

Calculus Practice: Chain Rule 2a

Differentiate each function with respect to x .

1) $y = (-2x^5 - 1)^{-2}$

A) $\frac{dy}{dx} = -2(-2x^5 - 1)^{-3} \cdot -10x^4$
 $= \frac{20x^4}{(-2x^5 - 1)^3}$

B) $\frac{dy}{dx} = (-2x^5 - 1)^{-3} \cdot -10x^4$
 $= -\frac{10x^4}{(-2x^5 - 1)^3}$

C) $\frac{dy}{dx} = -2(-2x^5 - 1)^{-3}$
 $= -\frac{2}{(-2x^5 - 1)^3}$

D) $\frac{dy}{dx} = -10x^4$

3) $f(x) = \sqrt[4]{5x^2 + 2}$

A) $f'(x) = \frac{1}{4}(5x^2 + 2)^{-\frac{3}{4}} \cdot 10x$
 $= \frac{5x}{2(5x^2 + 2)^{\frac{3}{4}}}$

B) $f'(x) = (5x^2 + 2)^{-\frac{3}{4}} \cdot 10x$
 $= \frac{10x}{(5x^2 + 2)^{\frac{3}{4}}}$

C) $f'(x) = \frac{1}{4}(5x^2 + 2)^{-\frac{3}{4}}$
 $= \frac{1}{4(5x^2 + 2)^{\frac{3}{4}}}$

D) $f'(x) = 10x$

2) $f(x) = \sqrt[4]{3x^5 - 5}$

A) $f'(x) = 15x^4$

B) $f'(x) = \frac{1}{4}(3x^5 - 5)^{-\frac{3}{4}}$
 $= \frac{1}{4(3x^5 - 5)^{\frac{3}{4}}}$

C) $f'(x) = \frac{1}{4}(3x^5 - 5)^{-\frac{3}{4}} \cdot 15x^4$
 $= \frac{15x^4}{4(3x^5 - 5)^{\frac{3}{4}}}$

D) $f'(x) = (3x^5 - 5)^{-\frac{3}{4}} \cdot 15x^4$
 $= \frac{15x^4}{(3x^5 - 5)^{\frac{3}{4}}}$

4) $y = (2x + 3)^{-5}$

A) $\frac{dy}{dx} = (2x + 3)^{-6} \cdot 2$
 $= \frac{2}{(2x + 3)^6}$

B) $\frac{dy}{dx} = -5(2x + 3)^{-6}$
 $= -\frac{5}{(2x + 3)^6}$

C) $\frac{dy}{dx} = 2$

D) $\frac{dy}{dx} = -5(2x + 3)^{-6} \cdot 2$
 $= -\frac{10}{(2x + 3)^6}$

$$5) f(x) = \sqrt[3]{3x+4}(5x^5+3)$$

$$\begin{aligned} \text{A) } f'(x) &= \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 \cdot 25x^4 + \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 \cdot 25x^4 \\ &= \frac{50x^4}{(3x+4)^{\frac{2}{3}}} \end{aligned}$$

$$\begin{aligned} \text{B) } f'(x) &= (3x+4)^{\frac{1}{3}} \cdot 25x^4 + (5x^5+3) \cdot \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 \\ &= \frac{80x^5 + 100x^4 + 3}{(3x+4)^{\frac{2}{3}}} \end{aligned}$$

$$\begin{aligned} \text{C) } f'(x) &= \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 + 25x^4 \\ &= \frac{25x^4(3x+4)^{\frac{2}{3}} + 1}{(3x+4)^{\frac{2}{3}}} \end{aligned}$$

$$\text{D) } f'(x) = (3x+4)^{\frac{1}{3}} \cdot 25x^4$$

$$6) f(x) = \sqrt[5]{\frac{x^2-2}{x^4+2}}$$

$$\begin{aligned} \text{A) } f'(x) &= \frac{1}{5} \cdot \left(\frac{x^2-2}{x^4+2}\right)^{-\frac{4}{5}} \\ &= \frac{(x^4+2)^{\frac{4}{5}}}{5(x^2-2)^{\frac{4}{5}}} \end{aligned}$$

$$\begin{aligned} \text{B) } f'(x) &= \left(\frac{x^2-2}{x^4+2}\right)^{-\frac{4}{5}} \cdot \frac{(x^4+2) \cdot 2x - (x^2-2) \cdot 4x^3}{(x^4+2)^2} \\ &= \frac{2x(-x^4+2+4x^2)}{(x^2-2)^{\frac{4}{5}} \cdot (x^4+2)^{\frac{6}{5}}} \end{aligned}$$

$$\begin{aligned} \text{C) } f'(x) &= \frac{1}{5} \cdot \left(\frac{x^2-2}{x^4+2}\right)^{-\frac{4}{5}} \cdot \frac{(x^4+2) \cdot 2x - (x^2-2) \cdot 4x^3}{(x^4+2)^2} \\ &= \frac{2x(-x^4+2+4x^2)}{5(x^2-2)^{\frac{4}{5}} \cdot (x^4+2)^{\frac{6}{5}}} \end{aligned}$$

$$\begin{aligned} \text{D) } f'(x) &= \frac{(x^4+2) \cdot 2x - (x^2-2) \cdot 4x^3}{(x^4+2)^2} \\ &= \frac{2x(-x^4+2+4x^2)}{(x^4+2)^2} \end{aligned}$$

Calculus Practice: Chain Rule 2a

Differentiate each function with respect to x .

