

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  $\frac{dy}{dx}$

**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  $f'(x)$

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

5 Find  $\frac{dy}{dx}$

**a**  $y = \sqrt{x}$       **b**  $y = 4 - \frac{1}{x}$       **c**  $y = 3x^2 + \sqrt[3]{x}$       **d**  $y = 9x + \frac{3}{x}$   
**e**  $y = \frac{1}{4x} - \frac{1}{x^2}$       **f**  $y = \frac{6}{\sqrt[4]{x}}$       **g**  $y = \sqrt{x^5}$       **h**  $y = 8\sqrt{x} + \frac{4}{3x^2}$

6 Find  $\frac{ds}{dt}$

**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  $\frac{dy}{dx}$

**a**  $y = \sqrt{x}(x - 4)$       **b**  $y = \frac{x^3 - 2x}{x}$       **c**  $y = \frac{4x^3 + x}{x^2}$       **d**  $y = \frac{x + 3}{\sqrt{x}}$   
**e**  $y = \frac{4 - x^3}{2x}$       **f**  $y = \frac{5 + \sqrt{x}}{x^2}$       **g**  $y = \frac{9x - 2}{3x}$       **h**  $y = \frac{8x + x^3}{4\sqrt{x}}$

8 In each case, find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$ .

**a**  $y = 4x^2 - x + 3$       **b**  $y = x^3 + 5x^2 + 2x - 6$       **c**  $y = 8 - \frac{2}{x}$   
**d**  $y = 2x^4 + 3x^2 - 9$       **e**  $y = \frac{3x^6 - 4}{x^2}$       **f**  $y = 6x^{\frac{1}{2}} - x^{-\frac{1}{2}}$