

CHAIN-RULE

Notes:

$$y = u^3$$

$$\frac{dy}{du} = 3u^2$$

$$y = (x^2 + 2x)^3$$

$$\text{Let: } u = x^2 + 2x \Rightarrow y = u^3$$

$$\frac{du}{dx} = 2x + 2$$

$$\frac{dy}{du} = 3u^2$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$= 3u^2 \times (2x + 2)$$

$$= 6(x + 1) \cdot u^2$$

$$= \underline{\underline{6(x + 1)(x^2 + 2x)^2}}$$

1 b. $y = (2x - 7)^8$

$$\frac{dy}{dx} = 16 \underline{\underline{(2x - 7)^7}}$$

3b. $y = \sqrt[3]{6x - 1} = (6x - 1)^{\frac{1}{3}}$

$$\frac{dy}{dx} = \frac{1}{3} (6x - 1)^{-\frac{2}{3}} \cdot 6$$

$$= \frac{2}{\sqrt[3]{(6x - 1)^2}}$$

d. $y = (\frac{1}{2}x + 4)^4$

$$\frac{dy}{dx} = 2 \underline{\underline{(\frac{1}{2}x + 4)^3}}$$

d. $y = 5(3x - 2)^{-\frac{2}{3}}$

$$\frac{dy}{dx} = -\frac{2}{3} \cdot 5 \cdot 3 (3x - 2)^{-\frac{5}{3}}$$

$$= -10 (3x - 2)^{-\frac{5}{3}} = -\frac{10}{\sqrt[3]{(3x - 2)^5}}$$

2b. $y = (4 - x)^{-2}$

$$\frac{dy}{dx} = -2 (4 - x)^{-3} (-1)$$

$$= \frac{2}{\underline{\underline{(4 - x)^3}}}$$

4. $y = (2x + 1)^3 + (2x - 1)^3$

$$\frac{dy}{dx} = 6(2x + 1)^2 + 6(2x - 1)^2$$

$$x = 1, \frac{dy}{dx} = 6(3)^2 + 6(1)^2 = \underline{\underline{60}}$$

d. $y = 4(4x - 1)^{-4}$

$$\frac{dy}{dx} = -16(4x - 1)^{-5} \cdot 4$$

$$= \underline{\underline{\frac{-64}{(4x - 1)^5}}}$$

5. $y = (1 - 4x)^{\frac{3}{2}}$

$$\frac{dy}{dx} = \frac{3}{2} \cdot (-4) (1 - 4x)^{-\frac{1}{2}} = -6\sqrt{1 - 4x}$$

$$m_t = -30 = -6\sqrt{1 - 4x}$$

$$5 = \sqrt{1 - 4x}$$

$$25 = 1 - 4x$$

$$4x = -24$$

$$x = -6, y = 125$$

$$(-6, 125)$$

$$6. y = (3x+1)^{-1} \text{ at } (-1, -\frac{1}{2})$$

$$\frac{dy}{dx} = -3(3x+1)^{-2}$$

$$m_t = -3(-2)^{-2} = -\frac{3}{4}$$

$$y + \frac{1}{2} = -\frac{3}{4}(x+1)$$

$$4y + 2 = -3(x+1)$$

$$4y + 3x = -5$$

$$7. y = (6x+3)^{\frac{1}{2}} \quad x=13, y=9$$

$$\frac{dy}{dx} = \frac{1}{2} \cdot 6(6x+3)^{-\frac{1}{2}}$$

$$m_t = 3 \cdot \frac{1}{9} = \frac{1}{3} \quad m_n = -3$$

$$y-9 = -3(x-13)$$

$$y = -3x + 48$$