Section 9.7

Using Derivative Formulas

Part 1: Review

Example 1: $\frac{d}{dx}\frac{1}{4}$ $= 0$

Example 2: $\frac{d}{dx}\frac{x^4}{4}$ $= x^3$

Example 3: $\frac{d}{dx}(x^3 - 5x^2 + 1)(x^5 - 3)$

$$= (3x^2 - 10x)(x^5 - 3) + (5x^4)(x^3 - 5x^2 + 1)$$

Example 4: $\frac{d}{dx}\frac{1+x^2-x^4}{1+x^4}$

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

Part 2: Combining Derivative Formulas

Example 5: $\frac{d}{dx}\,\frac{5}{3}\,x^3(4\,x^5-5)^3$

$$= \underbrace{5x^2(4x^5-5)}_{\text{product rule}} + \frac{5}{3}x^3\cdot\underbrace{3(4x^5-5)^2\cdot 20x^4}_{\text{chain rule.}}$$

Example 6: $\frac{d}{dx}\,(5\,x^3+1)\,(x^4+5\,x)^2$

$$= \underbrace{15x^2(x^4+5x)^2}_{\text{product rule}} + (5x^3+1)\cdot\underbrace{2(x^4+5x)(4x^3+5)}_{\text{chain rule}}$$

Example 7: $\frac{d}{dq}\,((q^3+q)\,(q^2-7\,q))^3$

$$= \underbrace{3[(q^3+q)(q^2-7q)]^2\cdot[(3q^2+1)(q^2-7q)+(2q-7)(q^3+q)]}_{\text{chain rule}}$$

product rule

Example 8: $\frac{d}{dx}\left(\frac{2x-1}{x^2+x}\right)^4$

quotient rule.

$$= 4\left(\frac{2x-1}{x^2+x}\right)^3 \cdot \left[\frac{2(x^2+x) - (2x+1)(2x-1)}{(x^2+x)^2}\right]$$

chain rule.

Example 9: $\frac{d}{dx}\frac{\sqrt[3]{2x-1}}{2x+1} = \frac{(2x-1)^{1/3}}{2x+1}$

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

Example 10: $\frac{d}{dx}x^4 \cdot \sqrt[3]{4x^3+2x}$

$$= 4x^3\sqrt[3]{4x^3+2x} + x^4 \cdot \frac{1}{3}(4x^3+2x)^{-2/3} \cdot (12x^2+2)$$