5.1 Notes and Examples

Name: Block: Seat:

Natural Logarithm Derivatives

Natural Logarithm Derivatives: Definitions and Properties

1. (a) Domain:

   (b) Range:

   (c) The Natural logarithmic function is defined by $\ln x = \int$

   (d) The function is always

      1.
      2.
      3.

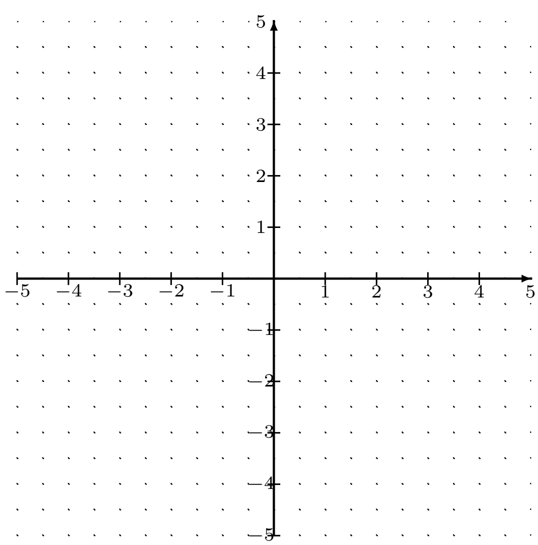
   (e) Properties of Natural logs

      1. $\ln(1) =$
      2. $\ln(e^x) =$
      3. $\ln(ab) =$
      4. $\ln(a^n) =$
      5. $\ln\left(\frac{a}{b}\right) =$

   (f) _______ is the base of the Natural Log because $\ln e =$

   (g) The letter _______ denotes the positive real number such that $\ln e = \int$

2. Sketch $f(x) = \ln x$



   (a) $\lim_{x \to 0^+} \ln x =$

   (b) $\lim_{x \to 0^-} \ln x =$

   (c) $\lim_{x \to 0} \ln x =$

(d) $\lim_{x\to\infty} \ln x =$

3. Expand the following
   (a) $\ln 3e^2$

   (b) $\ln \frac{10}{9}$

   (c) $\ln \sqrt{3x+2}$

   (d) $\ln \frac{6x}{5}$

   (e) $\ln \frac{(x^2+3)^2}{x\sqrt[3]{x^2+1}}$

4. Condense $2\left[\ln x - \ln(x+1) - \ln(x-1)\right]$

5. Derivative of the Natural Logarithmic Function
   (a) For $x > 0$, $\frac{d}{dx}[\ln x] =$

   (b) If u is a function of x, then for $u > 0$, $\frac{d}{dx}[\ln u] =$

   (c) If u is a function of x, then for $u > 0$, $\frac{d}{dx}[\ln |u|] =$

6. Differentiate
   (a) $\ln(x^2 - 5)$

   (b) $\ln \frac{x^2}{\sqrt{2x^3}}$
   Always simplify/expand before differentiating

(c) $\ln\sqrt{x+1}$

(d) $\ln\dfrac{x(x^2+1)}{\sqrt{2x^3-1}}$

(e) $\ln\cos x$

7. Find the relative extrema of $\ln(x^2+2x+3)$