

Chain Rule Quiz Study Guide

Date _____ Period _____

Differentiate each function with respect to x .

1) $y = (3x^2 - 1)^2$

2) $y = (x^2 + 3)^5$

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

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

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

6) $f(x) = (3x^5 - 1)^{\frac{1}{2}}$

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

8) $y = \sqrt[3]{x^3 + 5}$

9) $y = (3x - 5)(-x^3 + 2)^3$

$$10) y = (x^3 + 3)^4(x^4 + 1)$$

$$11) f(x) = \cos x^5$$

$$12) y = \sin 2x^3$$

$$13) f(x) = (2x^5 + 3)\tan 5x^2$$

$$14) f(x) = (x^5 + 4)\tan 5x^2$$

$$15) f(x) = \frac{\tan x^5}{2x^3 + 1}$$

$$16) f(x) = \sin \frac{x^3}{-4x^5 + 5}$$

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Differentiate each function with respect to x .

1) $y = (3x^2 - 1)^2$

$$\begin{aligned}\frac{dy}{dx} &= 2(3x^2 - 1) \cdot 6x \\ &= 12x(3x^2 - 1)\end{aligned}$$

2) $y = (x^2 + 3)^5$

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

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

$$\begin{aligned}f'(x) &= -2(5x^3 + 3)^{-3} \cdot 15x^2 \\ &= -\frac{30x^2}{(5x^3 + 3)^3}\end{aligned}$$

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

$$\begin{aligned}\frac{dy}{dx} &= -5(-5x^5 + 2)^{-6} \cdot -25x^4 \\ &= \frac{125x^4}{(-5x^5 + 2)^6}\end{aligned}$$

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

$$\begin{aligned}f'(x) &= \frac{1}{3}(3x^3 + 2)^{-\frac{2}{3}} \cdot 9x^2 \\ &= \frac{3x^2}{(3x^3 + 2)^{\frac{2}{3}}}\end{aligned}$$

6) $f(x) = (3x^5 - 1)^{\frac{1}{2}}$

$$\begin{aligned}f'(x) &= \frac{1}{2}(3x^5 - 1)^{-\frac{1}{2}} \cdot 15x^4 \\ &= \frac{15x^4}{2(3x^5 - 1)^{\frac{1}{2}}}\end{aligned}$$

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

$$\begin{aligned}f'(x) &= \frac{1}{3}(3x^5 + 4)^{-\frac{2}{3}} \cdot 15x^4 \\ &= \frac{5x^4}{(3x^5 + 4)^{\frac{2}{3}}}\end{aligned}$$

8) $y = \sqrt[3]{x^3 + 5}$

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

9) $y = (3x - 5)(-x^3 + 2)^3$

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

$$10) y = (x^3 + 3)^4(x^4 + 1)$$

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

$$11) f(x) = \cos x^5$$

$$\begin{aligned} f'(x) &= -\sin x^5 \cdot 5x^4 \\ &= -5x^4 \sin x^5 \end{aligned}$$

$$12) y = \sin 2x^3$$

$$\begin{aligned} \frac{dy}{dx} &= \cos 2x^3 \cdot 6x^2 \\ &= 6x^2 \cos 2x^3 \end{aligned}$$

$$13) f(x) = (2x^5 + 3)\tan 5x^2$$

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

$$14) f(x) = (x^5 + 4)\tan 5x^2$$

$$\begin{aligned} f'(x) &= (x^5 + 4) \cdot \sec^2 5x^2 \cdot 10x + \tan 5x^2 \cdot 5x^4 \\ &= 5x(2x^5 \sec^2 5x^2 + 8 \sec^2 5x^2 + x^3 \tan 5x^2) \end{aligned}$$

$$15) f(x) = \frac{\tan x^5}{2x^3 + 1}$$

$$\begin{aligned} f'(x) &= \frac{(2x^3 + 1) \cdot \sec^2 x^5 \cdot 5x^4 - \tan x^5 \cdot 6x^2}{(2x^3 + 1)^2} \\ &= \frac{x^2(10x^5 \sec^2 x^5 + 5x^2 \sec^2 x^5 - 6 \tan x^5)}{(2x^3 + 1)^2} \end{aligned}$$

$$16) f(x) = \sin \frac{x^3}{-4x^5 + 5}$$

$$\begin{aligned} f'(x) &= \cos \frac{x^3}{-4x^5 + 5} \cdot \frac{(-4x^5 + 5) \cdot 3x^2 - x^3 \cdot -20x^4}{(-4x^5 + 5)^2} \\ &= \frac{x^2 \cos \frac{x^3}{-4x^5 + 5} \cdot (8x^5 + 15)}{(-4x^5 + 5)^2} \end{aligned}$$