

Chain + Quotient Rule Practice

Date _____ Period _____

Differentiate each function with respect to x .

1) $y = \frac{(x^4 - 3)^3}{3x - 2}$

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

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

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

$$5) y = \frac{(x - 4)^{\frac{1}{4}}}{-4x^3 - 3}$$

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

$$7) y = \frac{5x^2 + 3}{(5x^3 + 3)^3}$$

$$8) y = \left(\frac{-3x^2 - 5}{4x + 1} \right)^4$$

$$9) y = \frac{(-3x^2 + 5)^{\frac{1}{5}}}{-4x - 1}$$

$$10) y = \frac{\sqrt[5]{-2x^3 - 3}}{-5x - 1}$$

Answers to Chain + Quotient Rule Practice (ID: 1)

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

$$= \frac{3(x^4-3)^2(11x^4-8x^3+3)}{(3x-2)^2}$$

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

$$= \frac{5(-2x^5-x^4-6)}{(-5x-1)^4}$$

$$3) \frac{dy}{dx} = \frac{(-5x^5-2) \cdot 2(-x-4) \cdot -1 - (-x-4)^2 \cdot -25x^4}{(-5x^5-2)^2}$$

$$= \frac{(-x-4)(-15x^5+4-100x^4)}{(-5x^5-2)^2}$$

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

$$= \frac{(-5x^2-3)(45x^2+80x-9)}{(-3x-4)^2}$$

$$5) \frac{dy}{dx} = \frac{(-4x^3-3) \cdot \frac{1}{4}(x-4)^{-\frac{3}{4}} - (x-4)^{\frac{1}{4}} \cdot -12x^2}{(-4x^3-3)^2}$$

$$= \frac{44x^3-192x^2-3}{4(-4x^3-3)^2 \cdot (x-4)^{\frac{3}{4}}}$$

$$6) \frac{dy}{dx} = \frac{(-x-3) \cdot \frac{1}{2}(3x^3-2)^{-\frac{1}{2}} \cdot 9x^2 + (3x^3-2)^{\frac{1}{2}}}{(-x-3)^2}$$

$$= \frac{-3x^3-4-27x^2}{2(-x-3)^2 \cdot (3x^3-2)^{\frac{1}{2}}}$$

$$7) \frac{dy}{dx} = \frac{(5x^3+3)^3 \cdot 10x - (5x^2+3) \cdot 3(5x^3+3)^2 \cdot 15x^2}{((5x^3+3)^3)^2}$$

$$= \frac{5x(-35x^3+6-27x)}{(5x^3+3)^4}$$

$$8) \frac{dy}{dx} = 4 \cdot \left(\frac{-3x^2-5}{4x+1} \right)^3 \cdot \frac{(4x+1) \cdot -6x - (-3x^2-5) \cdot 4}{(4x+1)^2}$$

$$= \frac{8(-3x^2-5)^3(-6x^2-3x+10)}{(4x+1)^5}$$

$$9) \frac{dy}{dx} = \frac{(-4x-1) \cdot \frac{1}{5}(-3x^2+5)^{-\frac{4}{5}} \cdot -6x - (-3x^2+5)^{\frac{1}{5}} \cdot -4}{(-4x-1)^2}$$

$$= \frac{2(-18x^2+50+3x)}{5(-4x-1)^2 \cdot (-3x^2+5)^{\frac{4}{5}}}$$

$$\begin{aligned} 10) \frac{dy}{dx} &= \frac{(-5x-1) \cdot \frac{1}{5}(-2x^3-3)^{-\frac{4}{5}} \cdot -6x^2 - (-2x^3-3)^{\frac{1}{5}} \cdot -5}{(-5x-1)^2} \\ &= \frac{-20x^3 - 75 + 6x^2}{5(-5x-1)^2 \cdot (-2x^3-3)^{\frac{4}{5}}} \end{aligned}$$