IYGB GCE

Core Mathematics C3

Advanced

Practice Paper F

Difficulty Rating: 2.8800/1.2821

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 10 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

Differentiate each of the following expressions with respect to x.

a) $y=\left(1-x^2\right)^6$ **(2)**

b) $y=x^3\sin 3x$ **(3)**

c) $y=\dfrac{5x}{x^3+2}$ **(3)**

Question 2

If $\sin x=\dfrac{3}{5}$, show clearly that

$$\sec 2x=\frac{25}{7}.$$ **(4)**

Question 3

Solve the equation

$$\left|x^2-2x-4\right|=4.$$ **(5)**

Question 4

$$f(x) = 4x - 3\sin x - 1, \quad 0 \le x \le 2\pi .$$

a) Show that the equation $f(x) = 0$ has a solution α in the interval $(0.7, 0.8)$. **(2)**

An iterative formula, of the form given below, is used to find α.

$$x_{n+1} = A + B\sin x_n , \quad x_1 = 0.75 ,$$

where A and B are constants.

b) Find, to 5 decimal places, the value of x_2, x_3, x_4 and x_5. **(4)**

c) By considering the sign of $f(x)$ in a suitable interval show clearly that $\alpha = 0.775$, correct to 3 decimal places. **(3)**

Question 5

A preservation programme, for elephants in Africa, was introduced 8 years ago. The elephants were then released to the wild. Let t be the number of years since the start of the programme.

The population of elephants P, is given by

$$P = 400\mathrm{e}^{\frac{1}{12}(t-8)} , \ t \ge 0 .$$

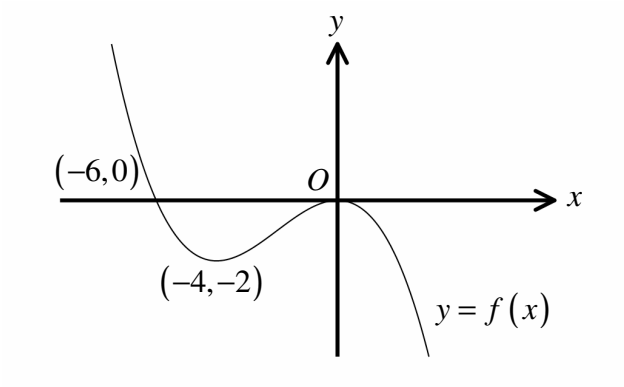
Assuming that P can be treated as a continuous variable, find …

a) … the number of elephants when the programme started. **(1)**

b) … the number of elephants released to the wild. **(1)**

c) … the value of t when the number of elephants will reach 1000. **(4)**

Question 6



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

The graph of the function meets the x axis at $(-6,0)$ and has stationary points at the origin and at the point with coordinates $(-4,-2)$.

Sketch the graph of $y = -4f(x+1)$. **(4)**

The sketch must include the coordinates of any points where the graph meets the x axis and the coordinates of the two stationary points.

Question 7

Solve the following trigonometric equation.

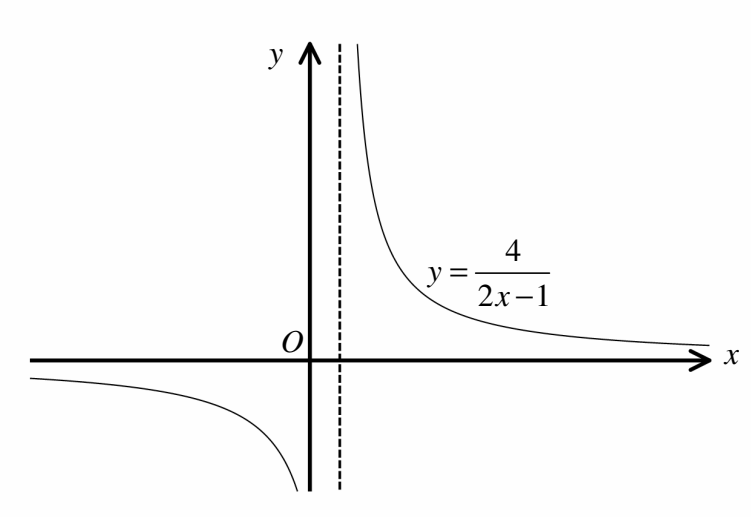
$$2\cos 2\theta = 4\cos\theta - 3, \qquad 0 \le \theta < 360°. \qquad \textbf{(6)}$$

Question 8

$$y=\frac{2}{x-2}-\frac{6}{(x-2)(2x-1)}.$$

a) Show clearly that $y=\dfrac{4}{2x-1}$ **(4)**

The figure below shows the graph of $y=\dfrac{4}{2x-1}$, $x\neq a$.



b) State the equation of the vertical asymptote of the curve, shown dotted in the figure above. **(1)**

The function f is defined

$$f(x)=\frac{4}{2x-1},\ x>1$$

c) State the range of $f(x)$. **(2)**

d) Obtain an expression for the inverse of the function, $f^{-1}(x)$. **(3)**

e) State the domain and range of $f^{-1}(x)$. **(2)**

Question 9

A curve C has equation

$$y=\frac{4x+k}{4x-k},\ x\neq\frac{k}{4},\text{ where } k \text{ is a constant.}$$

a) Find a simplified expression for $\frac{dy}{dx}$, in terms k. **(5)**

The point P lies on C, where $x=3$.

b) Given that the gradient at P is $-\frac{8}{27}$, show that one possible value of k is 48 and find the other. **(5)**

Question 10

$$\sin 3x\equiv 3\sin x-4\sin^3 x.$$

a) Prove the validity of the above trigonometric identity by writing $\sin 3x$ as $\sin(2x+x)$. **(6)**

b) By differentiating both sides of the above trigonometric identity with respect to x, find the corresponding identity for $\cos 3x$ in terms of $\cos x$. **(5)**
