Calculus Name_____ ID: 1

Product and Quotient Rules

Date_____ Period____

Differentiate each function with respect to *x*.

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

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

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

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

5) $y = (x^4 + 4)(x^5 + 2)$

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

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

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

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

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

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

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

13) $y = \dfrac{5x^5}{3x^5 + 3}$

14) $y = \dfrac{5x^2}{2x^4 + 2}$

15) $y = \dfrac{2x^3}{4x^4 + 5}$

16) $y = \dfrac{4x^3}{x^5 + 3}$

17) $y = \dfrac{x^5 + 5}{x^3 + 5}$

18) $y = \dfrac{x^4 + 4x^2}{2x^4 + 2}$

19) $y = \dfrac{x^5 - 3}{3x^3 + 3}$

20) $y = \dfrac{2x^5 + 5x^3}{x^5 + 4}$

21) $y = \dfrac{5x^4 + 2x^3 + x^2}{2x^5 + 2}$

22) $y = \dfrac{2x^4 + 4x^3 + 5x^2}{5x^3 + 5}$

23) $y = \dfrac{x^3 + 4x^2 + 4}{4x^3 + 3}$

24) $y = \dfrac{x^5 + 5x^3 + 5x^2}{3x^2 + 3}$

Answers to Product and Quotient Rules (ID: 1)

1) $\frac{dy}{dx} = (2x^2 + 1) \cdot -8x - 4x^2 \cdot 4x$
$= -32x^3 - 8x$

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

3) $\frac{dy}{dx} = 3x^3 \cdot 20x^4 + (4x^5 + 2) \cdot 9x^2$
$= 96x^7 + 18x^2$

4) $\frac{dy}{dx} = 2x^3 \cdot 20x^3 + (5x^4 + 5) \cdot 6x^2$
$= 70x^6 + 30x^2$

5) $\frac{dy}{dx} = (x^4 + 4) \cdot 5x^4 + (x^5 + 2) \cdot 4x^3$
$= 9x^8 + 20x^4 + 8x^3$

6) $\frac{dy}{dx} = (-x^3 - 4) \cdot 12x^2 + (4x^3 + 3) \cdot -3x^2$
$= -24x^5 - 57x^2$

7) $\frac{dy}{dx} = (4x^3 + 1) \cdot -9x^2 + (-3x^3 + 3) \cdot 12x^2$
$= -72x^5 + 27x^2$

8) $\frac{dy}{dx} = (5x^4 + 3) \cdot 20x^3 + (5x^4 + 2) \cdot 20x^3$
$= 200x^7 + 100x^3$

9) $\frac{dy}{dx} = (x^5 + 3x^4 + 3) \cdot 3x^2 + (x^3 - 5)(5x^4 + 12x^3)$
$= 8x^7 + 21x^6 - 25x^4 - 60x^3 + 9x^2$

10) $\frac{dy}{dx} = (-4x^5 + 2x^3 + 1) \cdot 8x^3 + (2x^4 + 5)(-20x^4 + 6x^2)$
$= -72x^8 + 28x^6 - 100x^4 + 8x^3 + 30x^2$

11) $\frac{dy}{dx} = (2x^2 + 3)(-25x^4 + 3x^2) + (-5x^5 + x^3 - 5) \cdot 4x$
$= -70x^6 - 65x^4 + 9x^2 - 20x$

12) $\frac{dy}{dx} = (-2x^5 - 4)(16x^3 + 6x) + (4x^4 + 3x^2 + 4) \cdot -10x^4$
$= -72x^8 - 42x^6 - 40x^4 - 64x^3 - 24x$

13) $\frac{dy}{dx} = \frac{(3x^5 + 3) \cdot 25x^4 - 5x^5 \cdot 15x^4}{(3x^5 + 3)^2}$
$= \frac{25x^4}{3x^{10} + 6x^5 + 3}$

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

15) $\frac{dy}{dx} = \frac{(4x^4 + 5) \cdot 6x^2 - 2x^3 \cdot 16x^3}{(4x^4 + 5)^2}$
$= \frac{-8x^6 + 30x^2}{16x^8 + 40x^4 + 25}$

16) $\frac{dy}{dx} = \frac{(x^5 + 3) \cdot 12x^2 - 4x^3 \cdot 5x^4}{(x^5 + 3)^2}$
$= \frac{-8x^7 + 36x^2}{x^{10} + 6x^5 + 9}$

17) $\frac{dy}{dx} = \frac{(x^3 + 5) \cdot 5x^4 - (x^5 + 5) \cdot 3x^2}{(x^3 + 5)^2}$
$= \frac{2x^7 + 25x^4 - 15x^2}{x^6 + 10x^3 + 25}$

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

19) $\frac{dy}{dx} = \frac{(3x^3 + 3) \cdot 5x^4 - (x^5 - 3) \cdot 9x^2}{(3x^3 + 3)^2}$
$= \frac{2x^7 + 5x^4 + 9x^2}{3x^6 + 6x^3 + 3}$

20) $\frac{dy}{dx} = \frac{(x^5 + 4)(10x^4 + 15x^2) - (2x^5 + 5x^3) \cdot 5x^4}{(x^5 + 4)^2}$
$= \frac{-10x^7 + 40x^4 + 60x^2}{x^{10} + 8x^5 + 16}$

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

$= \dfrac{-5x^8 - 4x^7 - 3x^6 + 20x^3 + 6x^2 + 2x}{2x^{10} + 4x^5 + 2}$

22) $\dfrac{dy}{dx} = \dfrac{(5x^3 + 5)(8x^3 + 12x^2 + 10x) - (2x^4 + 4x^3 + 5x^2) \cdot 15x^2}{(5x^3 + 5)^2}$

$= \dfrac{2x^6 - 5x^4 + 8x^3 + 12x^2 + 10x}{5x^6 + 10x^3 + 5}$

23) $\dfrac{dy}{dx} = \dfrac{(4x^3 + 3)(3x^2 + 8x) - (x^3 + 4x^2 + 4) \cdot 12x^2}{(4x^3 + 3)^2}$

$= \dfrac{-16x^4 - 39x^2 + 24x}{16x^6 + 24x^3 + 9}$

24) $\dfrac{dy}{dx} = \dfrac{(3x^2 + 3)(5x^4 + 15x^2 + 10x) - (x^5 + 5x^3 + 5x^2) \cdot 6x}{(3x^2 + 3)^2}$

$= \dfrac{3x^6 + 10x^4 + 15x^2 + 10x}{3x^4 + 6x^2 + 3}$