Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

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

2.1

- $y = 4x^3 - 6x^{-1} + x^{1/2}$
- $\dfrac{dy}{dx} = \mathbf{12x^2 + 6x^{-2} + \frac{1}{2}x^{-1/2}}$

2.2

- $6(2x + 5)^5 \times 2$
- $\mathbf{12(2x + 5)^5}$

2.3

- $\dfrac{dy}{dx} = 3x^2 - 2 = 10$ at $x = 2$
- $\mathbf{y = 10x - 16}$

2.4

- $\mathbf{12x^2 - 4}$

3.1

- $f'(x) = 3x^2 - 12x + 9$
- $3(x - 1)(x - 3) < 0$
- $\mathbf{1 < x < 3}$

3.2

(a)

- $V = x^3$, $\dfrac{dV}{dx} = 3x^2 = 48$
- $\dfrac{dx}{dt} = \dfrac{12}{48} = \mathbf{0.25}$ cm s^{-1}

(b) $S = 6x^2$, $\dfrac{dS}{dx} = 48$; $\dfrac{dS}{dt} = 48 \times 0.25 = \mathbf{12}$ cm^2 s^{-1}

3.3

(a) $2 - 16x^{-3}$

(b) $x^3 = 8$, $x = 2$; (**2**, **6**)

(c) $\dfrac{d^2y}{dx^2} = 48x^{-4} > 0$: **minimum**

(d)

- at $x = 1$: $y = 10$, gradient $2 - 16 = -14$
- normal gradient $\frac{1}{14}$: $y - 10 = \frac{1}{14}(x - 1)$
- $\mathbf{x - 14y + 139 = 0}$

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