

**Directions:** Differentiate the following functions.

1.  $y = \sec(x^5) + \sec^5(x) = \sec(x^5) + (\sec(x))^5$

$$\frac{dy}{dx} = \sec(x^5) \tan(x^5) 5x^4 + 5(\sec(x))^4 \sec(x) \tan(x)$$

$$= \boxed{5x^4 \sec(x^5) \tan(x^5) + 5 \sec^5(x) \tan(x)}$$

2.  $y = \left(\frac{x^3 - x^2}{\sin(x)}\right)^4$

$$\frac{dy}{dx} = \boxed{4 \left(\frac{x^3 - x^2}{\sin(x)}\right)^3 \frac{(3x^2 - 2x) \sin(x) - (x^3 - x^2) \cos(x)}{\sin^2(x)}}$$

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

$$\frac{dy}{dx} = -2(x^4 - 3x^3)^{-2} (4x^3 - 9x^2) = \boxed{\frac{18x^2 - 8x^3}{(x^4 - 3x^3)^2}}$$

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

$$\frac{dy}{dx} = 5x^4 - \frac{1}{2}(\tan(x^3))^{-\frac{1}{2}} D_x [\tan(x^3)]$$

$$= \boxed{5x^4 - \frac{\sec^2(x^3) 3x^2}{2\sqrt{\tan(x^3)}}}$$

**Directions:** Differentiate the following functions.

1.  $y = e^{\cos(x)} + \cos(e^x)$

$$\frac{dy}{dx} = e^{\cos(x)}(-\sin(x)) - \sin(e^x)e^x$$

$$= \boxed{-\sin(x)e^{\cos(x)} - \sin(x)e^x}$$

2.  $y = (x^2 + 3x - 4)^{100}$

$$\frac{dy}{dx} = \boxed{100(x^2 + 3x - 4)^{99}(2x + 3)}$$

3.  $y = \frac{2}{5}\sqrt{e^{5x} + 5x} = \frac{2}{5}(e^{5x} + 5x)^{\frac{1}{2}}$

$$\frac{dy}{dx} = \frac{2}{5} \cdot \frac{1}{2}(e^{5x} + 5x)^{-\frac{1}{2}}(e^{5x} \cdot 5 + 5)$$

$$= \frac{1}{5} \frac{1}{(e^{5x} + 5x)^{\frac{1}{2}}} 5(e^{5x} + 1) = \boxed{\frac{e^{5x} + 1}{\sqrt{e^{5x} + 5x}}}$$

4.  $y = x^4 + \left(e^x + \frac{x^3 - 1}{x + 1}\right)^4$

$$\frac{dy}{dx} = 4x^3 + 4\left(e^x + \frac{x^3 - 1}{x + 1}\right)^3 D_x \left[ e^x + \frac{x^3 + 1}{x + 1} \right]$$

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