

Basic Differentiation

Question Paper

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Differentiation
Sub Topic	Basic Differentiation
Booklet	Question Paper

Time Allowed: 76 minutes

Score: /63

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 A function f is such that $f(x) = \frac{15}{2x+3}$ for $0 \leq x \leq 6$.
- (i) Find an expression for $f'(x)$ and use your result to explain why f has an inverse. [3]
- (ii) Find an expression for $f^{-1}(x)$, and state the domain and range of f^{-1} . [4]

- 2 (i) Express $2x^2 - 10x + 8$ in the form $a(x+b)^2 + c$, where a , b and c are constants, and use your answer to state the minimum value of $2x^2 - 10x + 8$. [4]
- (ii) Find the set of values of k for which the equation $2x^2 - 10x + 8 = kx$ has no real roots. [4]

- 3 A curve has equation $y = f(x)$. It is given that $f'(x) = \frac{1}{\sqrt{x+6}} + \frac{6}{x^2}$ and that $f(3) = 1$. Find $f(x)$. [5]

- 4 A curve has equation $y = f(x)$. It is given that $f'(x) = x^{-\frac{3}{2}} + 1$ and that $f(4) = 5$. Find $f(x)$. [4]

- 5 The length, x metres, of a Green Anaconda snake which is t years old is given approximately by the formula

$$x = 0.7\sqrt{(2t-1)},$$

where $1 \leq t \leq 10$. Using this formula, find

- (i) $\frac{dx}{dt}$, [2]
- (ii) the rate of growth of a Green Anaconda snake which is 5 years old. [2]

- 6 (i) Sketch the curve $y = 2 \sin x$ for $0 \leq x \leq 2\pi$. [1]

- (ii) By adding a suitable straight line to your sketch, determine the number of real roots of the equation

$$2\pi \sin x = \pi - x.$$

State the equation of the straight line. [3]

- 7 The function f is such that $f(x) = 2 \sin^2 x - 3 \cos^2 x$ for $0 \leq x \leq \pi$.
- (i) Express $f(x)$ in the form $a + b \cos^2 x$, stating the values of a and b . [2]
- (ii) State the greatest and least values of $f(x)$. [2]
- (iii) Solve the equation $f(x) + 1 = 0$. [3]
- 8 The equation of a curve is such that $\frac{dy}{dx} = \frac{3}{\sqrt{x}} - x$. Given that the curve passes through the point $(4, 6)$, find the equation of the curve. [4]
- 9 The function f is such that $f(x) = a - b \cos x$ for $0^\circ \leq x \leq 360^\circ$, where a and b are positive constants. The maximum value of $f(x)$ is 10 and the minimum value is -2 .
- (i) Find the values of a and b . [3]
- (ii) Solve the equation $f(x) = 0$. [3]
- (iii) Sketch the graph of $y = f(x)$. [2]
- 10 A curve is such that $\frac{dy}{dx} = \frac{6}{\sqrt{4x-3}}$ and $P(3, 3)$ is a point on the curve.
- (i) Find the equation of the normal to the curve at P , giving your answer in the form $ax + by = c$. [3]
- (ii) Find the equation of the curve. [4]
- 11 (a) Differentiate $4x + \frac{6}{x^2}$ with respect to x . [2]
- (b) Find $\int \left(4x + \frac{6}{x^2}\right) dx$. [3]