

## Question 1

(a) 15 marks Att 5

$$\frac{dy}{dx} = 3x^2 - 14x + 6 \quad \text{or} \quad f'(x) = 3x^2 - 14x + 6$$

(b) (i) 10 marks Att 3

$$y = \frac{3x+1}{x-2}$$

$$u = 3x+1 \quad v = x-2$$

$$\frac{du}{dx} = 3 \quad \frac{dv}{dx} = 1 \quad [4m]$$

$$\frac{dy}{dx} = \frac{(x-2)(3) - 1(3x+1)}{(x-2)^2} \quad [9m]$$

$$\Rightarrow \frac{dy}{dx} = \frac{3x-6-3x-1}{(x-2)^2} = \frac{-7}{(x-2)^2} \quad [10m]$$

$$\text{Note } \frac{dy}{dx} = \frac{-7}{x^2 - 4x + 4} \quad [9m]$$

(b) (ii) 10 marks Att 3

I

$$y = (x^2 - 2x - 9)^4$$

$$\frac{dy}{dx} = 4(x^2 - 2x - 9)^3(2x - 2) \quad [9m]$$

$$x = -2:$$

$$\frac{dy}{dx} = 4((-2)^2 - 2(-2) - 9)^3(2(-2) - 2) = 24 \quad [10m]$$

II

$$u = (x^2 - 2x - 9)^4 \quad y = u^4$$

$$\frac{du}{dx} = 2x - 2 \quad \frac{dy}{du} = 4u^3 \quad [4m]$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} = 4u^3(2x - 2) = 4(x^2 - 2x - 9)^3(2x - 2) \quad [9m]$$

$$x = -2:$$

$$\frac{dy}{dx} = 4((-2)^2 - 2(-2) - 9)^3(2(-2) - 2) = 24 \quad [10m]$$

(c) (i) 5 marks Att 2

$$\frac{ds}{dt} = 18 - 4t = 18 - 4(3) = 6 \text{ m s}^{-1} \text{ at } t = 3$$

(c) (ii) 5 marks Att 2

$$\frac{ds}{dt} = 18 - 4t = 0 \Rightarrow 4t = 18 \Rightarrow t = 4.5 \text{ s}$$

$$s = 18t - 2t^2 = 18(4.5) - 2(4.5)^2 = 40.5 \text{ m}$$

(c) (iii) 5 marks Att 2

$$\left[ \frac{d^2s}{dt^2} \right] = -4 \quad [5m]$$

**Question 2****(a) (i)****5 marks****Att 2**

7. (a) (i)

$$\frac{dy}{dx} = 7x^6$$

**(a) (ii)****5 marks****Att 2**

7. (a) (ii)

$$\frac{dy}{dx} = 5 - 12x^3$$

**(i)****10 marks****Att 3****(ii)****10 marks****Att 3**

$$7. (b) (i) \quad f'(x) = (4 - x^2)(3) + (1 + 3x)(-2x) \quad \text{or} \quad 12 - 3x^2 - 2x - 6x^2 \quad \text{or} \quad -9x^2 - 2x + 12.$$

$$\text{or} \quad f(x) = 4 + 12x - x^2 - 3x^3 \quad \Rightarrow \quad f'(x) = 12 - 2x - 9x^2$$

$$(ii) \quad y = (3x^2 - 4x)^8$$

$$\frac{dy}{dx} = 8(3x^2 - 4x)^7 (6x - 4) \quad [7m]$$

$$= 8(3(1)^2 - 4(1))^7 (6(1) - 4) = 8(-1)(2) = -16 \quad [10m] \quad \text{at } x = 1.$$

**(c) (i)****5 marks****Att 2**

$$7. (c) (i) \quad h = 20 + 90(7) - 5(7)^2 = 20 + 630 - 245 = 405 \text{ m.}$$

**(c) (ii)****5 marks****Att 2**

$$\frac{dh}{dt} = 90 - 10t$$

$$= 90 - 10(7) = 90 - 70 = 20 \text{ ms}^{-1}.$$

$$7. (c) (iii) \quad \frac{dh}{dt} = 90 - 10t = 0 \quad [1^{\text{st}} \text{ 5 marks}]$$

$$\Rightarrow 10t = 90 \quad \Rightarrow \quad t = 9 \text{ s.}$$

$$h = 20 + 90(9) - 5(9)^2 = 20 + 810 - 405 = 425 \text{ m} \quad [2^{\text{nd}} \text{ 5 marks}]$$