Calculus Practice: Chain Rule 1a

Differentiate each function with respect to *x*.

1) $f(x) = (3x^4 + 4)^5$

A) $f'(x) = (3x^4 + 4)^4 \cdot 12x^3$

B) $f'(x) = 5(3x^4 + 4)^4$

C) $f'(x) = 5(3x^4 + 4)^4 \cdot 12x^3$
$= 60x^3(3x^4 + 4)^4$

D) $f'(x) = 12x^3$

2) $f(x) = (5x^4 + 1)^5$

A) $f'(x) = 20x^3$

B) $f'(x) = 5(5x^4 + 1)^4 \cdot 20x^3$
$= 100x^3(5x^4 + 1)^4$

C) $f'(x) = 5(5x^4 + 1)^4$

D) $f'(x) = (5x^4 + 1)^4 \cdot 20x^3$

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

A) $f'(x) = 3(2x^4 + 3)^2 \cdot 8x^3 + 3(2x^4 + 3)^2 \cdot 8x^3$
$= 48x^3(2x^4 + 3)^2$

B) $f'(x) = (2x^4 + 3)^3 + (x + 5) \cdot 3(2x^4 + 3)^2 \cdot 8x^3$
$= (2x^4 + 3)^2(26x^4 + 3 + 120x^3)$

C) $f'(x) = 3(2x^4 + 3)^2 \cdot 8x^3 + 1$
$= 24x^3(2x^4 + 3)^2 + 1$

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

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

A) $f'(x) = 2(4x^4 + 3) \cdot 16x^3 + 2(4x^4 + 3) \cdot 16x^3$
$= 64x^3(4x^4 + 3)$

B) $f'(x) = (4x^4 + 3)^2 + (x + 1) \cdot 2(4x^4 + 3) \cdot 16x^3$
$= (4x^4 + 3)(36x^4 + 3 + 32x^3)$

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

D) $f'(x) = 2(4x^4 + 3) \cdot 16x^3 + 1$
$= 128x^7 + 96x^3 + 1$

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

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

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

C) $\frac{dy}{dx} = 5((x^4 - 2)^2 - 2)^4 \cdot 2(x^4 - 2) \cdot 4x^3$
$= 40x^3((x^4 - 2)^2 - 2)^4(x^4 - 2)$

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

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

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

B) $\frac{dy}{dx} = ((2x^2 + 3)^4 - 5) \cdot 4(2x^2 + 3)^3 \cdot 4x$
$= 16x(2x^2 + 3)^3((2x^2 + 3)^4 - 5)$

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

D) $\frac{dy}{dx} = 4(2x^2 + 3)^3 \cdot 4x$
$= 16x(2x^2 + 3)^3$

7) $f(x) = \dfrac{3x^5 + 2}{(-x^3 + 2)^2}$

A) $f'(x) = \dfrac{(-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2}{(3x^5 + 2)^2}$
$= \dfrac{3x^2(-x^3 + 2)(x^5 + 10x^2 + 4)}{(3x^5 + 2)^2}$

B) $f'(x) = \dfrac{(-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2}{((-x^3 + 2)^2)^2}$
$= \dfrac{3x^2(x^5 + 10x^2 + 4)}{(-x^3 + 2)^3}$

C) $f'(x) = \dfrac{(-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2}{(-x^3 + 2)^2}$
$= \dfrac{3x^2(x^5 + 10x^2 + 4)}{-x^3 + 2}$

D) $f'(x) = (-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2$
$= 3x^2(-x^3 + 2)(x^5 + 10x^2 + 4)$

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

A) $f'(x) = \dfrac{(-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3}{-x^4 + 3}$
$= \dfrac{x^3(x^5 + 4)^2(-11x^5 + 45x + 16)}{-x^4 + 3}$

B) $f'(x) = (-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3$
$= x^3(x^5 + 4)^2(-11x^5 + 45x + 16)$

C) $f'(x) = \dfrac{(-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3}{((x^5 + 4)^3)^2}$
$= \dfrac{x^3(-11x^5 + 45x + 16)}{(x^5 + 4)^4}$

D) $f'(x) = \dfrac{(-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3}{(-x^4 + 3)^2}$
$= \dfrac{x^3(x^5 + 4)^2(-11x^5 + 45x + 16)}{(-x^4 + 3)^2}$

Calculus Practice: Chain Rule 1a

Differentiate each function with respect to *x*.

