Calculus

Name_____

Chain Rule

Date_____ Period____

Differentiate each function with respect to *x*.

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

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

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

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

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

6) $y = ((-3x^4 - 1)^3 + 2)^5$

7) $y = \left((-4x-1)^3 - 3\right)^5$

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

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

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

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

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Differentiate each function with respect to *x*.

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

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

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

$$\frac{dy}{dx} = 2(x + 2)$$

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

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

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

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

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

$$\frac{dy}{dx} = 3((-3x^5 - 4)^4 + 3)^2 \cdot 4(-3x^5 - 4)^3 \cdot -15x^4$$
$$= -180x^4((-3x^5 - 4)^4 + 3)^2 \cdot (-3x^5 - 4)^3$$

6) $y = ((-3x^4 - 1)^3 + 2)^5$

$$\frac{dy}{dx} = 5((-3x^4 - 1)^3 + 2)^4 \cdot 3(-3x^4 - 1)^2 \cdot -12x^3$$
$$= -180x^3((-3x^4 - 1)^3 + 2)^4 \cdot (-3x^4 - 1)^2$$

7) $y = \left((-4x-1)^3 - 3\right)^5$

$$\frac{dy}{dx} = 5\left((-4x-1)^3 - 3\right)^4 \cdot 3(-4x-1)^2 \cdot -4$$
$$= -60\left((-4x-1)^3 - 3\right)^4 \cdot (-4x-1)^2$$

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

$$\frac{dy}{dx} = 2\left((-2x^4+5)^3 + 2\right) \cdot 3(-2x^4+5)^2 \cdot -8x^3$$
$$= -48x^3(-2x^4+5)^2\left((-2x^4+5)^3 + 2\right)$$

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

$$\frac{dy}{dx} = (-4x-5)^{-5} \cdot \frac{1}{4}(x^4+1)^{-\frac{3}{4}} \cdot 4x^3 + (x^4+1)^{\frac{1}{4}} \cdot -5(-4x-5)^{-6} \cdot -4$$
$$= \frac{16x^4 - 5x^3 + 20}{(x^4+1)^{\frac{3}{4}} \cdot (-4x-5)^6}$$

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

$$\frac{dy}{dx} = \frac{(-5x^3+3)^3 \cdot 2(-5x^2-4) \cdot -10x - (-5x^2-4)^2 \cdot 3(-5x^3+3)^2 \cdot -15x^2}{\left((-5x^3+3)^3\right)^2}$$
$$= \frac{5x(-5x^2-4)(-25x^3-12-36x)}{(-5x^3+3)^4}$$

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

$$\frac{dy}{dx} = \frac{(x^5-2)^3 \cdot 4(-x^4+2)^3 \cdot -4x^3 - (-x^4+2)^4 \cdot 3(x^5-2)^2 \cdot 5x^4}{\left((x^5-2)^3\right)^2}$$
$$= \frac{x^3(-x^4+2)^3(-x^5+32-30x)}{(x^5-2)^4}$$