C1 2009 Jan.

(10)

$$y = x^3 + 3x^2 - 9x - 13$$

$$\frac{dy}{dx} = 3x^2 + 6x - 9 = 0 \quad \text{for stationary points}$$

$\div 3$

$$x^2 + 2x - 3 = 0$$

$$(x+3)(x-1) = 0$$

$$x = -3 \qquad x = 1$$

when $x = -3$

$$y = (-3)^3 + 3(-3)^2 - 9(-3) - 13$$
$$= -27 + 27 + 27 - 13$$
$$= 14$$

when $x = 1$

$$y = 1^3 + 3(1)^2 - 9(1) - 13$$
$$= 1 + 3 - 9 - 13$$
$$= -18$$

$(-3, 14)$ and $(1, -18)$ are stationary points

$$\frac{d^2y}{dx^2} = 6x + 6$$

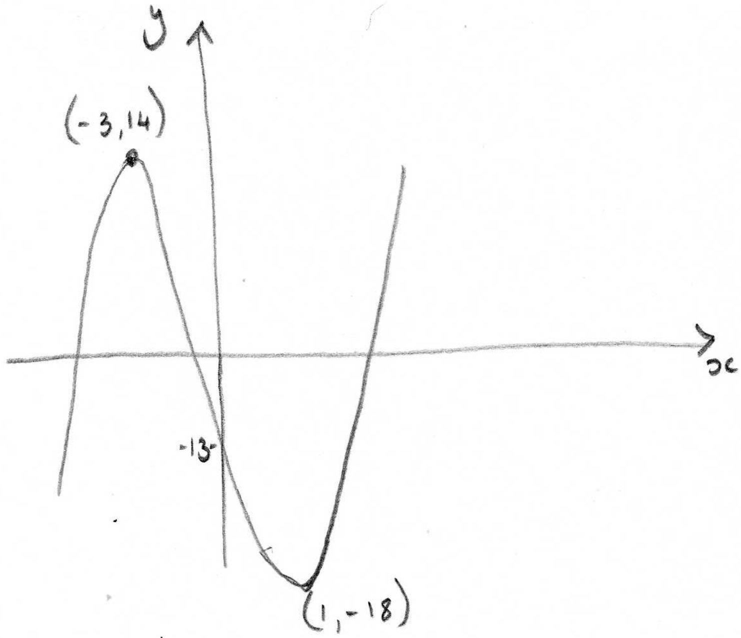
when $x = -3$

$$\frac{d^2y}{dx^2} = -18 + 6 = -12 < 0$$

when $x = 1$

$$\frac{d^2y}{dx^2} = 6 + 6 = 12 > 0$$

$(-3, 14)$ is maximum $\qquad$ $(1, -18)$ is minimum.



$x^3 + 3x^2 - 9x - 13 = 0$ has 3 real roots as the function $y = x^3 + 3x^2 - 9x - 13$ crosses the x axis 3 times