DIFFERENTIATION & FUNCTIONS (Q 6, 7 & 8, PAPER 1)

2003

6 (a) Let $g(x) = \frac{2x}{3} - 1$.

Find the value of *x* for which g(x) = 5.

- (b) Differentiate $x^2 2x$ with respect to x from first principles.
- (c) Let $f(x) = 3 5x 2x^2$, $x \in \mathbf{R}$.
 - (i) Find f'(x), the derivative of f(x), and hence find the co-ordinates of the local maximum point of the curve y = f(x).
 - (ii) Solve the equation f(x) = 0.
 - (iii) Use your answers from parts (i) and (ii) to sketch the graph of
 - $f: x \rightarrow 3-5x-2x^2$, showing scaled and labelled axes.
- 7 (a) Differentiate with respect to x: (i) x^3

(ii)
$$\frac{x^2 - x^4}{2}$$
.

(b) (i) Differentiate $(3x^3 - 2x^2 + 2)^4$ with respect to x.

- (ii) Given that $y = (5x^2 + 3)(4 x^2)$, find $\frac{dy}{dx}$ when x = 1.
- (c) A train is travelling along a track. Suddenly, the brakes are applied. From the time the brakes are applied (t = 0 seconds), the distance travelled by the train, in metres, is given by

$$s = 30t - \frac{1}{4}t^2.$$

- (i) What is speed of the train at the moment the brakes are applied?
- (ii) How many seconds does it take for the train to come to rest?
- (iii) How far does the train travel in that time?

Answers

6 (a) 9 (b) 2x-2(c) (i) $f'(x) = -5-4x; (-\frac{5}{4}, \frac{49}{8})$ (ii) $-3, \frac{1}{2}$ 7 (a) (i) $3x^2$ (ii) $x-2x^3$ (b) (i) $(36x^2-16x)(3x^3-2x^2+2)^3$ (ii) 14 (c) (i) 30 m s⁻¹ (ii) 60 s (iii) 900 m



Answers		
8 (a) 4; [0, 3]		
(b) (i) 2	(ii) $x^2 + 6x + 9; -\frac{3}{2}$	
(c) (i) $3x^2 + 4x$	(ii) $-\frac{4}{3}$ (iii) $-\frac{3}{2}, \frac{1}{6}$	