

Practice Exercises May 19 to May 22, 2020

Differentiate each function with respect to the given variable.

1) $g = \ln 4t^5$

2) $h(r) = e^{3r^3}$

3) $t = e^{4r^3}$

4) $h(r) = e^{2r^2}$

5) $g(w) = \ln 4w^4$

6) $f(x) = e^{2x^3}$

Differentiate each function with respect to x . For 7 to 10, use the rules for $\ln u$ and e^u . In 11-15, rewrite the expressions using the laws of logarithms and then differentiate the sum or difference of logarithms. Please NOTE, this is NOT LOGARITHMIC DIFFERENTIATION. For numbers 16 to 25 use rules for $\log u$ and a^u .

$$7) y = \ln(e^{5x^5} + 5)$$

$$8) y = e^{e^{x^2}}$$

$$9) y = e^{e^{3x^2}}$$

$$10) y = \ln(4 + e^{3x^5})$$

$$11) y = \ln \sqrt[3]{\frac{3x^5}{3x^3 + 2}}$$

$$12) y = \ln \left(\frac{x^2}{2x^5 + 3} \right)^5$$

$$13) y = \ln \left(\frac{4x^4}{x^3 - 2} \right)^2$$

$$14) y = \ln \sqrt{\frac{4x^5}{x^4 + 1}}$$

$$15) y = \ln \left(\frac{5x^4}{4x^2 + 3} \right)^2$$

$$16) f(x) = 4^{3x^3}$$

$$17) f(x) = \log_4 2x^3$$

$$18) f(x) = 3^{x^4}$$

$$19) y = \log_2 5x^2$$

$$20) y = \log_2 x^2$$

$$21) f(x) = \log_5 2x^2$$

$$22) y = 3^{3^{x^3}}$$

$$23) y = \log_5 (4^{5x^2} + 5)$$

$$24) y = \log_4 \log_5 4x^2$$

$$25) y = 4^{3 + \log_2 3x^4}$$

Use logarithmic differentiation to differentiate each function with respect to x .

$$26) y = 5x^{x^5}$$

$$27) y = 5x^{3x}$$

$$28) y = (2x^4 - 3)^4$$

$$29) y = \sqrt[3]{5x^2 + 3}(2x - 1)^3$$

$$30) y = \frac{\sqrt{5x^3 - 1}}{(5x^5 + 2)^4}$$

Use logarithmic differentiation to differentiate each function with respect to x . You do not need to simplify or substitute for y .

$$31) y = \frac{(x + 5)^2}{(3x^3 + 4)^4 \cdot (x^5 + 4)^5 \cdot (5x^3 + 1)^3}$$

For each problem, find the derivative of the function at the given value. Then use it to find the equation of the tangent and normal lines for 32 to 33.

32) $y = -e^{x-1}$ at $x = 0$

33) $y = \ln(-x + 1)$ at $x = 0$

34) $y = -\ln(x + 2)$ at $x = -1$

35) $y = -e^{x-2}$ at $x = 0$

Answers to Practice Exercises May 19 to May 22, 2020 (ID: 1)

$$1) \frac{dg}{dt} = \frac{1}{4t^5} \cdot 20t^4 \quad 2) h'(r) = e^{3r^3} \cdot 9r^2 \quad 3) \frac{dt}{dr} = e^{4r^3} \cdot 12r^2 \quad 4) h'(r) = e^{2r^2} \cdot 4r$$

$$= \frac{5}{t}$$

$$5) g'(w) = \frac{1}{4w^4} \cdot 16w^3 \quad 6) f'(x) = e^{2x^3} \cdot 6x^2 \quad 7) \frac{dy}{dx} = \frac{1}{e^{5x^5} + 5} \cdot e^{5x^5} \cdot 25x^4$$

$$= \frac{4}{w} \quad = \frac{25x^4 e^{5x^5}}{e^{5x^5} + 5}$$

$$8) \frac{dy}{dx} = e^{e^{x^2}} \cdot e^{x^2} \cdot 2x \quad 9) \frac{dy}{dx} = e^{e^{3x^2}} \cdot e^{3x^2} \cdot 6x \quad 10) \frac{dy}{dx} = \frac{1}{4 + e^{3x^5}} \cdot e^{3x^5} \cdot 15x^4$$

$$= 2xe^{e^{x^2} + x^2} \quad = 6xe^{e^{3x^2} + 3x^2} \quad = \frac{15x^4 e^{3x^5}}{4 + e^{3x^5}}$$

$$11) \frac{dy}{dx} = \frac{1}{3} \left(\frac{1}{3x^5} \cdot 15x^4 - \frac{1}{3x^3 + 2} \cdot 9x^2 \right)$$

