DIFFERENTIATION

1 Differentiate with respect to x

a $(x + 3)^5$ **b** $(2x - 1)^3$ **c** $(8 - x)^7$ **d** $2(3x + 4)^6$

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

2 Differentiate with respect to t

a $2e^{3t}$ **b** $\sqrt{4t-1}$ **c** $5 \ln 2t$ **d** $(8-3t)^{\frac{3}{2}}$

e $3 \ln (6t + 1)$ **f** $\frac{1}{2} e^{5t+4}$ **g** $\frac{6}{\sqrt[3]{2t-5}}$ **h** $2 \ln (3 - \frac{1}{4}t)$

3 Find $\frac{d^2y}{dx^2}$ for each of the following.

a $y = (3x - 1)^4$ **b** $y = 4 \ln (1 + 2x)$ **c** $y = \sqrt{5-2x}$

4 Find the value of $f'(x)$ at the value of x indicated in each case.

a $f(x) = x^2 - 6 \ln 2x$, $x = 3$ **b** $f(x) = 3 + 2x - e^{x-2}$, $x = 2$

c $f(x) = (2 - 5x)^4$, $x = \frac{1}{2}$ **d** $f(x) = \frac{4}{x+5}$, $x = -1$

5 Find the value of x for which $f'(x)$ takes the value indicated in each case.

a $f(x) = 4\sqrt{3x+15}$, $f'(x) = 2$ **b** $f(x) = x^2 - \ln (x - 2)$, $f'(x) = 5$

6 Differentiate with respect to x

a $(x^2 - 4)^3$ **b** $2(3x^2 + 1)^6$ **c** $\ln (3 + 2x^2)$ **d** $(2 + x)^3(2 - x)^3$

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

i $3 \ln (4 - \sqrt{x})$ **j** $(e^{4x} + 2)^7$ **k** $\frac{1}{5+4\sqrt{x}}$ **l** $(\frac{2}{x} - x)^5$

7 Find the coordinates of any stationary points on each curve.

a $y = (2x - 3)^5$ **b** $y = (x^2 - 4)^3$ **c** $y = 8x - e^{2x}$

d $y = \sqrt{1+2x^2}$ **e** $y = 2 \ln (x - x^2)$ **f** $y = 4x + \frac{1}{x-3}$

8 Find an equation for the tangent to each curve at the point on the curve with the given x-coordinate.

a $y = (3x - 7)^4$, $x = 2$ **b** $y = 2 + \ln (1 + 4x)$, $x = 0$

c $y = \frac{9}{x^2+2}$, $x = 1$ **d** $y = \sqrt{5x-1}$, $x = \frac{1}{4}$

9 Find an equation for the normal to each curve at the point on the curve with the given x-coordinate.

a $y = e^{4-x^2} - 10$, $x = -2$ **b** $y = (1 - 2x^2)^3$, $x = \frac{1}{2}$

c $y = \frac{1}{2-\ln x}$, $x = 1$ **d** $y = 6e^{\frac{x}{3}}$, $x = 3$