

1. Expand the following expressions using logarithm rules, then differentiate.

(a) $\ln(5xe^x(x^2 + 1))$

(b) $\ln(e^{5x})$

(c) $e^{\ln(x^3+4x+1)}$

(d) $\ln((x^2 + 2)(x^3)(e^{x+2}))$

2. Calculate the derivative of $\ln(1 + x)$. Write this as a rate equation (don't forget an initial condition!)

3. Find a degree 2 polynomial approximation to $\ln(1+x)$ by using your rate equation from the previous Question.

4. What is $e^{\ln(1+x)}$? Compose a degree 2 approximation of e^x with your degree 2 approximation of $\ln(1+x)$ above and compare the two.

5. Differentiate the following:

$$\ln(x^3 + x^2 + 1) \quad e^{x^2} \ln(x) \quad x \ln(x) + e^x \quad e^{\ln(2x+3)} x^2 + e^x \ln(x)$$

6. Could you compute a polynomial approximation to $\ln(x)$? Remember that our polynomial approximations are accurate near zero - what does $\ln(x)$ look like near zero?

7. Using the multiple-derivatives method, determine a degree 2 polynomial approximation to $\ln(1+x)$. Compare with Question 3.