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

2005

6 (a) Let
$$g(x) = \frac{x+5}{2}, x \in \mathbf{R}$$
.
Find $g(0) + g(2)$.

- (b) Differentiate $3x x^2$ with respect to x from first principles.
- (c) Let $f(x) = x^2 + px + 10$, $x \in \mathbf{R}$, where $p \in \mathbf{Z}$.
 - (i) Find f'(x), the derivative of f(x).
 - (ii) The minimum value of f(x) is at x = 3. Find the value of p.
 - (iii) Find the equation of the tangent to f(x) at the point (0, 10).

7 (a) Differentiate $9+3x-5x^2$ with respect to x. (b) (i) Differentiate $(3x^2-2)(x^2+4)$ with respect to x. (ii) Given that $y = \frac{x^2}{x-1}$, find $\frac{dy}{dx}$ when x = 3.

(c) A car begins to slow down at p in order to stop at a red traffic light at q.



The distance of the car from *p*, after *t* seconds, is given by

$$s = 12t - \frac{3}{2}t^2$$

where *s* is in metres.

- (i) Find the speed of the car as it passes p.
- (ii) Find the time taken to stop.
- (iii) The car stops exactly at q. Find the distance from p to q.

Answers

6 (a) 6 (b) 3-2x(c) 2x + p (ii) p = -6 (iii) 6x + y - 10 = 07 (a) 3-10x(b) (i) $12x^3 + 20x$ (ii) $\frac{3}{4}$ (c) (i) 12 ms^{-1} (ii) 4 s (iii) 24 m 8 Let $f(x) = \frac{1}{x-1}, x \in \mathbf{R}, x \neq 1$.

- (i) Find f(-3), f(-1.5), f(0.5), f(1.5), f(5).
- (ii) Draw the graph of the function *f* from x = -3 to x = 5.
- (iii) On the same diagram, draw the graph of the function g(x) = x + 1in the domain $-2 \le x \le 2, x \in \mathbf{R}$.
- (iv) Use your graphs to estimate the values of *x* for which f(x) = g(x).
- (v) Find, using algebra, the values of x for which f(x) = g(x).

Answers 8 (i) -0.25, -0.4, -2, 2, 0.25(iv) ± 1.4 (v) $\pm \sqrt{2}$