

CALCULUS: Graphical, Numerical, Algebraic by Finney, Demana, Waits and Kennedy
Chapter 3: Derivatives 3.6: Chain Rule pg. 148-156

What you'll Learn About

- How to find the derivative of a composite function

A) $y = \sin(x)$

$$\frac{dy}{dx} = |\cos x| \cdot 1 = \cos x$$

\uparrow
derivative
of angle

B) $y = \sin(x^2 - 4)$

$$y' = \cos(x^2 - 4) \cdot 2x$$

\uparrow
derivative
of angle

C) $y = \cos^2(3x)$

$$y = [\cos(3x)]^2$$

$$y' = 2[\cos(3x)]^1 \cdot (-\sin(3x)) \cdot (3)$$

$\underbrace{}_{\text{power rule}}$ $\underbrace{}_{\frac{d}{dx} \text{ of trig fct}}$ $\begin{matrix} \uparrow \\ \frac{d}{dx} \text{ angle} \end{matrix}$ $\begin{matrix} \uparrow \\ \text{power rule} \end{matrix}$ $\begin{matrix} \uparrow \\ \frac{d}{dx} (\cos(3x)) \end{matrix}$

$$y = x^2$$

$$y' = 2x$$

product rule

→ D) $y = (\csc x)^2 \cot x$

$$y' = (\csc x)^2 \cdot (-\csc^2 x) + (\cot x) \left[2\csc x \cdot (\csc x \cot x) \right]$$

$$y' = -\csc^4 x - 2\cot^2 x \csc^2 x$$

$$\frac{d}{dx} (\csc^2 x)$$

$$3[2x^2 - 3x]$$

$$E) \quad y = 5\sqrt{\sin(2x) + \cos(2x)}$$

$$y = 5 \left(\sin(2x) + \cos(2x) \right)^{1/2}$$
$$y' = 5 \cdot \frac{1}{2} \left[\sin(2x) + \cos(2x) \right]^{-1/2} \cdot \left(\cos(2x) \cdot 2 - \sin(2x) \cdot 2 \right)$$

power rule

$$E) \quad y = (\sin x + \cos x)^{-2}$$

$$y' = -2(\sin x + \cos x)^{-3} \cdot \left(\cos x \cdot 1 - \sin x \cdot 1 \right)$$
$$y' = \frac{-2(\cos x - \sin x)}{(\sin x + \cos x)^3}$$

$$F) \quad y = \frac{1}{(\sin(x^3) + \cos(x^3))^4}$$

$$y = (\sin(x^3) + \cos(x^3))^{-4}$$

$$y' = -4 \left[\sin(x^3) + \cos(x^3) \right]^{-5} \cdot \left(\cos(x^3) \cdot 3x^2 - \sin(x^3) \cdot 3x^2 \right)$$

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$$\textcircled{15} \quad y = (\sin x)^{-5}$$

$$\frac{dy}{dx} = -5(\sin x)^{-6} \cdot \cos x + 1$$

$$y = [\cos(7x)]^2$$

$$y' = 2[\cos(7x) \cdot -\sin(7x) \cdot 7]$$