1) $y = (-2x^5 - 1)^{-2}$

$$\begin{aligned} *A) \frac{dy}{dx} &= -2(-2x^5 - 1)^{-3} \cdot -10x^4 \\ &= \frac{20x^4}{(-2x^5 - 1)^3} \end{aligned}$$

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

$$\begin{aligned} C) \frac{dy}{dx} &= -2(-2x^5 - 1)^{-3} \\ &= -\frac{2}{(-2x^5 - 1)^3} \end{aligned}$$

$$D) \frac{dy}{dx} = -10x^4$$

3) $f(x) = \sqrt[4]{5x^2 + 2}$

$$\begin{aligned} *A) f'(x) &= \frac{1}{4}(5x^2 + 2)^{-\frac{3}{4}} \cdot 10x \\ &= \frac{5x}{2(5x^2 + 2)^{\frac{3}{4}}} \end{aligned}$$

$$\begin{aligned} B) f'(x) &= (5x^2 + 2)^{-\frac{3}{4}} \cdot 10x \\ &= \frac{10x}{(5x^2 + 2)^{\frac{3}{4}}} \end{aligned}$$

$$\begin{aligned} C) f'(x) &= \frac{1}{4}(5x^2 + 2)^{-\frac{3}{4}} \\ &= \frac{1}{4(5x^2 + 2)^{\frac{3}{4}}} \end{aligned}$$

$$D) f'(x) = 10x$$

2) $f(x) = \sqrt[4]{3x^5 - 5}$

$$A) f'(x) = 15x^4$$

$$\begin{aligned} B) f'(x) &= \frac{1}{4}(3x^5 - 5)^{-\frac{3}{4}} \\ &= \frac{1}{4(3x^5 - 5)^{\frac{3}{4}}} \end{aligned}$$

$$\begin{aligned} *C) f'(x) &= \frac{1}{4}(3x^5 - 5)^{-\frac{3}{4}} \cdot 15x^4 \\ &= \frac{15x^4}{4(3x^5 - 5)^{\frac{3}{4}}} \end{aligned}$$

$$\begin{aligned} D) f'(x) &= (3x^5 - 5)^{-\frac{3}{4}} \cdot 15x^4 \\ &= \frac{15x^4}{(3x^5 - 5)^{\frac{3}{4}}} \end{aligned}$$

4) $y = (2x + 3)^{-5}$

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

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

$$C) \frac{dy}{dx} = 2$$

$$\begin{aligned} *D) \frac{dy}{dx} &= -5(2x + 3)^{-6} \cdot 2 \\ &= -\frac{10}{(2x + 3)^6} \end{aligned}$$

$$5) f(x) = \sqrt[3]{3x+4}(5x^5+3)$$

$$\begin{aligned} \text{A) } f'(x) &= \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 \cdot 25x^4 + \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 \cdot 25x^4 \\ &= \frac{50x^4}{(3x+4)^{\frac{2}{3}}} \end{aligned}$$

$$\begin{aligned} * \text{B) } f'(x) &= (3x+4)^{\frac{1}{3}} \cdot 25x^4 + (5x^5+3) \cdot \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 \\ &= \frac{80x^5+100x^4+3}{(3x+4)^{\frac{2}{3}}} \end{aligned}$$

$$\begin{aligned} \text{C) } f'(x) &= \frac{1}{3}(3x+4)^{-\frac{2}{3}} \cdot 3 + 25x^4 \\ &= \frac{25x^4(3x+4)^{\frac{2}{3}}+1}{(3x+4)^{\frac{2}{3}}} \end{aligned}$$

$$\text{D) } f'(x) = (3x+4)^{\frac{1}{3}} \cdot 25x^4$$

$$6) f(x) = \sqrt[5]{\frac{x^2-2}{x^4+2}}$$

$$\begin{aligned} \text{A) } f'(x) &= \frac{1}{5} \cdot \left(\frac{x^2-2}{x^4+2}\right)^{-\frac{4}{5}} \\ &= \frac{(x^4+2)^{\frac{4}{5}}}{5(x^2-2)^{\frac{4}{5}}} \end{aligned}$$

$$\begin{aligned} \text{B) } f'(x) &= \left(\frac{x^2-2}{x^4+2}\right)^{-\frac{4}{5}} \cdot \frac{(x^4+2) \cdot 2x - (x^2-2) \cdot 4x^3}{(x^4+2)^2} \\ &= \frac{2x(-x^4+2+4x^2)}{(x^2-2)^{\frac{4}{5}} \cdot (x^4+2)^{\frac{6}{5}}} \end{aligned}$$

$$\begin{aligned} * \text{C) } f'(x) &= \frac{1}{5} \cdot \left(\frac{x^2-2}{x^4+2}\right)^{-\frac{4}{5}} \cdot \frac{(x^4+2) \cdot 2x - (x^2-2) \cdot 4x^3}{(x^4+2)^2} \\ &= \frac{2x(-x^4+2+4x^2)}{5(x^2-2)^{\frac{4}{5}} \cdot (x^4+2)^{\frac{6}{5}}} \end{aligned}$$

$$\begin{aligned} \text{D) } f'(x) &= \frac{(x^4+2) \cdot 2x - (x^2-2) \cdot 4x^3}{(x^4+2)^2} \\ &= \frac{2x(-x^4+2+4x^2)}{(x^4+2)^2} \end{aligned}$$