

Rules of Differentiation

1. Power Rule
2. Product Rule
3. Quotient Rule
4. Chain Rule

1. Power Rule:

$$\frac{d}{dx} x^n = nx^{n-1}$$

$$\frac{d}{dx} (x^2) = 2x^{2-1} = 2x \text{ Ans}$$

$$\frac{d}{dx} (x^5) = 5x^{5-1} = 5x^4 \text{ Ans}$$

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

$$x = x^1$$

$$x^0 = 1$$

$$\frac{d}{dx} (x) = \frac{d}{dx} x^{1-1} = 1x^0 = 1 \cdot 1 = 1 \text{ Ans}$$

2. Product Rule:

$$\frac{d}{dx}(U.V) = U \frac{d}{dx}V + V \frac{d}{dx}U$$

$$\frac{d}{dx}(x-5)(3-x) = (x-5) \frac{d}{dx}(3-x) + (3-x) \frac{d}{dx}(x-5)$$

$$= (x-5) \frac{d}{dx}(0-1) + (3-x) \frac{d}{dx}(1-0)$$

$$= (x-5).(0-1) + (3-x).(1-0)$$

$$= (x-5).(-1) + (3-x).1$$

$$= -(x-5) + (3-x)$$

$$= -x + 5 + 3 - x = -2x + 8 \text{ Ans}$$

3. Qoutient Rule:

$$\frac{d}{dx} \left(\frac{U}{V} \right) = \frac{V \frac{d}{dx} U - U \frac{d}{dx} V}{V^2}$$

$$\frac{d}{dx} \left(\frac{2x - 3}{2x + 1} \right)$$

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

$$= (2x + 1) \frac{d}{dx} (2 - 0) - (2x - 3) \frac{d}{dx} (2 + 0)$$

$$= (2x + 1)(2 - 0) - (2x - 3)(2 + 0)$$

$$= (\mathbf{2x} + 1)(\mathbf{2 - 0}) - (\mathbf{2x} - 3)(\mathbf{2 + 0})$$

$$= \mathbf{1(2 - 0) - 3(2 - 0)}$$

$$= \mathbf{2(4)}$$

$$\frac{\mathbf{8}}{(2x + 1)^2} \mathbf{Ans}$$

4. Chain Rule:

$$\begin{aligned}\frac{d}{dx}(x^2 + 2)^5 &= 5((x^2 + 2)^4 \frac{d}{dx}(x^2 + 2)) \\ &= 5(x^2 + 2)^4(2x) \\ &= 10x(x^2 + 2)^4\end{aligned}$$