Name_____

Differentiation - Product Rule

Date_____ Period____

Differentiate each function with respect to *x*.

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

2) $f(x) = x^2(-3x^2 - 2)$

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

4) $f(x) = (2x^4 - 3)(x^2 + 1)$

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

6) $f(x) = \left(-3 + x^{-3}\right)(-4x^3 + 3)$

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

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

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

10) $f(x) = \left(-10x^2 - 7\sqrt[5]{x^2} + 9\right)(2x^3 + 4)$

11) $y = (5 + 3x^{-2})(4x^5 + 6x^3 + 10)$

12) $y = (-6x^4 + 2 + 6x^{-4})(6x^4 + 7)$

13) $f(x) = \left(-7x^4 + 10x^{\frac{2}{5}} + 8\right)(x^2 + 10)$

Critical thinking question:

14) A classmate claims that $(f \cdot g)' = f' \cdot g'$ for any functions f and g. Show an example that proves your classmate wrong.

Kuta Software - Infinite Calculus Name_____

Differentiation - Product Rule

Date_____ Period____

Differentiate each function with respect to x.

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

$$\frac{dy}{dx} = -x^3 \cdot 12x^3 + (3x^4 - 2) \cdot -3x^2$$
$$= -21x^6 + 6x^2$$

2) $f(x) = x^2(-3x^2 - 2)$

$$f'(x) = x^2 \cdot -6x + (-3x^2 - 2) \cdot 2x$$
$$= -12x^3 - 4x$$

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

$$\frac{dy}{dx} = (-2x^4 - 3) \cdot -4x + (-2x^2 + 1) \cdot -8x^3$$
$$= 24x^5 - 8x^3 + 12x$$

4) $f(x) = (2x^4 - 3)(x^2 + 1)$

$$f'(x) = (2x^4 - 3) \cdot 2x + (x^2 + 1) \cdot 8x^3$$
$$= 12x^5 + 8x^3 - 6x$$

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

$$f'(x) = (5x^5 + 5) \cdot -10x^4 + (-2x^5 - 3) \cdot 25x^4$$
$$= -100x^9 - 125x^4$$

6) $f(x) = (-3 + x^{-3})(-4x^3 + 3)$

$$f'(x) = (-3 + x^{-3}) \cdot -12x^2 + (-4x^3 + 3) \cdot -3x^{-4}$$
$$= 36x^2 - \frac{9}{x^4}$$

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

$$\frac{dy}{dx} = (-2x^4 + 5x^2 + 4) \cdot -6x + (-3x^2 + 2)(-8x^3 + 10x)$$
$$= 36x^5 - 76x^3 - 4x$$

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

$$\frac{dy}{dx} = (x^4 + 3)(-20x^4 + 20x^3) + (-4x^5 + 5x^4 + 5) \cdot 4x^3$$
$$= -36x^8 + 40x^7 - 60x^4 + 80x^3$$

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

$$\frac{dy}{dx} = (5x^4 - 3x^2 - 1) \cdot -10x + (-5x^2 + 3)(20x^3 - 6x)$$
$$= -150x^5 + 120x^3 - 8x$$

10) $f(x) = \left(-10x^2 - 7\sqrt[5]{x^2} + 9\right)(2x^3 + 4)$

$$f'(x) = \left(-10x^2 - 7x^{\frac{2}{5}} + 9\right) \cdot 6x^2 + (2x^3 + 4)\left(-20x - \frac{14}{5}x^{-\frac{3}{5}}\right)$$
$$= -100x^4 - \frac{238x^{\frac{12}{5}}}{5} + 54x^2 - 80x - \frac{56}{5x^{\frac{3}{5}}}$$

11) $y = (5 + 3x^{-2})(4x^5 + 6x^3 + 10)$

$$\frac{dy}{dx} = (5 + 3x^{-2})(20x^4 + 18x^2) + (4x^5 + 6x^3 + 10) \cdot -6x^{-3}$$
$$= 100x^4 + 126x^2 + 18 - \frac{60}{x^3}$$

12) $y = (-6x^4 + 2 + 6x^{-4})(6x^4 + 7)$

$$\frac{dy}{dx} = (-6x^4 + 2 + 6x^{-4}) \cdot 24x^3 + (6x^4 + 7)(-24x^3 - 24x^{-5})$$
$$= -288x^7 - 120x^3 - \frac{168}{x^5}$$

13) $f(x) = \left(-7x^4 + 10x^{\frac{2}{5}} + 8\right)(x^2 + 10)$

$$f'(x) = \left(-7x^4 + 10x^{\frac{2}{5}} + 8\right) \cdot 2x + (x^2 + 10)\left(-28x^3 + 4x^{-\frac{3}{5}}\right)$$
$$= -42x^5 - 280x^3 + 24x^{\frac{7}{5}} + 16x + \frac{40}{x^{\frac{3}{5}}}$$

Critical thinking question:

14) A classmate claims that $(f \cdot g)' = f' \cdot g'$ for any functions f and g. Show an example that proves your classmate wrong.

Many answers. Ex: $f = 2x$, $g = 4$, $8 \neq 0$