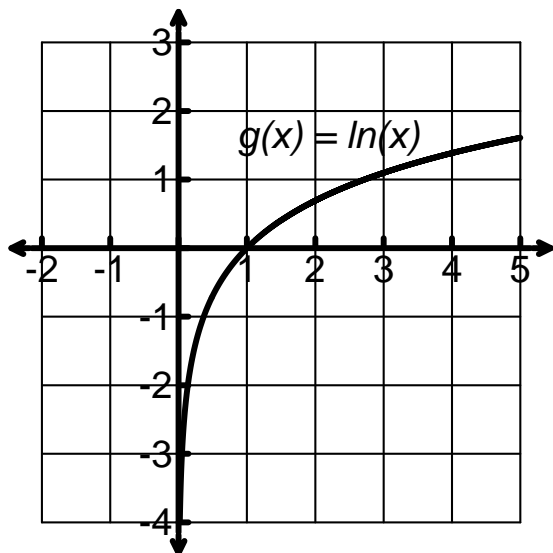


## Natural Logarithmic Function

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1. The inverse of  $g(x) = \ln(x)$  is  $g^{-1}(x) = e^x$

2. Continuous, and increasing everywhere (*monotonic*)

3.  $\lim_{x \rightarrow (-\infty)} (g(x)) = \text{DNE}$

and  $\lim_{x \rightarrow \infty} (g(x)) = \infty$

4. Must know.....  $\ln 1 = 0$  and  $e^{(\ln x)} = x$

$$\frac{d}{dx}(\ln(x)) = \frac{1}{x}$$

$$\frac{d}{dx}(\ln(u)) = \frac{du}{u}, \text{ for } u > 0$$

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1. Find  $v'(t)$  for  $v(t) = \ln(t^2 + 3)$ .

2. If  $y = 4x \ln(5x^4)$ , find  $y'$ .

3. Differentiate  $h(x) = \frac{\ln(\tan(x))}{3\pi}$ .

\*\*4. Find the slope of the line normal to the graph of  $y = 2 \ln(\sec x)$  at  $x = \frac{\pi}{4}$ .

\*\*5. Write an equation for the line tangent to the graph of  $f(x) = -2 + \ln(x^2)$  at  $x = 1$ .

\*\*6. If  $f(x) = \ln(x + 4 + e^{-3x})$ , then  $f'(0)$  is \_\_\_\_\_.

## Notes for Review of "e" and "ln"

1. Find  $y'$  if  $y = \ln(x^5 - 4x)$ .

2. Find the  $x$ -value(s), if any, where the tangent line is horizontal for

$$g(x) = \frac{-x}{4} + e^{2x}.$$

3. Find the velocity if a position function is given by

$$s(t) = \frac{7}{\sqrt{t}} + \ln(3t - 5).$$

4. If  $y = \frac{\ln x}{x}$ , find  $y'$ .

5. Differentiate  $f(x) = e^{-x} \ln(3x^2)$ .

(calc.) 6. Let  $f$  be the function given by  $f(x) = \ln\left(\frac{3x^2}{x-5}\right)$ . For what

value of  $x$  is the slope of the line tangent to  $f$  equal to  $-0.4$ ?

7. Find the instantaneous rate of change at  $x = \ln 3$  for

$$H(x) = \frac{x^2}{4} - e^{2x}.$$

8. Prove that  $f(x) := \begin{cases} x^2 + 1 & x \leq 1 \\ 2x & x > 1 \end{cases}$  is/is not differentiable at  $x = 1$ .

9. Find  $y'$  if  $y = \ln(\ln x)$

10. Find the slope of the normal line for  $f(x) = e^{x^2}$  at  $x = 1$ .

11. Simplify  $\lim_{x \rightarrow 6} \frac{2x - 12}{x^2 - 9x + 18}$ .

12.  $\frac{d}{dx} [\text{Arctan } 3x^2]$

13. Simplify  $\lim_{h \rightarrow 0} \frac{3 \ln(5(x+h)^2) - 3 \ln(5x^2)}{h}$