

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**  $\left(\frac{2}{x}-x\right)^5$

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**  $y = 6e^{\frac{x}{3}}$ ,                       $x = 3$