

Problem Set 3: Differential Calculus
CSSS 505 & SOC 512
Due: January 27, 2021

1. Plot the function $f(x) = 3x + 2$.

(a) By eye, what is the derivate of this function at $x=4$?

(b) Compute the derivative using the appropriate formula.

Compute the derivative:

2. $f(x) = x^5$

3. $f(x) = 10x - 30$

4. $f(x) = 2x^4 + x^2$

5. $f(x) = \tan(x)$

6. $f(x) = e^{\sin(x)}$

7. $f(x) = xe^x + \log(\sin(x))$

We can also have a function of a different variable. This is just changing the variable name and you will see this a lot in your statistics methods classes.

8. Compute the derivative of $g(\theta) = \theta^2 - \theta^4$

9. Find the global minimum of $f(z) = z^2 - 6z + 8$

10. In the following function, treat x as a constant, and differentiate with respect to μ :
 $h(\mu) = x\mu^2$

11. In the following function of μ , treat X_1, X_2, \dots, X_n as constants. Maximize the function over μ . In other words, find the value of μ , expressed in terms of X_1, X_2, \dots, X_n , at which the function reaches its global maximum:
 $L(\mu) = \log\left(\frac{1}{\sqrt{2\pi}}e^{-\sum_{i=1}^n (X_i - \mu)^2}\right)$