Due Date: Wednesday, March 30 at 10AM EDT

Carefully read and provide solutions to the problems below, showing all work required to justify any conclusions you make. You are encouraged to collaborate with your classmates, but all solutions turned in should be your own work. If you do collaborate, please record the names of those other students on your submitted work. Finally, your work should be submitted as a PDF on Canvas before the listed due date.

Textbook problems: Section 4.4 #6, 12, 16, 26; Section 4.5 #6, 18, 20; Section 5.1 #26, 40, 44; Section 5.2 #6, 14, 20

Optional textbook problems: the odd numbered problems from Sections 4.4 - 4.5, 5.1 - 5.2.

Problem 1. A cylindrical steel storage tank is being built to store beer after the brewing process. The tank will have a height of 10 feet and a diameter of 4 feet, but as brewed beer is added to the tank and starts to cools down, the steel will first expand and then contract. Is the overall volume in the tank more sensitive to fluctuations in the height or in the diameter of the tank?

Problem 2. Approximate $\dfrac{1}{1-(0.5001)(0.4997)}$ using a linear approximation to the function $f(x,y) = \dfrac{1}{1-xy}$. What is the maximum error in your approximation?

Problem 3. Recall from Section 5.2 that if two vectors $\vec{u}$ and $\vec{v}$ meet at an angle θ, then $\vec{u}\cdot\vec{v} = |\vec{u}|\,|\vec{v}|\cos(\theta)$. Draw a picture illustrating this formula in the xy-plane, i.e. when $\vec{u}$ and $\vec{v}$ are two-dimensional vectors.

Problem 4. A block sliding down a surface with a 45° slope can be stopped by precisely 18 kg of force. Ignoring friction, what is the weight of the block? *Hint: represent the weight of the block (that is, the force on the block due to gravity) and the stopping force as vectors.*