difficulty Rating: 2.8467/1.2685

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.

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Question 1

$$x^3+10x-4=0.$$

a) Show that the above equation has a root α, which lies between 0 and 1. **(2)**

The recurrence relation

$$x_{n+1}=\frac{4-x_n^3}{10}$$

starting with $x_0=0.3$ is to be used to find α.

b) Find, to 4 decimal places, the values of x_1, x_2, x_3 and x_4. **(3)**

c) By considering the sign of an appropriate function $f(x)$ in a suitable interval, show clearly that $\alpha=0.39389$, correct to 5 decimal places. **(3)**

Question 2

A curve C has equation

$$y=\sqrt{x-3},\ x>3.$$

Find an equation of the normal to C at the point where $x=7$ **(5)**

Question 3

$$f(x)=|3x+2|,\ x\in\mathbb{R}.$$

a) Sketch the graph of $f(x)$, clearly indicating the coordinates of any points where the graph of $f(x)$ meets the coordinate axes. **(3)**

b) Solve the equation

$$f(x)=1.$$ **(3)**

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Question 4

$$f(x) \equiv \sqrt{3}\sin x + \cos x,\ 0 \le x < 2\pi .$$

a) Express $f(x)$ in the form $R\cos(x-\alpha)$, $R>0$, $0<\alpha<\frac{\pi}{2}$. **(3)**

b) State the maximum value of $f(x)$ and find the value of x for which this maximum value occurs. **(3)**

c) Solve the equation

$$f(x) = \sqrt{3}.$$ **(5)**

Question 5

Differentiate each of the following expressions with respect to x, simplifying the final answers as far as possible

a) $y = \left(x^2 - 4\right)^3$ **(2)**

b) $y = x\cos 2x$ **(3)**

c) $y = \dfrac{\sin x}{x}$ **(3)**

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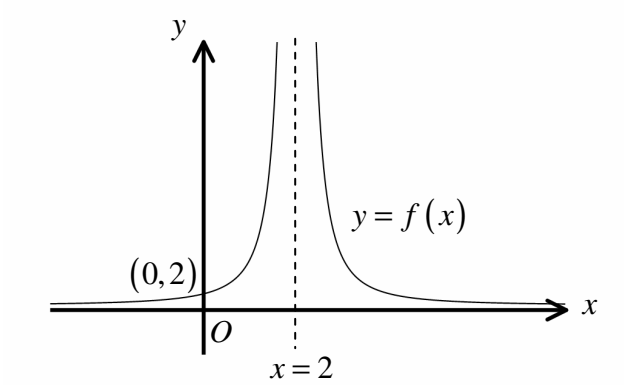
Question 6

The figure below shows the graph of a function with equation $y = f(x)$.

The curve meets the y axis at $(0,2)$ while the lines with equations $x = 2$ and $y = 0$ are asymptotes to the curve.



Sketch on separate diagrams the graph of …

a) … $y = 2f(x+2)$. **(2)**

b) … $y = f(2x+2)$. **(2)**

c) … $y = -f(-x)$. **(3)**

The sketches must include

- the coordinates of any points where the graph meets the coordinate axes.
- any asymptotes to the curve, clearly stated or labelled.

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Question 7

The function f is defined as

$$f:x\mapsto \frac{2}{x-3}-\frac{4}{x^2-4x+3},\ x\in\mathbb{R},\ x>1.$$

a) Show clearly that

$$f:x\mapsto \frac{2}{x-1},\ x\in\mathbb{R},\ x>1. \qquad \textbf{(4)}$$

b) Find an expression for f^{-1}, in its simplest form. **(3)**

The function g is given by

$$g:x\mapsto 2x^2+4,\ x\in\mathbb{R}.$$

c) Solve the equation

$$fg(x)=\frac{4}{7}. \qquad \textbf{(4)}$$

Question 8

$$6\sec^2 2x+5\tan 2x=12,\ 0\le\theta<\pi.$$

Find the solutions of the above trigonometric equation, giving the answers in radians correct to two decimal places. **(7)**

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Question 9

When hot cooking oil cools down, its temperature, T °C, is related to the time, t minutes, for which it has been cooling, by the formula

$$T = 20 + 160\mathrm{e}^{-0.1t}, \ t \geq 0.$$

a) Sketch the graph of T against t, clearly marking its asymptote and the coordinates of the starting point of the curve. **(3)**

b) Determine the value of t, when $T = 100$. **(3)**

c) Find an expression for $\dfrac{dT}{dt}$. **(2)**

d) Calculate the value of T, at the instant when the oil is cooling at the rate of 2 °C per minute. **(4)**