Name_____

Calculus Practice 2.1C4: Chain Rule 6a

Differentiate each function with respect to x.

1) $y = 5^{2x^2}$

   A) $\dfrac{dy}{dx} = 5^{2x^2} \ln 5 \cdot 4x$

   B) $\dfrac{dy}{dx} = 4x$

   C) $\dfrac{dy}{dx} = 5^{2x^2} \ln 5$

   D) $\dfrac{dy}{dx} = 5^{(2x^2 - 1)\ln 5} \cdot 4x$

2) $y = 2^{x^3}$

   A) $\dfrac{dy}{dx} = 2^{(x^3 - 1)\ln 2} \cdot 3x^2$

   B) $\dfrac{dy}{dx} = 2^{x^3} \ln 2 \cdot 3x^2$

   C) $\dfrac{dy}{dx} = 2^{x^3} \ln 2$

   D) $\dfrac{dy}{dx} = 3x^2$

3) $y = \log_5 \log_5 x^4$

   A) $\dfrac{dy}{dx} = \log_5 x^4$

   B) $\dfrac{dy}{dx} = \dfrac{\ln 5}{\log_5 x^4}$

   C) $\dfrac{dy}{dx} = \dfrac{\ln 5}{\dfrac{1}{x^4 \ln 5} \cdot 4x^3}$

      $= \dfrac{x \cdot (\ln 5)^2}{4}$

   D) $\dfrac{dy}{dx} = \dfrac{1}{\log_5 x^4 \cdot \ln 5} \cdot \dfrac{1}{x^4 \ln 5} \cdot 4x^3$

      $= \dfrac{4}{x \log_5 x^4 \cdot (\ln 5)^2}$

4) $f(x) = \log_2 \log_4 4x^5$

   A) $f'(x) = \dfrac{\ln 2}{\dfrac{1}{4x^5 \ln 4} \cdot 20x^4}$

      $= \dfrac{x \ln 4 \cdot \ln 2}{5}$

   B) $f'(x) = \dfrac{1}{\log_4 4x^5 \cdot \ln 2} \cdot \dfrac{1}{4x^5 \ln 4} \cdot 20x^4$

      $= \dfrac{5}{x \log_4 4x^5 \cdot \ln 2 \cdot \ln 4}$

   C) $f'(x) = \log_4 4x^5$

   D) $f'(x) = \dfrac{\ln 2}{\log_4 4x^5}$

5) $f(x) = \log_4 4x^3 \cdot (x^4 + 3)$

   A) $f'(x) = \dfrac{1}{4x^3 \ln 4} \cdot 12x^2 + 4x^3$

         $= \dfrac{4x^4 \ln 4 + 3}{x \ln 4}$

   B) $f'(x) = \log_4 4x^3 \cdot 4x^3$

   C) $f'(x) = \log_4 4x^3 \cdot 4x^3 + (x^4 + 3) \cdot \dfrac{1}{4x^3 \ln 4} \cdot 12x^2$

         $= \dfrac{4x^4 \log_4 4x^3 \cdot \ln 4 + 3x^4 + 9}{x \ln 4}$

   D) $f'(x) = \dfrac{1}{4x^3 \ln 4} \cdot 12x^2 \cdot 4x^3 + \dfrac{1}{4x^3 \ln 4} \cdot 12x^2 \cdot 4x^3$

         $= \dfrac{24x^2}{\ln 4}$

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

   A) $f'(x) = \dfrac{(x^5 - 3) \cdot 5^{2x^4} \ln 5 \cdot 8x^3 - 5^{2x^4} \cdot 5x^4}{(x^5 - 3)^2}$

         $= \dfrac{x^3 \cdot 5^{2x^4}(8x^5 \ln 5 - 24 \ln 5 - x \cdot 5)}{(x^5 - 3)^2}$

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

         $= \dfrac{x^3(8x^5 \ln 5 - 24 \ln 5 - x \cdot 5)}{5^{2x^4}}$

   C) $f'(x) = (x^5 - 3) \cdot 5^{2x^4} \ln 5 \cdot 8x^3 - 5^{2x^4} \cdot 5x^4$

         $= x^3 \cdot 5^{2x^4}(8x^5 \ln 5 - 24 \ln 5 - 5x)$

   D) $f'(x) = \dfrac{(x^5 - 3) \cdot 5^{2x^4} \ln 5 \cdot 8x^3 - 5^{2x^4} \cdot 5x^4}{x^5 - 3}$

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$\quad = \dfrac{4x^4 \log_4 4x^3 \cdot \ln 4 + 3x^4 + 9}{x \ln 4}$

D) $f'(x) = \dfrac{1}{4x^3 \ln 4} \cdot 12x^2 \cdot 4x^3 + \dfrac{1}{4x^3 \ln 4} \cdot 12x^2 \cdot 4x^3$

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

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C) $f'(x) = (x^5 - 3) \cdot 5^{2x^4} \ln 5 \cdot 8x^3 - 5^{2x^4} \cdot 5x^4$

$\quad = x^3 \cdot 5^{2x^4}(8x^5 \ln 5 - 24 \ln 5 - 5x)$

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