

Problem : 0580/42/F/M/23/Q9

$$f(x) = x^3 - 3x^2 - 4$$

- (a) Find the gradient of the graph of $y = f(x)$ where $x = 1$.

$$\begin{aligned} f'(x) &= 3x^2 - 3 \times 2x \\ &= 3x^2 - 6x \end{aligned}$$

$$f'(1) = 3(1) - 6(1) = -3$$

- (b) Find the coordinates of the turning points of the graph of $y = f(x)$.

$$f'(x) = 3x^2 - 6x$$

$$f'(x) = 0$$

$$3x^2 - 6x = 0$$

$$3x(x - 2) = 0$$

$$x = 0 \quad x = 2$$

$$f(x) = x^3 - 3x^2 - 4$$

$$x = 0 \quad f(x) = -4 \quad (0, -4)$$

$$\begin{aligned} x = 2 \quad f(2) &= 2^3 - 3(2)^2 - 4 \\ &= 8 - 12 - 4 \\ &= -8 \end{aligned}$$

$$(2, -8)$$