

Calculus I SI Worksheet

Section 3.4 Chain Rule

$$1. \frac{d}{dx} \sqrt{4-3x^2} = (4-3x^2)^{1/2}$$

inside: $4-3x^2$ outside: $(x)^{1/2}$

$$\frac{dy}{dx} = \frac{1}{2} (4-3x^2)^{-1/2} \cdot (4-3x^2)' = \frac{1}{2} (4-3x^2)^{-1/2} \cdot (-6x)$$

$$\frac{dy}{dx} = \frac{-3x}{\sqrt{4-3x^2}}$$

$$2. \frac{d}{dx} e^{3x^2+7x^2-6}$$

inside: $3x^2$ outside: e^u

$$\frac{dy}{dx} = e^{3x^2} \cdot (3x^2)' + 14x$$

$$\boxed{\frac{dy}{dx} = 6xe^{3x^2} + 14x}$$

$$3. \frac{d}{dx} \tan(e^x - x^2)$$

inside: $e^x - x^2$ outside: $\tan(u)$

$$\frac{dy}{dx} = \sec^2(e^x - x^2) \cdot (e^x - x^2)'$$

$$\boxed{\frac{dy}{dx} = (e^x - 2x) \sec^2(e^x - x^2)}$$

4. $\frac{d}{dx} \sec(\sqrt{x^2-6})$

inside: x^2-6 outside: $\sqrt{x}$
 inside: $\sqrt{x^2-6}$ outside: $\sec(x)$

$$\begin{aligned} \frac{dy}{dx} &= \sec(\sqrt{x^2-6}) \tan(\sqrt{x^2-6}) \cdot (x^2-6)^{1/2} \\ &= \sec(\sqrt{x^2-6}) \tan(\sqrt{x^2-6}) \cdot \frac{1}{2} (x^2-6)^{-1/2} \cdot (x^2-6)' \\ &= \sec(\sqrt{x^2-6}) \tan(\sqrt{x^2-6}) \cdot \frac{1}{2} (x^2-6)^{-1/2} \cdot (2x) \end{aligned}$$

$$\boxed{\frac{dy}{dx} = \frac{x \sec(\sqrt{x^2-6}) \tan(\sqrt{x^2-6})}{\sqrt{x^2-6}}}$$

5. Find $f''(x)$ for $f(x) = \sin(3x^2 + 4)$

$$f'(x) = \cos(3x^2+4) \cdot (3x^2+4)' = 6x \cos(3x^2+4)$$

$$\boxed{f''(x) = 6 \cos(3x^2+4) - 36x^2 \sin(3x^2+4)}$$

$$\begin{array}{c|c} 6x & \cos(3x^2+4) \\ \hline 6 & -\sin(3x^2+4) \cdot (3x^2+4)' \\ & = -\sin(3x^2+4) (6x) \end{array}$$

6. $\frac{d}{dx} 8x^3 + 5x^2 \cos(x)$

$$\begin{array}{c|c} 5x^2 & \cos(x) \\ \hline 10x & -\sin(x) \end{array}$$

$$\frac{dy}{dx} = 8x^3 \ln(8) \cdot (x^3)' + 10x \cos(x) - 5x^2 \sin(x)$$

$$\boxed{\frac{dy}{dx} = 3x^2 \cdot 8x^3 \ln(8) + 10x \cos(x) - 5x^2 \sin(x)}$$

7. $\frac{d}{dx} e^{\sqrt{x}} - \csc(x^2)$

$$\frac{dy}{dx} = e^{\sqrt{x}} \cdot (x)^{1/2} + \csc(x^2) \cot(x^2) \cdot (x^2)'$$

$$\boxed{\frac{dy}{dx} = \frac{e^{\sqrt{x}}}{2\sqrt{x}} + 2x \csc(x^2) \cot(x^2)}$$