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12.5

1) a) $5x - 7x^2$

$$5x^0 - 14x^1 = 5 \cdot 0 - 14x$$

b) $8x^{5/2} - 6x^4$

$$5/2 (8) x^{3/2} - 4(6) x^3 = 20x^{3/2} - 24x^3$$

c) $5/2 (8) x^{3/2} - 2(4)x - 1/3 (6) x^{-2/3}$

$$20x^{3/2} - 8x - 2x^{-2/3}$$

2) $\sqrt{x} + \frac{1}{\sqrt{x}} = x^{1/2} + x^{-1/2}$

$$1/2 x^{-1/2} - 1/2 x^{-3/2}$$

b) $\left(\frac{1}{7}\right) x^{-2} + x^{1/4}$

$$-\frac{2}{7} x^{-3} + \frac{x^{-3/4}}{4}$$

3) a) $x(2x^2 - 6x + 5) = 2x^3 - 6x^2 + 5x$

$$\frac{dy}{dx} = 6x^2 - 12x + 5$$

b) $(x^2 - 2) \left(x + \frac{2}{x}\right) = x^3 + 2x - 2x + \frac{4}{x}$

$$3x^2 + 2 - 2 + 4x^{-2}$$

$$= 3x^2 + \frac{4}{x^2}$$

c) $\frac{1}{\sqrt{x}} (6x^{3/2} - 8x^{3/2})$

$$x^{-1/2} (6x^{3/2} - 8x^{3/2}) = 6x^2 - 8x$$

$$\frac{dy}{dx} = 12x - 8$$

4) $\frac{1}{2} x^4 - 8x^2 + 2 \quad \frac{dy}{dx} = 2x^3 - 16x$

$$2(-2)^3 - 16(-2) = 16 = \text{gradient}$$

b) $6x^{-1/2} - 3x - 2x^2 \quad f'(x) = -3x^{-3/2} - 3 - 4x$

$$-3(1)^{-3/2} - 3 - 4(1) = -10 = \text{gradient}$$

$$5) f(x) = \frac{4x^2 - 8x}{x^3} = x^{-3}(4x^2 - 8x)$$

$$f'(x) = 4x^{-1} - 8x^{-2} \quad f'(x) = -4x^{-2} + 16x^{-3}$$

$$4(-2)^{-2} + 16(-2)^{-3} = -3 = \text{gradient}$$

$$6) f(x) = px^2 - 8p\sqrt{x} \quad f'(4) = 15$$

$$f'(x) = 2px - 4px^{-1/2}$$

$$2p(4) - 4p(4)^{-1/2} = 15$$

$$8p - 2p = 15$$

$$p = 2.5 = \frac{5}{2}$$

$$7) h(x) = px^3 + 4px + qx^{-1}$$

$$h(-1) = -41 \quad h'(-1) = 67$$

$$p(-1)^3 + 4p(-1) + q(-1)^{-1}$$

$$h'(x) = 3px^2 + 4p - qx^{-2}$$

$$-p - 4p - q = -41$$

$$h'(-1) = 3p + 4p - q$$

$$-5p - q = -41$$

$$7p - q = 67$$

$$7p - q = 67$$

$$7(9) - 67 = q$$

$$-5p + q = -41$$

$$12p = 108$$

$$p = 9$$

$$q = -4$$

$$8) f(x) = (1+2x)^6 \quad g(x) = (1-2x)^6$$

$$a) \binom{6}{0}(1)^6(2x)^0 + \binom{6}{1}(1)^5(2x)^1 + \binom{6}{2}(1)^4(2x)^2$$

$$1 + 12x + 60x^2$$

$$b) f'(x) = 12 + 120x$$

$$g'(x) = -12 + 120x$$