1 Consider a curve with equation $y = 2x^2 + x$.

a If P is the point (1, 3) and Q is the point $((1 + h), 2(1 + h)^2 + (1 + h))$. Find the gradient of chord PQ.

b Find the gradient of PQ when $h = 0.1$.

c Find the gradient of the curve at P.

2 For the function $f(x) = 2x^2$, find $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$.

3 Evaluate the following limits:

a $\lim_{x \to 0} \frac{(x+3)^2 - 9}{x}$ **b** $\lim_{h \to 0} \frac{h^3 - 2h^2 + h}{h}$ **c** $\lim_{x \to 2} \frac{x^3 + 8}{x+2}$

4 Find the derivative of each of the following:

a $y = 8x^3 - 3x + 4$ **b** $y = 2x(x^2 - 2x^3)$

c $y = (2x+3)(x+1)$ **d** $y = -x^4 + 3x(x^3 - x)$

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

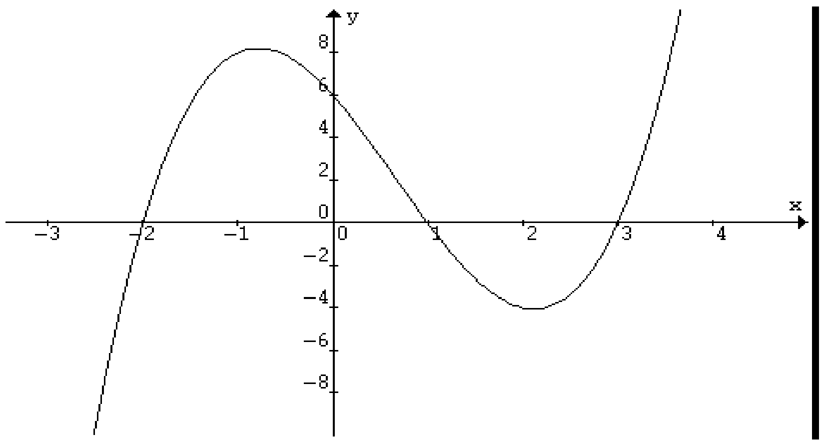
g $y = 7x^4 - \frac{1}{x^2} + 7$ **h** $y = 3x^{-2} + 2\sqrt{x}$

5 Let $y = x^4 + x^3 + x^{-2} + 8$.

a Find the average rate of change of y between $x = 1$ and $x = 2$.

b Find the gradient of the curve at $x = 2$.

6 For the graph shown, sketch the graph of the gradient function.



7 If $y = x^2 - 3x - 18$ find the interval(s) for which $\frac{dy}{dx} > 0$.

8 The function $s(t) = -3t^3 + 6t^2 - 3$ represents the displacement of a particle moving along a straight line, where t is in seconds and s is in metres.

a Find the **position** of the particle after 3 seconds.

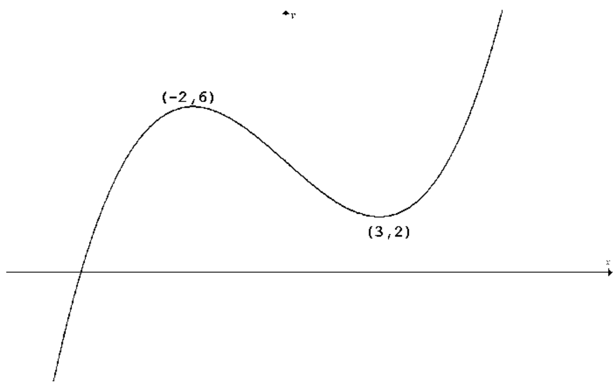
b Find the **velocity** of the particle at that time.

9 The curve with equation $y = ax^2 + bx$ has a gradient of 5 at the point (1, –2).

a Find the values of a and b.

b Find the coordinates of the point where the gradient is 0.

10 For the graph of $f: R \rightarrow R$, find:



a $\{x: f'(x) > 0\}$

b $\{x: f'(x) < 0\}$

c $\{x: f'(x) = 0\}$

11 Find the coordinates of the points on the curve $y = x^2 + 5x + 3$ at which the tangent:

a makes an angle of 45° with the positive direction of the x-axis

b is parallel to the line $y = 3x + 4$.

12 Consider the equation $y = x(x^2 - 9)$.

a Find the gradient at the points at which the curve crosses the x-axis.

b Find the coordinates of the point on the curve at which the gradient = 0.