# Dr Oliver Mathematics
# Points of Inflexion: Part 1

1. At which point(s) does the graph of

$$y = 5x^4 - x^5$$

has a point of inflexion?

**Solution**

$$y = 5x^4 - x^5 \Rightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = 20x^3 - 5x^4$$
$$\Rightarrow \frac{\mathrm{d}^2y}{\mathrm{d}x^2} = 60x^2 - 20x^3.$$

Now,

$$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = 0 \Rightarrow 60x^2 - 20x^3 = 0$$
$$\Rightarrow 20x^2(3 - x) = 0$$
$$\Rightarrow x = 0 \text{ or } x = 3.$$

The only sign change for $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$ is $x = 3$ (which, after all, is the definition of a point of inflexion: around $x = 0$, we go positive-zero-positive). Finally,

$$x = 3 \Rightarrow y = 5(3^4) - 3^5 = 162;$$

hence, the point of inflexion is $\underline{\underline{(3, 162)}}$.