1) $f(x) = (3x^4 + 4)^5$

A) $f'(x) = (3x^4 + 4)^4 \cdot 12x^3$

B) $f'(x) = 5(3x^4 + 4)^4$

*C) $f'(x) = 5(3x^4 + 4)^4 \cdot 12x^3$
$= 60x^3(3x^4 + 4)^4$

D) $f'(x) = 12x^3$

2) $f(x) = (5x^4 + 1)^5$

A) $f'(x) = 20x^3$

*B) $f'(x) = 5(5x^4 + 1)^4 \cdot 20x^3$
$= 100x^3(5x^4 + 1)^4$

C) $f'(x) = 5(5x^4 + 1)^4$

D) $f'(x) = (5x^4 + 1)^4 \cdot 20x^3$

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

A) $f'(x) = 3(2x^4 + 3)^2 \cdot 8x^3 + 3(2x^4 + 3)^2 \cdot 8x^3$
$= 48x^3(2x^4 + 3)^2$

*B) $f'(x) = (2x^4 + 3)^3 + (x + 5) \cdot 3(2x^4 + 3)^2 \cdot 8x^3$
$= (2x^4 + 3)^2(26x^4 + 3 + 120x^3)$

C) $f'(x) = 3(2x^4 + 3)^2 \cdot 8x^3 + 1$
$= 24x^3(2x^4 + 3)^2 + 1$

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

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

A) $f'(x) = 2(4x^4 + 3) \cdot 16x^3 + 2(4x^4 + 3) \cdot 16x^3$
$= 64x^3(4x^4 + 3)$

*B) $f'(x) = (4x^4 + 3)^2 + (x + 1) \cdot 2(4x^4 + 3) \cdot 16x^3$
$= (4x^4 + 3)(36x^4 + 3 + 32x^3)$

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

D) $f'(x) = 2(4x^4 + 3) \cdot 16x^3 + 1$
$= 128x^7 + 96x^3 + 1$

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

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

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

*C) $\frac{dy}{dx} = 5((x^4 - 2)^2 - 2)^4 \cdot 2(x^4 - 2) \cdot 4x^3$
$= 40x^3((x^4 - 2)^2 - 2)^4(x^4 - 2)$

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

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

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

B) $\frac{dy}{dx} = ((2x^2 + 3)^4 - 5) \cdot 4(2x^2 + 3)^3 \cdot 4x$
$= 16x(2x^2 + 3)^3((2x^2 + 3)^4 - 5)$

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

D) $\frac{dy}{dx} = 4(2x^2 + 3)^3 \cdot 4x$
$= 16x(2x^2 + 3)^3$

7) $f(x) = \dfrac{3x^5 + 2}{(-x^3 + 2)^2}$

A) $f'(x) = \dfrac{(-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2}{(3x^5 + 2)^2}$
$= \dfrac{3x^2(-x^3 + 2)(x^5 + 10x^2 + 4)}{(3x^5 + 2)^2}$

*B) $f'(x) = \dfrac{(-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2}{((-x^3 + 2)^2)^2}$
$= \dfrac{3x^2(x^5 + 10x^2 + 4)}{(-x^3 + 2)^3}$

C) $f'(x) = \dfrac{(-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2}{(-x^3 + 2)^2}$
$= \dfrac{3x^2(x^5 + 10x^2 + 4)}{-x^3 + 2}$

D) $f'(x) = (-x^3 + 2)^2 \cdot 15x^4 - (3x^5 + 2) \cdot 2(-x^3 + 2) \cdot -3x^2$
$= 3x^2(-x^3 + 2)(x^5 + 10x^2 + 4)$

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

A) $f'(x) = \dfrac{(-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3}{-x^4 + 3}$
$= \dfrac{x^3(x^5 + 4)^2(-11x^5 + 45x + 16)}{-x^4 + 3}$

B) $f'(x) = (-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3$
$= x^3(x^5 + 4)^2(-11x^5 + 45x + 16)$

C) $f'(x) = \dfrac{(-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3}{((x^5 + 4)^3)^2}$
$= \dfrac{x^3(-11x^5 + 45x + 16)}{(x^5 + 4)^4}$

*D) $f'(x) = \dfrac{(-x^4 + 3) \cdot 3(x^5 + 4)^2 \cdot 5x^4 - (x^5 + 4)^3 \cdot -4x^3}{(-x^4 + 3)^2}$
$= \dfrac{x^3(x^5 + 4)^2(-11x^5 + 45x + 16)}{(-x^4 + 3)^2}$