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

$$12) \frac{dy}{dx} = 5 \left(\frac{1}{x^2} \cdot 2x - \frac{1}{2x^5 + 3} \cdot 10x^4 \right)$$

$$= \frac{30(-x^5 + 1)}{x(2x^5 + 3)}$$

$$13) \frac{dy}{dx} = 2 \left(\frac{1}{4x^4} \cdot 16x^3 - \frac{1}{x^3 - 2} \cdot 3x^2 \right)$$

$$= \frac{2(x^3 - 8)}{x(x^3 - 2)}$$

$$14) \frac{dy}{dx} = \frac{1}{2} \left(\frac{1}{4x^5} \cdot 20x^4 - \frac{1}{x^4 + 1} \cdot 4x^3 \right)$$

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

$$15) \frac{dy}{dx} = 2 \left(\frac{1}{5x^4} \cdot 20x^3 - \frac{1}{4x^2 + 3} \cdot 8x \right)$$

$$= \frac{8(2x^2 + 3)}{x(4x^2 + 3)}$$

$$16) f'(x) = 4^{3x^3} \ln 4 \cdot 9x^2$$

$$17) f'(x) = \frac{1}{2x^3 \ln 4} \cdot 6x^2 \quad 18) f'(x) = 3^{x^4} \ln 3 \cdot 4x^3 \quad 19) \frac{dy}{dx} = \frac{1}{5x^2 \ln 2} \cdot 10x$$

$$= \frac{3}{x \ln 4} \quad = \frac{2}{x \ln 2}$$

$$20) \frac{dy}{dx} = \frac{1}{x^2 \ln 2} \cdot 2x \quad 21) f'(x) = \frac{1}{2x^2 \ln 5} \cdot 4x \quad 22) \frac{dy}{dx} = 3^{3^{x^5}} \ln 3 \cdot 3^{x^5} \ln 3 \cdot 5x^4$$

$$= \frac{2}{x \ln 2} \quad = \frac{2}{x \ln 5} \quad = 5x^4 \cdot 3^{3^{x^5} + x^5} \cdot (\ln 3)^2$$

$$23) \frac{dy}{dx} = \frac{1}{(4^{5x^2} + 5) \ln 5} \cdot 4^{5x^2} \ln 4 \cdot 10x$$

$$= \frac{10x \cdot 4^{5x^2} \ln 4}{(4^{5x^2} + 5) \ln 5}$$

$$24) \frac{dy}{dx} = \frac{1}{\log_5 4x^2 \cdot \ln 4} \cdot \frac{1}{4x^2 \ln 5} \cdot 8x$$

$$= \frac{2}{x \log_5 4x^2 \cdot \ln 4 \cdot \ln 5}$$

$$25) \frac{dy}{dx} = 4^{3 + \log_2 3x^4} \ln 4 \cdot \frac{1}{3x^4 \ln 2} \cdot 12x^3$$

$$= \frac{4^{4 + \log_2 3x^4} \ln 4}{x \ln 2}$$

$$26) \frac{dy}{dx} = y(5x^4 \ln x + x^4)$$

$$27) \frac{dy}{dx} = y(3 \ln x + 3) \quad 28) \frac{dy}{dx} = y \cdot \frac{32x^3}{2x^4 - 3} \quad 29) \frac{dy}{dx} = y \left(\frac{10x}{15x^2 + 9} + \frac{6}{2x - 1} \right)$$

$$30) \frac{dy}{dx} = y \left(\frac{15x^2}{10x^3 - 2} - \frac{100x^4}{5x^5 + 2} \right)$$

$$32) \left. \frac{dy}{dx} \right|_{x=0} = -\frac{1}{e} \qquad 33) \left. \frac{dy}{dx} \right|_{x=0} = -1$$

$$31) \frac{dy}{dx} = y \left(\frac{2}{x+5} - \frac{36x^2}{3x^3+4} - \frac{25x^4}{x^5+4} - \frac{45x^2}{5x^3+1} \right)$$

$$34) \left. \frac{dy}{dx} \right|_{x=-1} = -1 \qquad 35) \left. \frac{dy}{dx} \right|_{x=0} = -\frac{1}{e^2}$$