

Differentiation Review #1 (Power, Product, Quotient, and Chain Rules)

Differentiate each function with respect to x .

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

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

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

4) $f(x) = 4x^3$

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

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

7) $f(x) = \frac{1}{2}x$

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

9) $f(x) = -3x^5(-5x^5 - 4)$

10) $f(x) = 2x^2(2x^2 - 5)$

$$11) f(x) = (2x^4 + 2) \cdot -5x^2$$

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

$$13) f(x) = (-4x^4 + 4)(x^3 + 4)$$

$$14) f(x) = (-5x^4 - 5)(-x^5 + 3)$$

$$15) f(x) = (4x^4 - 4)(-4x^5 - 1)$$

$$16) f(x) = (-4x^2 - 3)(x^4 + 3)$$

$$17) f(x) = (2x^3 + 1)(4x^4 - 2x^3 + 3)$$

$$18) f(x) = (x^5 - 3x^4 + 4)(-2x^4 + 2)$$

$$19) f(x) = \frac{4x^4}{5x^2 + 5}$$

$$20) f(x) = \frac{3}{2x^4 - 2}$$

$$21) f(x) = \frac{2}{3x^3 - 5}$$

$$22) f(x) = \frac{5}{5x^2 + 2}$$

$$23) f(x) = \frac{3x^5 + 3x^3}{2x^2 + 2}$$

$$24) f(x) = \frac{3x^5 + 4}{x^5 - 5}$$

$$25) f(x) = \frac{3x^5 - 2x^3}{5x^4 - 5}$$

$$26) f(x) = \frac{4x^4 - x^3}{x^3 + 3}$$

$$27) f(x) = \frac{2x^5 - 3x^3 - 4}{5x^4 + 2}$$

$$28) f(x) = \frac{x^5 - 5x^2 - 3}{2x^5 + 2}$$

$$29) f(x) = (-4x^2 - 5)^5$$

$$30) f(x) = (-3x^2 + 4)^4$$

$$31) f(x) = (x^4 + 5)^4$$

$$32) f(x) = (x^5 - 3)^3$$

$$33) f(x) = \frac{5x^3 - 3}{(x - 4)^2}$$

$$34) f(x) = (-4x^4 - 5)^4(3x^3 - 1)$$

$$35) f(x) = \frac{(3x^2 - 1)^2}{-4x - 5}$$

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

$$37) f(x) = ((4x + 3)^3 + 1)^2$$

$$38) f(x) = ((-5x - 2)^5 - 4)^2$$

$$39) f(x) = ((-x^5 - 2)^5 - 4)^4$$

$$40) f(x) = ((-x^2 + 2)^3 + 1)^4$$

Answers to Differentiation Review #1 (Power, Product, Quotient, and Chain Rules)

$$1) f'(x) = 25x^4 + 6x^2$$

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

$$3) f'(x) = 12x^2 + 8x + 4$$

$$4) f'(x) = 12x^2$$

$$5) f'(x) = \frac{5x^4}{2} + \frac{3}{4}$$

$$6) f'(x) = \frac{10x^4}{3} - 4 \quad 7) f'(x) = \frac{1}{2}$$

$$8) f'(x) = -\frac{20x^4}{3} + 12x^3 + 1$$

$$9) f'(x) = -3x^5 \cdot -25x^4 + (-5x^5 - 4) \cdot -15x^4 \\ = 150x^9 + 60x^4$$

$$10) f'(x) = 2x^2 \cdot 4x + (2x^2 - 5) \cdot 4x \\ = 16x^3 - 20x$$

$$11) f'(x) = (2x^4 + 2) \cdot -10x - 5x^2 \cdot 8x^3 \\ = -60x^5 - 20x$$

$$12) f'(x) = (-3x^2 + 4) \cdot -12x^2 - 4x^3 \cdot -6x \\ = 60x^4 - 48x^2$$

$$13) f'(x) = (-4x^4 + 4) \cdot 3x^2 + (x^3 + 4) \cdot -16x^3 \\ = -28x^6 - 64x^3 + 12x^2$$

$$14) f'(x) = (-5x^4 - 5) \cdot -5x^4 + (-x^5 + 3) \cdot -20x^3 \\ = 45x^8 + 25x^4 - 60x^3$$

$$15) f'(x) = (4x^4 - 4) \cdot -20x^4 + (-4x^5 - 1) \cdot 16x^3 \\ = -144x^8 + 80x^4 - 16x^3$$

$$16) f'(x) = (-4x^2 - 3) \cdot 4x^3 + (x^4 + 3) \cdot -8x \\ = -24x^5 - 12x^3 - 24x$$

$$17) f'(x) = (2x^3 + 1)(16x^3 - 6x^2) + (4x^4 - 2x^3 + 3) \cdot 6x^2 \\ = 56x^6 - 24x^5 + 16x^3 + 12x^2$$

