Problem Set 3: Differential Calculus CS&SS Math Camp 2021

- 1. Plot the function f(x) = 3x + 2.
 - (a) By eye, what is the derivative of f(x) at x = 4, i.e. what is the slope of the tangent line to the curve 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 besides x. 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 : $h(\mu) = x\mu^2$
- Bonus In the following function of μ , treat $X_1, X_2, ..., X_n$ (your data) as constants. Maximize the function over μ (the population mean). In other words, find the value of μ , expressed in terms of $X_1, X_2, ..., X_n$, at which the function reaches its global maximum. HINT: review your rules of logarithms and exponents to simplify the expression before taking the derivative. $L(\mu) = log(\frac{1}{\sqrt{2\pi}}e^{-\sum_{i=1}^{n}(X_i-\mu)^2})$