Name_____

Calculus Practice: Differentiating Products and Quotients of Functions 2a

Differentiate each function with respect to x.

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

A) $f'(x) = \left(3x^{\frac{5}{4}} + 4\right) \cdot 4x^3 + x^4 \cdot \frac{15}{4}x^{\frac{1}{4}}$

$= \frac{63x^{\frac{17}{4}}}{4} + 16x^3$

B) $f'(x) = \left(3x^{\frac{5}{4}} + 4\right)x^4 + \frac{15}{4}x^{\frac{1}{4}} \cdot 4x^3$

$= 3x^{\frac{21}{4}} + 4x^4 + 15x^{\frac{13}{4}}$

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

D) $f'(x) = 3x^{\frac{5}{4}} + 4 + \frac{15}{4}x^{\frac{1}{4}}$

$= 3x^{\frac{5}{4}} + \frac{15x^{\frac{1}{4}}}{4} + 4$

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

A) $f'(x) = \left(-4x^{\frac{2}{3}} + 3\right) \cdot 3x^5 - \frac{8}{3}x^{-\frac{1}{3}} \cdot 15x^4$

$= -12x^{\frac{17}{3}} + 9x^5 - 40x^{\frac{11}{3}}$

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

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

C) $f'(x) = \left(-4x^{\frac{2}{3}} + 3\right) \cdot 15x^4 + 3x^5 \cdot -\frac{8}{3}x^{-\frac{1}{3}}$

$= -68x^{\frac{14}{3}} + 45x^4$

D) $f'(x) = 3x^5 \cdot -\frac{8}{3}x^{-\frac{1}{3}}$

$= -8x^{\frac{14}{3}}$

3) $f(x) = \left(2 - \frac{2}{x^3}\right) \cdot 3x^5$

A) $f'(x) = 2 - 2x^{-3} + 6x^{-4}$

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

B) $f'(x) = \left(2 - 2x^{-3}\right) \cdot 15x^4 + 3x^5 \cdot 6x^{-4}$

$= 30x^4 - 12x$

C) $f'(x) = \left(2 - 2x^{-3}\right) \cdot 3x^5 + 6x^{-4} \cdot 15x^4$

$= 6x^5 - 6x^2 + 90$

D) $f'(x) = 3x^5 + 15x^4$

4) $f(x) = \left(4\sqrt[4]{x} - 2\right) \cdot 5x^5$

A) $f'(x) = 5x^5 x^{-\frac{3}{4}}$

$= 5x^{\frac{17}{4}}$

B) $f'(x) = \left(4x^{\frac{1}{4}} - 2\right) \cdot 5x^5 + x^{-\frac{3}{4}} \cdot 25x^4$

$= 20x^{\frac{21}{4}} - 10x^5 + 25x^{\frac{13}{4}}$

C) $f'(x) = \left(4x^{\frac{1}{4}} - 2\right) \cdot 25x^4 + 5x^5 x^{-\frac{3}{4}}$

$= 105x^{\frac{17}{4}} - 50x^4$

D) $f'(x) = 5x^5 + 25x^4$

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

   A) $f'(x) = \left(4x^4 - 3\right) \cdot \dfrac{8}{5}x^{-\frac{1}{5}}$

      $= \dfrac{32x^4 - 24}{5x^{\frac{1}{5}}}$

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

      $= 4x^4 + 16x^3 - 3$

   C) $f'(x) = \left(2x^{\frac{4}{5}} + 4\right) \cdot 16x^3 + \left(4x^4 - 3\right) \cdot \dfrac{8}{5}x^{-\frac{1}{5}}$

      $= \dfrac{192x^{\frac{19}{5}}}{5} + 64x^3 - \dfrac{24}{5x^{\frac{1}{5}}}$

   D) $f'(x) = \left(2x^{\frac{4}{5}} + 4\right)\left(4x^4 - 3\right) + \dfrac{8}{5}x^{-\frac{1}{5}} \cdot 16x^3$

      $= 8x^{\frac{24}{5}} + 16x^4 + \dfrac{128x^{\frac{14}{5}}}{5} - 6x^{\frac{4}{5}} - 12$

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

   A) $f'(x) = \left(x^{\frac{1}{4}} + 5\right) \cdot -8x + \left(-4x^2 + 4\right) \cdot \dfrac{1}{4}x^{-\frac{3}{4}}$

      $= -9x^{\frac{5}{4}} - 40x + \dfrac{1}{x^{\frac{3}{4}}}$

   B) $f'(x) = \left(x^{\frac{1}{4}} + 5\right)\left(-4x^2 + 4\right) + \dfrac{1}{4}x^{-\frac{3}{4}} \cdot -8x$

      $= -4x^{\frac{9}{4}} - 20x^2 + 2x^{\frac{1}{4}} + 20$

   C) $f'(x) = \left(-4x^2 + 4\right) \cdot \dfrac{1}{4}x^{-\frac{3}{4}}$

      $= -x^{\frac{5}{4}} + \dfrac{1}{x^{\frac{3}{4}}}$

   D) $f'(x) = \left(x^{\frac{1}{4}} + 5\right) \cdot -8x$

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7) $y = \dfrac{5}{x^3}\left(4x^4 - 4\right)$

   A) $\dfrac{dy}{dx} = 5x^{-3} \cdot 16x^3$

      $= 80$

   B) $\dfrac{dy}{dx} = 4x^4 - 4 + 16x^3$

      $= 4x^4 + 16x^3 - 4$

   C) $\dfrac{dy}{dx} = 5x^{-3}\left(4x^4 - 4\right) - 15x^{-4} \cdot 16x^3$

      $= 20x - \dfrac{240}{x} - \dfrac{20}{x^3}$

   D) $\dfrac{dy}{dx} = 5x^{-3} \cdot 16x^3 + \left(4x^4 - 4\right) \cdot -15x^{-4}$

      $= 20 + \dfrac{60}{x^4}$

8) $y = \dfrac{2}{x^4}\left(4x^4 + 5\right)$

   A) $\dfrac{dy}{dx} = \left(4x^4 + 5\right) \cdot -8x^{-5}$

      $= -\dfrac{32}{x} - \dfrac{40}{x^5}$

   B) $\dfrac{dy}{dx} = 2x^{-4} \cdot 16x^3$

      $= \dfrac{32}{x}$

   C) $\dfrac{dy}{dx} = 2x^{-4}\left(4x^4 + 5\right) - 8x^{-5} \cdot 16x^3$

      $= 8 - \dfrac{128}{x^2} + \dfrac{10}{x^4}$

   D) $\dfrac{dy}{dx} = 2x^{-4} \cdot 16x^3 + \left(4x^4 + 5\right) \cdot -8x^{-5}$

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  B) $f'(x) = \left(3x^{\frac{5}{4}} + 4\right)x^4 + \frac{15}{4}x^{\frac{1}{4}} \cdot 4x^3$

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