

Calculus Practice: Chain Rule 7b**Differentiate each function with respect to x .**

1) $y = \sec^{-1} 4x^2$

2) $y = \tan^{-1} -2x^4$

3) $f(x) = \csc^{-1} 5x^4$

4) $f(x) = \tan^{-1} 4x^2$

5) $f(x) = \sin^{-1} 5x^4$

6) $y = \cot^{-1} 5x^3$

7) $y = \cos^{-1} -4x^4$

8) $y = \cot^{-1} x^3$

$$9) y = \tan^{-1} (5x^4 + 4)^4$$

$$10) y = \cos^{-1} \sqrt[5]{x^3 + 3}$$

$$11) y = \cot^{-1} \sqrt{x^2 - 2}$$

$$12) y = \csc^{-1} (3x^5 + 2)^5$$

Calculus Practice: Chain Rule 7b

Differentiate each function with respect to x .

1) $y = \sec^{-1} 4x^2$

$$\begin{aligned}\frac{dy}{dx} &= \frac{1}{|4x^2| \sqrt{(4x^2)^2 - 1}} \cdot 8x \\ &= \frac{2}{x\sqrt{16x^4 - 1}}\end{aligned}$$

2) $y = \tan^{-1} -2x^4$

$$\begin{aligned}\frac{dy}{dx} &= \frac{1}{(-2x^4)^2 + 1} \cdot -8x^3 \\ &= -\frac{8x^3}{4x^8 + 1}\end{aligned}$$

3) $f(x) = \csc^{-1} 5x^4$

$$\begin{aligned}f'(x) &= -\frac{1}{|5x^4| \sqrt{(5x^4)^2 - 1}} \cdot 20x^3 \\ &= -\frac{4}{x\sqrt{25x^8 - 1}}\end{aligned}$$

4) $f(x) = \tan^{-1} 4x^2$

$$\begin{aligned}f'(x) &= \frac{1}{(4x^2)^2 + 1} \cdot 8x \\ &= \frac{8x}{16x^4 + 1}\end{aligned}$$

5) $f(x) = \sin^{-1} 5x^4$

$$\begin{aligned}f'(x) &= \frac{1}{\sqrt{1 - (5x^4)^2}} \cdot 20x^3 \\ &= \frac{20x^3}{\sqrt{1 - 25x^8}}\end{aligned}$$

6) $y = \cot^{-1} 5x^3$

$$\begin{aligned}\frac{dy}{dx} &= -\frac{1}{(5x^3)^2 + 1} \cdot 15x^2 \\ &= -\frac{15x^2}{25x^6 + 1}\end{aligned}$$

7) $y = \cos^{-1} -4x^4$

$$\begin{aligned}\frac{dy}{dx} &= -\frac{1}{\sqrt{1 - (-4x^4)^2}} \cdot -16x^3 \\ &= \frac{16x^3}{\sqrt{1 - 16x^8}}\end{aligned}$$

8) $y = \cot^{-1} x^3$

$$\begin{aligned}\frac{dy}{dx} &= -\frac{1}{(x^3)^2 + 1} \cdot 3x^2 \\ &= -\frac{3x^2}{x^6 + 1}\end{aligned}$$

$$9) y = \tan^{-1}(5x^4 + 4)^4$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{1}{((5x^4 + 4)^4)^2 + 1} \cdot 4(5x^4 + 4)^3 \cdot 20x^3 \\ &= \frac{80x^3(5x^4 + 4)^3}{(5x^4 + 4)^8 + 1} \end{aligned}$$

$$10) y = \cos^{-1} \sqrt[5]{x^3 + 3}$$

$$\begin{aligned} \frac{dy}{dx} &= -\frac{1}{\sqrt{1 - \left((x^3 + 3)^{\frac{1}{5}}\right)^2}} \cdot \frac{1}{5}(x^3 + 3)^{-\frac{4}{5}} \cdot 3x^2 \\ &= -\frac{3x^2}{5\sqrt{1 - \sqrt[5]{(x^3 + 3)^2}} \cdot \sqrt[5]{(x^3 + 3)^4}} \end{aligned}$$

$$11) y = \cot^{-1} \sqrt{x^2 - 2}$$

$$\begin{aligned} \frac{dy}{dx} &= -\frac{1}{\left((x^2 - 2)^{\frac{1}{2}}\right)^2 + 1} \cdot \frac{1}{2}(x^2 - 2)^{-\frac{1}{2}} \cdot 2x \\ &= -\frac{x}{\sqrt{x^2 - 2}(x^2 - 1)} \end{aligned}$$

$$12) y = \csc^{-1}(3x^5 + 2)^5$$

$$\begin{aligned} \frac{dy}{dx} &= -\frac{1}{|(3x^5 + 2)^5| \sqrt{((3x^5 + 2)^5)^2 - 1}} \cdot 5(3x^5 + 2)^4 \cdot 15x^4 \\ &= -\frac{75x^4(3x^5 + 2)^4}{|(3x^5 + 2)^5| \sqrt{(3x^5 + 2)^{10} - 1}} \end{aligned}$$