Solutions

Marking: **M1** a correct method, **A1** the correct answer.

Each answer shows the steps, then the **result**.

2.1

- $3x^4 \to 12x^3$, $-5x^2 \to -10x$, and the 7 vanishes

$$\frac{dy}{dx} = \mathbf{12x^3 - 10x}$$

2.2

- $\dfrac{dy}{dx} = 3x^2 - 4$
- substitute $x = 2$: $3(4) - 4$

$$= \mathbf{8}$$

2.3

- $\dfrac{dy}{dx} = 2x - 6$, and set it to zero
- $x = 3$
- substitute into the original: $9 - 18 + 5$

$$= (\mathbf{3},\ \mathbf{-4})$$

3.1

(a)

- differentiate term by term

$$\frac{dy}{dx} = \mathbf{6x^2 - 18x + 12}$$

(b)

- set it to zero: $6x^2 - 18x + 12 = 0$, so $x^2 - 3x + 2 = 0$
- $(x - 1)(x - 2) = 0$, so $x = 1$ or $x = 2$
- $y(1) = 2 - 9 + 12 = 5$ and $y(2) = 16 - 36 + 24 = 4$

$$(\mathbf{1},\ \mathbf{5}) \text{ and } (\mathbf{2},\ \mathbf{4})$$

(c)

- $\dfrac{d^2y}{dx^2} = 12x - 18$
- at $x = 1$ this is -6, which is negative, so $(1,\ 5)$ is a **maximum**; at $x = 2$ it is $+6$, so $(2,\ 4)$ is a **minimum**