$$18) f'(x) = (x^5 - 3x^4 + 4) \cdot -8x^3 + (-2x^4 + 2)(5x^4 - 12x^3) \\ = -18x^8 + 48x^7 + 10x^4 - 56x^3$$

$$19) f'(x) = \frac{(5x^2 + 5) \cdot 16x^3 - 4x^4 \cdot 10x}{(5x^2 + 5)^2} \\ = \frac{8x^5 + 16x^3}{5x^4 + 10x^2 + 5}$$

$$20) f'(x) = -\frac{3 \cdot 8x^3}{(2x^4 - 2)^2} \\ = -\frac{6x^3}{x^8 - 2x^4 + 1}$$

$$21) f'(x) = -\frac{2 \cdot 9x^2}{(3x^3 - 5)^2} \\ = -\frac{18x^2}{9x^6 - 30x^3 + 25}$$

$$22) f'(x) = -\frac{5 \cdot 10x}{(5x^2 + 2)^2} \\ = -\frac{50x}{25x^4 + 20x^2 + 4}$$

$$23) f'(x) = \frac{(2x^2 + 2)(15x^4 + 9x^2) - (3x^5 + 3x^3) \cdot 4x}{(2x^2 + 2)^2} \\ = \frac{9x^2}{2}$$

$$24) f'(x) = \frac{(x^5 - 5) \cdot 15x^4 - (3x^5 + 4) \cdot 5x^4}{(x^5 - 5)^2} \\ = -\frac{95x^4}{x^{10} - 10x^5 + 25}$$

$$25) f'(x) = \frac{(5x^4 - 5)(15x^4 - 6x^2) - (3x^5 - 2x^3) \cdot 20x^3}{(5x^4 - 5)^2} \\ = \frac{3x^8 + 2x^6 - 15x^4 + 6x^2}{5x^8 - 10x^4 + 5}$$

$$26) f'(x) = \frac{(x^3 + 3)(16x^3 - 3x^2) - (4x^4 - x^3) \cdot 3x^2}{(x^3 + 3)^2} \\ = \frac{4x^6 + 48x^3 - 9x^2}{x^6 + 6x^3 + 9}$$

$$27) f'(x) = \frac{(5x^4 + 2)(10x^4 - 9x^2) - (2x^5 - 3x^3 - 4) \cdot 20x^3}{(5x^4 + 2)^2}$$

$$= \frac{10x^8 + 15x^6 + 20x^4 + 80x^3 - 18x^2}{25x^8 + 20x^4 + 4}$$

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

$$= \frac{15x^6 + 20x^4 - 10x}{2x^{10} + 4x^5 + 2}$$

$$29) f'(x) = 5(-4x^2 - 5)^4 \cdot -8x$$

$$= -40x(-4x^2 - 5)^4$$

$$30) f'(x) = 4(-3x^2 + 4)^3 \cdot -6x$$

$$= -24x(-3x^2 + 4)^3$$

$$31) f'(x) = 4(x^4 + 5)^3 \cdot 4x^3$$

$$= 16x^3(x^4 + 5)^3$$

$$32) f'(x) = 3(x^5 - 3)^2 \cdot 5x^4$$

$$= 15x^4(x^5 - 3)^2$$

$$33) f'(x) = \frac{(x-4)^2 \cdot 15x^2 - (5x^3 - 3) \cdot 2(x-4)}{((x-4)^2)^2}$$

$$= \frac{5x^3 - 60x^2 + 6}{(x-4)^3}$$

$$34) f'(x) = (-4x^4 - 5)^4 \cdot 9x^2 + (3x^3 - 1) \cdot 4(-4x^4 - 5)^3 \cdot -16x^3$$

$$= x^2(-4x^4 - 5)^3(-228x^4 - 45 + 64x)$$

$$35) f'(x) = \frac{(-4x - 5) \cdot 2(3x^2 - 1) \cdot 6x - (3x^2 - 1)^2 \cdot -4}{(-4x - 5)^2}$$

$$= \frac{4(3x^2 - 1)(-9x^2 - 15x - 1)}{(-4x - 5)^2}$$

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

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

$$37) f'(x) = 2((4x + 3)^3 + 1) \cdot 3(4x + 3)^2 \cdot 4$$

$$= 24(4x + 3)^2((4x + 3)^3 + 1)$$

$$38) f'(x) = 2((-5x - 2)^5 - 4) \cdot 5(-5x - 2)^4 \cdot -5$$

$$= -50(-5x - 2)^4((-5x - 2)^5 - 4)$$

$$39) f'(x) = 4((-x^5 - 2)^5 - 4)^3 \cdot 5(-x^5 - 2)^4 \cdot -5x^4$$

$$= -100x^4((-x^5 - 2)^5 - 4)^3 \cdot (-x^5 - 2)^4$$

$$40) f'(x) = 4((-x^2 + 2)^3 + 1)^3 \cdot 3(-x^2 + 2)^2 \cdot -2x$$

$$= -24x((-x^2 + 2)^3 + 1)^3 \cdot (-x^2 + 2)^2$$