ECON 251: Problem Set 1
Due Friday September 16 by 11:00 PM

Instructions. Please submit your completed problem set on gradescope. To do this, you will either need to upload a pdf of your entire problem set or an image (for example, a picture that you take with your phone) of your work for each problem. If you upload a pdf, you will need to tag each problem on the appropriate page of the document. Please show your work and draw a box around your final answer. You are free to work together with your classmates, but the work that you upload must be your own.

1. Solve the following system of equations for x and y:

$$x - 2y = 6$$
$$x + 2y = 18$$

2. Consider the function $f(x) = ax^2 + bx + \sqrt{x}$. What is the derivative of $f(x)$ with respect to x?

3. Consider the function $f(x) = x^2 (\ln x)$. What is the derivative of $f(x)$ with respect to x?

4. Consider the function $f(x_1, x_2) = 4x_1 x_2 + 8x_1^2 x_2^2$. Find the partial derivative of $f(x_1, x_2)$ with respect to x_1.

5. Consider the function $y = 48 + 24x - 3x^2$. Find the value of x that maximizes y.

6. You flip a "fair" coin (i.e. one that is equally likely to land on heads or tails) three times. What is the probability the coin lands on heads at least twice?

7. Consider a standard six-sided die with the sides numbered 1, 2, 3, 4, 5, and 6. Each of those six numbers is an equally likely outcome of rolling the die. Define a random variable Z equal to the square of the number that the die lands on. What is the expected value of Z?

8. The random variable X is distributed uniformly on the interval $[2, 8]$: $X \sim U[2, 8]$. What is the expected value of X?

9. The random variable X is distributed uniformly on the interval $[3, 6]$: $Y \sim U[0, 6]$. What is the probability that X is greater than 4?

10. Prove the quadratic formula: show that the solution to the equation $ax^2 + bx + c = 0$ is:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$