$h(x) = f(x)\,g(x)$

$h'(x) = f(x)\,g'(x) + f'(x)\,g(x)$

$\boxed{\text{Key}}$ Math 4

Name________________________________

Date__________________ Period____

5-8 Practice

Differentiate each function with respect to *x*.

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

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

$= -12x^6 - 9x^6 + 6x^2$

$= \boxed{-21x^6 + 6x^2}$

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

$f'(x) = x^2(-6x) + 2x(-3x^2 - 2)$

$= -6x^3 - 6x^3 - 4x$

$= \boxed{-12x^3 - 4x}$

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

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

$= 8x^5 + 12x + 16x^5 - 8x^3$

$= \boxed{24x^5 - 8x^3 + 12x}$

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

$f'(x) = (2x^4 - 3)(2x) + (8x^3)(x^2 + 1)$

$= 4x^5 - 6x + 8x^5 + 8x^3$

$= \boxed{12x^5 + 8x^3 - 6x}$

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

$f'(x) = (5x^5 + 5)(-10x^4) + (25x^4)(-2x^5 - 3)$

$= -50x^9 - 50x^4 - 50x^9 - 75x^4$

$= \boxed{-100x^9 - 125x^4}$

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

$f'(x) = (-3 + x^{-3})(-12x^2) + -3x^{-4}(-4x^3 + 3)$

$= 36x^2 - \cancel{12x^{-1}} + \cancel{12x^{-1}} - 9x^{-4}$

$= 36x^2 - 9x^{-4}$

$= 36x^2 - \frac{9}{x^4}$

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

$y' = (-2x^4 + 5x^2 + 4)(-6x) + (-8x^3 + 10x)(-3x^2 + 2)$

$= \cancel{12x^5} - \cancel{30x^3} - 24x + \cancel{24x^5} - \cancel{16x^3} - \cancel{30x^3} + 20x$

$= \boxed{36x^5 - 76x^3 - 4x}$

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

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

$= \cancel{-20x^8} + \cancel{20x^7} - \cancel{60x^4} + \cancel{60x^3} - \cancel{16x^8} + \cancel{20x^7} + \cancel{20x^3}$

$= \boxed{-36x^8 + 40x^7 - 60x^4 + 80x^3}$

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

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

$$=\cancel{-50x^5}+\cancel{30x^3}+10x-\cancel{100x^5}+\cancel{60x^3}+\cancel{30x^3}-18x$$

$$=\boxed{-150x^5+120x^3-8x}$$

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

$$f'(x)=\left(-10x^2-7x^{2/5}+9\right)(6x^2)+\left(-20x-\frac{14}{5}x^{-3/5}\right)(2x^3+4)$$

$$=\cancel{-60x^4}-\cancel{42x^{12/5}}+54x^2\cancel{-40x^4}-80x-\cancel{\frac{28}{5}x^{12/5}}-\frac{56}{5}x^{-3/5}$$

$$=\boxed{-100x^4-\frac{238}{5}x^{12/5}+54x^2-80x-\frac{56}{5}x^{-3/5}}$$

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

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

$$=100x^4+126x^2+18-\frac{60}{x^3}$$

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

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

$$=-288x^7-120x^3-\frac{168}{x^5}$$

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

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

$$=-42x^5-280x^3+24x^{\frac{7}{5}}+16x+\frac{40}{x^{\frac{3}{5}}}$$

Critical thinking question:

Product rule

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.

Answers vary

Example: $f(x)=5x \quad g(x)=10$

$(f(x)\cdot g(x))'=5x(0)+5(10)=50$

$f'(x)\cdot g'(x)=5\cdot 0=0$ ← Not the same!