2 Find $\frac{dy}{dx}$ in the following:

a $y = x^3 + x^2$ **b** $y = x^4 + x$ **c** $y = 3x^2 + 2x$

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

g $y = 3x^{-3} + 2x^{-2}$ **h** $y = 4\sqrt{x} + 3x - 5$ **i** $y = \frac{1}{2}x^2 + \frac{1}{4}$

j $y = \frac{1}{x} - \frac{1}{x^2}$

3 Find $\frac{dy}{dx}$ in the following:

a $y = x^3 + 5x^2 - \frac{3}{x}$ **b** $y = 6(\sqrt[3]{x})$ **c** $y = 2x\sqrt{x}$

d $y = \frac{1}{x^2} - \frac{3}{x}$ **e** $y = x^2\sqrt{x}$ **f** $y = 3\sqrt[3]{x} + 2\sqrt{x}$

4 Find $\frac{dy}{dx}$ in the following (by first multiplying out brackets). Show all working.

a $y = x(x + 1)$ **b** $y = x^2(2x - 1)$ **c** $y = (x + 1)^2$

d $y = (2x - 1)^2$ **e** $y = (2x + 1)^2$ **f** $y = (x^2 + 1)^2$

g $y = x^3(x^2 + x^4)$ **h** $y = (x + 1)(x - 3)$ **i** $y = (3x + 2)^2$

j $y = (2x^2 - 1)^2$ **k** $y = (\sqrt{x} - 1)^2$ **l** $y = \left(x + \frac{1}{x}\right)^2$

5 Find the gradient of the curve $y = x^3 + 4x$ at the point where $x = 2$.

6 Find the gradient of the curve $y = 2x^2 - 3x + 7$ at the point $(1, 6)$.

7 Find the gradient of the curve $y = \frac{1}{x}$ at the point $(2, \frac{1}{2})$.

8 **a** Find the x-coordinate of the point P on the curve $y = x^2 + 3x$ where the gradient is 7.

b Find the y-coordinate of the point P.

9 Find the coordinates on the point on the curve $y = x^2 - 5x + 2$ where the gradient is 1.

10 Find the coordinates of the *two* points on the curve $y = x^3 - 3x^2 - 9x + 7$ where the gradient is zero.

[These are called 'turning points'.]