DIFFERENTIATION

1 Differentiate with respect to x

a x^2 **b** x^4 **c** x **d** x^9 **e** x^{-3} **f** x^{-1}

g $4x^2$ **h** $7x$ **i** $2x^5$ **j** 3 **k** $8x^{-2}$ **l** $11x^{-4}$

2 Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

a $y = x^5 + x^2$ **b** $y = x + x^3$ **c** $y = x^4 + 2$ **d** $y = x^6 - 2x$

e $y = 6x^3 + 5x^{-2}$ **f** $y = x^2 - 4x + 1$ **g** $y = x^{-1} - x^{-5}$ **h** $y = 4x^3 + 3x^{-4}$

3 Differentiate with respect to t

a t^6 **b** $5t^{-3}$ **c** $t^{\frac{1}{2}}$ **d** $t^{\frac{2}{3}}$ **e** $\frac{3}{4}t^2$ **f** $8t^{\frac{1}{4}}$

g $2t^{\frac{7}{2}}$ **h** $t^{-\frac{1}{5}}$ **i** $\frac{1}{2}t^{\frac{6}{5}}$ **j** $t^{-\frac{3}{2}}$ **k** $12t^{-\frac{5}{4}}$ **l** $\frac{1}{6}t^{\frac{4}{3}}$

4 Find $\mathrm{f}'(x)$

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

e $\mathrm{f}(x) = 7 + x^{-\frac{4}{5}}$ **f** $\mathrm{f}(x) = 2x^{\frac{1}{6}} + x^{\frac{3}{4}}$ **g** $\mathrm{f}(x) = 3x^{-1} - 5x^{-\frac{3}{2}}$ **h** $\mathrm{f}(x) = 2 - 7x^{-1} + x^{-\frac{8}{3}}$

5 Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

a $y = \sqrt{x}$ **b** $y = 4 - \dfrac{1}{x}$ **c** $y = 3x^2 + \sqrt[3]{x}$ **d** $y = 9x + \dfrac{3}{x}$

e $y = \dfrac{1}{4x} - \dfrac{1}{x^2}$ **f** $y = \dfrac{6}{\sqrt[4]{x}}$ **g** $y = \sqrt{x^5}$ **h** $y = 8\sqrt{x} + \dfrac{4}{3x^2}$

6 Find $\dfrac{\mathrm{d}s}{\mathrm{d}t}$

a $s = t(t + 3)$ **b** $s = (t - 2)^2$ **c** $s = 5t(t^3 + 4t)$ **d** $s = t^2(7t - t^{-1})$

e $s = (t + 1)(t + 6)$ **f** $s = (t - 4)(t + 2)$ **g** $s = t(t^4 + 3t^2 + 9)$ **h** $s = t(t - 1)(2t - 3)$

7 Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

a $y = \sqrt{x}\,(x - 4)$ **b** $y = \dfrac{x^3 - 2x}{x}$ **c** $y = \dfrac{4x^3 + x}{x^2}$ **d** $y = \dfrac{x + 3}{\sqrt{x}}$

e $y = \dfrac{4 - x^3}{2x}$ **f** $y = \dfrac{5 + \sqrt{x}}{x^2}$ **g** $y = \dfrac{9x - 2}{3x}$ **h** $y = \dfrac{8x + x^3}{4\sqrt{x}}$

8 In each case, find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$.

a $y = 4x^2 - x + 3$ **b** $y = x^3 + 5x^2 + 2x - 6$ **c** $y = 8 - \dfrac{2}{x}$

d $y = 2x^4 + 3x^2 - 9$ **e** $y = \dfrac{3x^6 - 4}{x^2}$ **f** $y = 6x^{\frac{1}{2}} - x^{-\frac{1}{2}}$