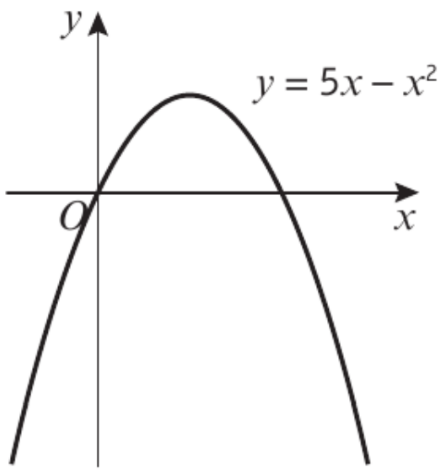
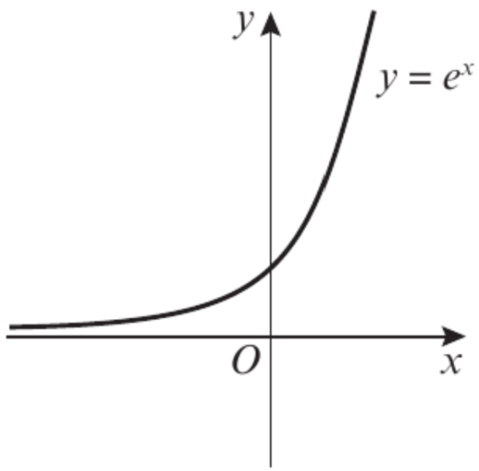
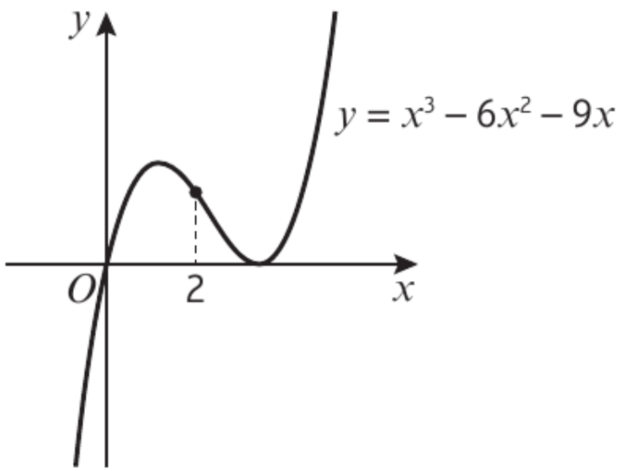
- **The function $f(x)$ is concave on a given interval if and only if $f''(x) \leqslant 0$ for every value of x in that interval.**
- **The function $f(x)$ is convex on a given interval if and only if $f''(x) \geqslant 0$ for every value of x in that interval.**



$\frac{d^2y}{dx^2} = -2$ so the curve is concave for all $x \in \mathbb{R}$.



$\frac{d^2y}{dx^2} = e^x$ which is always positive, so the curve is convex for all $x \in \mathbb{R}$.

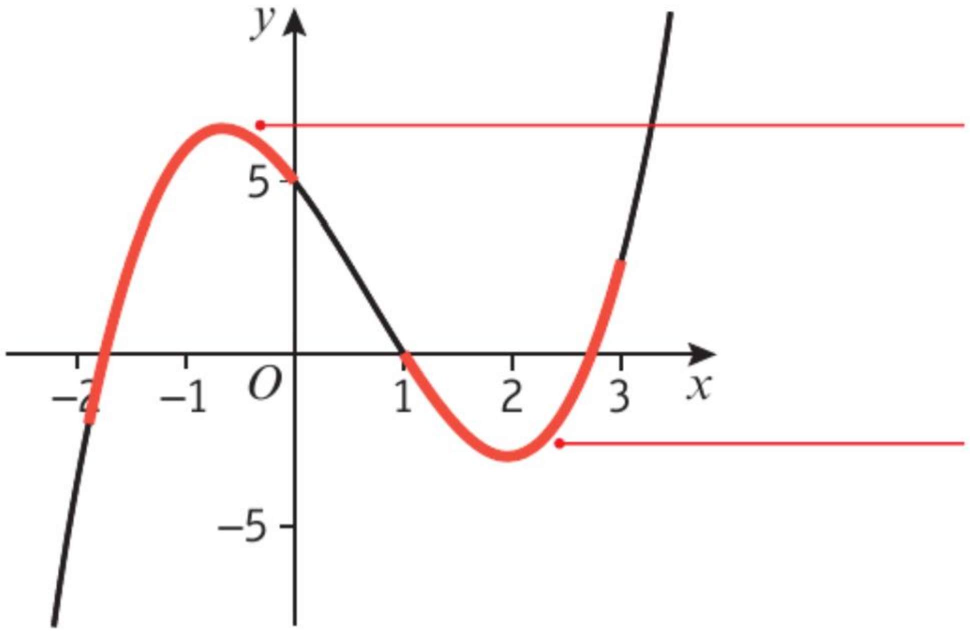


$\frac{d^2y}{dx^2} = 6x - 12$ so the curve is concave for all $x \leqslant 2$ and convex for $x \geqslant 2$.

Find the interval on which the function $f(x) = x^3 + 4x + 3$ is concave.

Show that the function $f(x) = e^{2x} + x^2$ is convex for all real values of x.

The point at which a curve changes from being concave to convex (or vice versa) is called a **point of inflection**. The diagram shows the curve with equation $y = x^3 - 2x^2 - 4x + 5$.



In the interval [–2, 0] the curve is concave.

In the interval [1, 3], the curve is convex.

The curve C has equation $y = x^3 - 2x^2 - 4x + 5$.

a Show that C is concave on the interval [–2, 0] and convex on the interval [1, 3].

b Find the coordinates of the point of inflection.