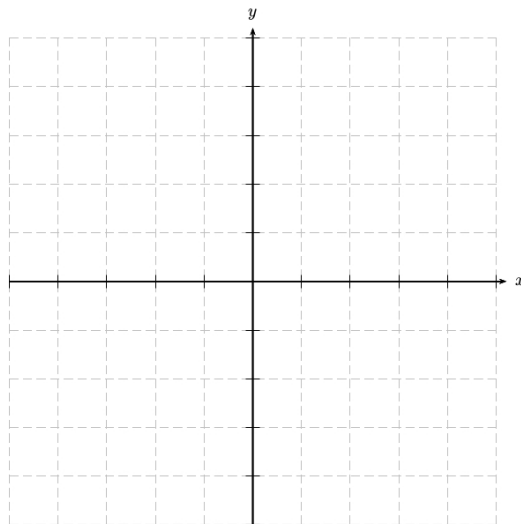


Due: Tuesday Sept 15 by 11:59pm EDT on GitHub Classroom

Complete the following questions as much as you can – this part of Lab 1 will be graded on competition, not correctness. If you are unfamiliar with a concept, just write “not covered”. The purpose of this worksheet is so I know how much to review different mathematical concepts. See the Lab 1 writeup for submission instructions.

You are welcome to discuss these questions with classmates and/or use other resources (please cite at the end). If you are completely unfamiliar with a topic though, it is better for me to know that than assume no review is needed.

1. Graph the line $x - 2y = 2$ on the axes below.



2. Given the matrix A below, compute its inverse A^{-1} . What is AA^{-1} ?

$$A = \begin{bmatrix} 7 & 1 \\ -2 & 1 \end{bmatrix}$$

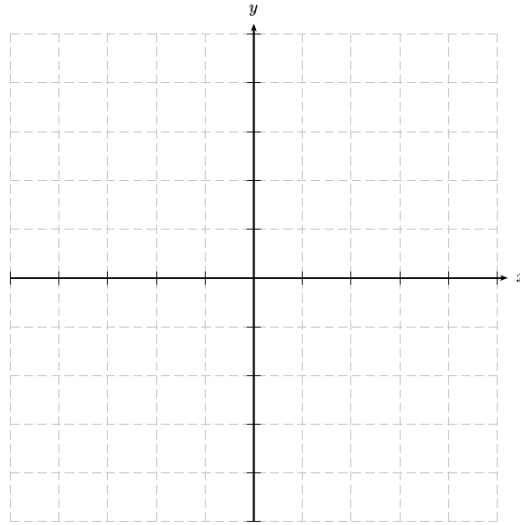
3. Say I compute AB , where A is an $n \times p$ matrix and B is a $p \times m$ matrix. Is this a legal operation? If so, what are the dimensions of the resulting matrix?

4. Compute the following matrix multiplication:

$$\begin{bmatrix} 3 & 1 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} 1 & -2 \\ 8 & 3 \end{bmatrix} =$$

5. Given the vectors \vec{a} and \vec{b} below, compute $\vec{a} + \vec{b}$ and demonstrate this vector addition on the axes.

$$\vec{a} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad \text{and} \quad \vec{b} = \begin{bmatrix} -4 \\ -1 \end{bmatrix}$$



6. What is the magnitude of vector \vec{a} from the previous question? What is the unit vector \vec{u} in the direction of \vec{a} ?

7. What is the dot product of vectors \vec{a} and \vec{b} from the previous questions? What does the value of the dot product indicate about the relative directions of \vec{a} and \vec{b} ?

$$\vec{a} \cdot \vec{b} =$$

8. Compute the derivatives of the following functions of one variable (simplify as much as you can).

(a) $f(x) = x^7$

(b) $f(x) = \log(g(x))$

(c) $f(x) = e^{g(x)}$

(d) $f(x) = \sin(x)$

(e) $f(w) = wx$

(f) $f(x) = a^x$

9. Compute the gradients of the following functions of multiple variables.

(a) $f(w_0, w_1) = w_0 + w_1x$

(b) $f(x, y) = g(x) \log(y)$

10. Say that 20% of the time, it is raining. In addition, 15% of the time, it is raining *and* I have my umbrella. *Given* that it is currently raining, what is the probability I have my umbrella?

11. Say I have a 4-sided tetrahedral die with sides labeled 1,2,3,4. The die is weighted, with probability $\frac{1}{6}$ of rolling a 1, 2, or 3, and probability $\frac{1}{2}$ of rolling a 4. What is the *expected value* of this die?

References: (including people, websites, and textbooks)