

Derivatives of Exponential and Logarithm Functions

For problems 1 – 6 differentiate the given function.

1. $f(x) = 2e^x - 8^x$ $f'(x) = 2e^x - 8^x \ln 8$ Just use formula.

2. $g(t) = 4 \log_3(t) - \ln(t)$ $g'(t) = 4 \left(\frac{1}{t \ln 3} \right) - \frac{1}{t} = \frac{4}{t \ln 3} - \frac{1}{t}$ Just use formula.

3. $R(w) = (3^w)(\log(w))$ $R'(w) = 3^w \left(\frac{1}{w \ln 10} \right) + (\log w)(3^w)(\ln 3)$ Formulas and Product Rule

4. $y = z^5 - e^z \ln(z)$ $y' = 5z^4 - \left[(e^z) \left(\frac{1}{z} \right) + (\ln z)(e^z) \right] = 5z^4 - \frac{e^z}{z} - e^z \ln z$ Formulas and Product Rule

5. $h(y) = \frac{y}{1-e^y}$ $h'(y) = \frac{(1-e^y) - y(-e^y)}{(1-e^y)^2} = \frac{1-e^y + ye^y}{(1-e^y)^2}$ Formulas and Quotient Rule

6. $f(t) = \frac{1+5t}{\ln(t)}$ $f'(t) = \frac{(\ln t)(5) - (1+5t) \left(\frac{1}{t} \right)}{(\ln t)^2} = \frac{5 \ln t - \frac{1}{t} + 5}{(\ln t)^2}$ Formulas and Quotient Rule

7. Find the tangent line to $f(x) = 7^x + 4e^x$ at $x=0$.
 Point: $x=0; y = 7^0 + 4e^0 = 5$ slope: $f'(x) = 7^x \ln 7 + 4e^x$ and $f'(0) = \ln 7 + 4$

$y - 5 = (\ln 7 + 4)x$

8. Find the tangent line to $f(x) = \ln(x) \log_2(x)$ at $x=2$.
 Point: $f(2) = \ln 2 \log_2 2 = \ln 2$ slope: $f'(x) = \ln x \left(\frac{1}{x \ln 2} \right) + (\log_2 x) \left(\frac{1}{x} \right)$
 $f'(2) = \frac{1}{2} + \frac{1}{2} = 1$

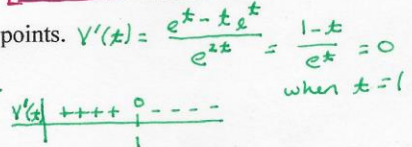
$y - \ln 2 = x - 2$

9. Determine if $V(t) = \frac{t}{e^t}$ is increasing or decreasing at the following points. $V'(t) = \frac{e^t - t e^t}{e^{2t}} = \frac{1-t}{e^t} = 0$ when $t=1$

(a) $t = -4$ Inc

(b) $t = 0$ Inc

(c) $t = 10$ Dec



10. Determine if $G(z) = (z-6) \ln(z)$ is increasing or decreasing at the following points.

(a) $z = 1$

(b) $z = e$

(c) $z = e^5$

$G'(z) = (z-6) \left(\frac{1}{z} \right) + \ln z$

a) $G'(1) = -5 + \ln 1 = -5 < 0$, so dec

b) $G'(e) = \frac{e-6}{e} + \ln e = 1 - \frac{6}{e} + 1 < 0$, so dec

c) $G'(e^5) = \frac{e^5-6}{e^5} + \ln e^5 = 1 - \frac{6}{e^5} + 5 > 0$, so inc

Derivatives of Inverse Trig Functions

For each of the following problems differentiate the given function.

1. $T(z) = 2 \cos(z) + 6 \cos^{-1}(z)$