

Problem 0580/43/M/J/20/ Q12

(a) A curve has equation $y = 4x^3 - 3x + 3$.

(i) Find the coordinates of the two stationary points.

$$\frac{dy}{dx} = 12x^2 - 3$$

$$\frac{dy}{dx} = 0 \quad 12x^2 - 3 = 0$$
$$x = -\frac{1}{2} \quad x = \frac{1}{2}$$

$$y = 4\left(-\frac{1}{2}\right)^3 - 3\left(-\frac{1}{2}\right) + 3$$
$$= 4$$

$$\left(-\frac{1}{2}, 4\right)$$

$$y = 4\left(\frac{1}{2}\right)^3 - 3\left(\frac{1}{2}\right) + 3 = 2$$
$$\left(\frac{1}{2}, 2\right)$$

(ii) Determine whether each of the stationary points is a maximum or a minimum.
Give reasons for your answers. _____

$$\frac{d^2y}{dx^2} = 24x$$

$$x = -\frac{1}{2} \quad \frac{d^2y}{dx^2} = 24 \times -\frac{1}{2} = -12 < 0$$

maximum

$$x = \frac{1}{2} \quad \frac{d^2y}{dx^2} = 24 \times \frac{1}{2} = 12 > 0$$

minimum.