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**A LEVEL MATHS**

# (67) Differentiation (Multiple Terms)

## WORKING AT D/E

(1) Find an expression for $\frac{dy}{dx}$ for each of the following:

(a) $y = x^7 - 3x$  (b) $y = x^7(x-1)$

(c) $y = 4x + \sqrt{x} + 1$  (d) $y = x^{\frac{3}{2}}(x-3)$

(2) Find an expression for $f'(x)$ for each of the following:

(a) $f(x) = 7x^{\frac{2}{5}} - \frac{4}{x}$  (b) $f(x) = x^{\frac{6}{11}}(2x-3)$

(c) $f(x) = \frac{4}{x}(6x+2)$  (d) $f(x) = -3x^{-\frac{1}{5}} + 8x^{\frac{1}{3}}$

(3) Given that $x = t\sqrt{t} + \frac{10}{t^2}$, show that $\frac{dx}{dt} = \frac{3}{2}\sqrt{t} - \frac{20}{t^3}$

## WORKING AT B/C

(1) A curve has a stationary point when $\frac{dy}{dx} = 0$

Find the $x$ coordinate of the two stationary points on the curve with equation $y = 8x + \frac{1}{x}$

(2) Give that $f(x) = 8x^{\frac{3}{4}} - 2x^{0.5}$

Show that $f'(16) = \frac{11}{4}$

(3) Given that $y = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x$

(a) Show that $\frac{dy}{dx} = (x+3)(x-2)$

(b) Hence, find the 2 values of $x$ for which the curve $y = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x$ has a stationary point.

## WORKING AT A*/A

(1) $y = -\frac{2}{3}x^{\frac{3}{2}} + \frac{1}{2}x^2 - 42x, \quad x \in R, x > 0$

Find the coordinates of the only point on the curve where $\frac{dy}{dx} = 0$, giving the $y$ coordinate as an exact fraction.

(2) $f(x) = 12 - x^{0.5}$

Use differentiation to show that the curve with equation $y = f(x)$ doesn't have a stationary point.

(3) The curve with equation $y = ax^2 + bx + c$ has:

- A stationary point when $x = \frac{-3}{8}$
- Crosses the $y$ axis when $y = 1$
- Has gradient $-5$ when $x = -1$

(a) Find the values of $a, b$ and $c$.
(b) Sketch the curve of $y = ax^2 + bx + c$