Week 9-Lab 2: Worksheet 12: Section 3.10

They asked:

(i) **What is the point of recitation sessions in Math?** *Recitation sessions are where you solve problems with your peers while there is someone in the room who can help you when you are all stuck in a problem.*

(ii) **Do I need to prepare before lab and be ready?** *Yes, so you can contribute to your team and ask questions while you are there. Otherwise, you are too confused to even be stuck in a problem. Remember attempts, even if they are wrong, are the first step in solving.*

(iii) **How many hours do I need to spend on Math 125?** *The minimum recommended hours for any STEM course outside the class, as a rule of thumb by all exports in the fields, is twice the number of hours spent in the class.*

(iv) **How do I get help?** *Go to lab sections, group tutoring, our help room and our office hours. Bring your problems, work on them and ask for hints when you are stuck. Talk through the material with friends. Most importantly, think for yourself! Learn how to solve problems on your own.*

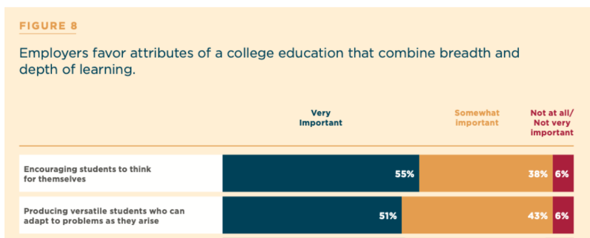


Figure 1: The AAC&U surveyed nearly 500 executives and hiring managers from businesses of varying size.

Solving Related Rates Problems

Be aware: Although the steps are the same for related rate problems, every problem is different from the others.

(1) If applicable, draw one or more figures representing the situation found in the problem.

(2) Identify the quantities in the problem. Clearly identify which are constants and which are variables.

(3) Determine which rates of change are known and which rates need to be calculated.

(4) Find an equation which **relates** the quantities whose rates you know to quantities whose rates you need to calculate.

- Often, this equation is geometric.

(5) Differentiate the equations implicitly and then substitute known quantities. Solve explicitly for the rates that need to be calculated.

Group Work Portion of the Worksheet

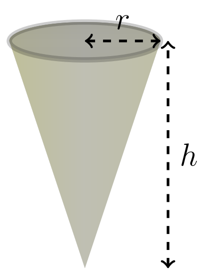
Names: ____

Work in groups to do this portion of the worksheet. Make sure to take parts in solving the problems. Your participation score is a combination of being prepared, willing to explore the problem, working in groups and contributing toward the solution.

1. The volume of a cone is given in terms of the radius and height as $V = \dfrac{\pi r^2 h}{3}$. The radius and height are changing over time. At a particular instant, $r = 5$, $\dfrac{dr}{dt} = 3$, $h = 6$, and $\dfrac{dh}{dt} = -4$.

   (a) **What is $\dfrac{dV}{dt}$ at that instant?**

   (b) Can r be expressed as an explicit function of h using the given information? *(Compare this to the next problem.)*



2. Water is leaking out of a tank shaped like an inverted cone. The tank has height 9 meters and the diameter at the top is 8 meters. If the water level is **falling** at a rate of $0.1\ \frac{m}{min}$, **when the height of the water is 5 meters**,

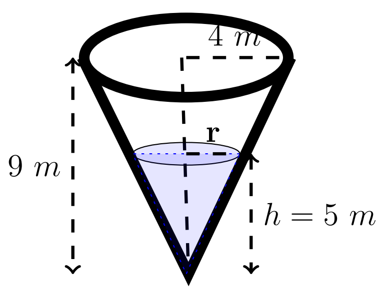
   (A) *identify and name the quantities in the problem:*

   (B) *what are the values of the known variables and rates?*

   (C) *which equation(s)* **relates** *the quantities?*

   (D) at what rate is the radius of the water, r, changing?

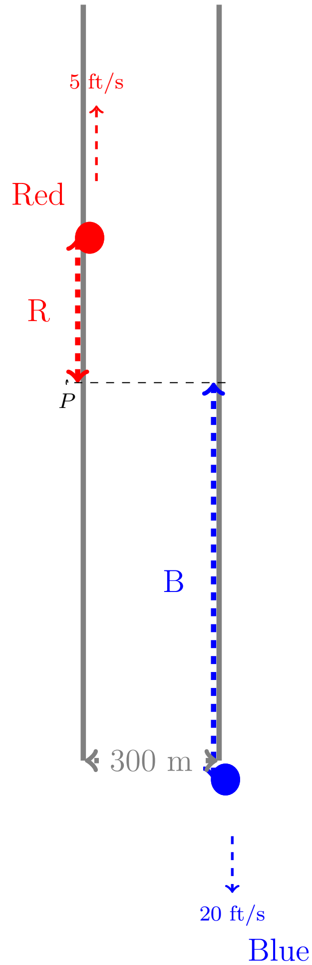
   (E) use the volume formula $V = \dfrac{\pi r^2 h}{3}$ to find the rate of change in the volume of water in the cone. *(Round to 3 decimal places.)*



Video: https://youtu.be/KxXG-Ycv1do

3. **Red** begins walking north at 5 ft/s from a point P. 5 seconds later, **Blue** starts running south at 20 ft/s from a point 300 ft due east of P. At what rate are they moving apart 20 seconds after **Red** begins walking?

(i) *Identify and name the quantities in the problem:*



(ii) *What rate is the problem searching for?*

(iii) *What are the values of the known variables and rates?*

(iv) *Which equation(s)* **relates** *the quantities?*

(v) *Solve.*

Similar Video: https://youtu.be/QfomShthfPk

GroupWork Rubrics:

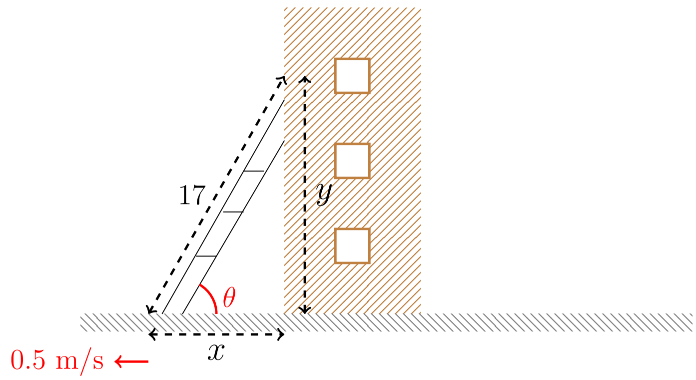
Preparedness: ___/0.5, Contribution: ___/0.5, Correct Answers: ___/0.5

Individual Portion of the Worksheet

Name: ________________

Upload this section individually on canvas or turn it in to your instructor on the 2nd lab day of the week. You can ask questions in class and work in groups but you turn in the individual work. Start before the class so you can ask questions during the class. If you didn't complete the work in class, make sure to work on it outside the class and complete it. Show all your work; your score depends on the work you have shown.

4. A 17-meter ladder leans against a building so that the angle between the ground and the ladder is θ radians. Let y be the distance from the bottom of the building to the top of the ladder at any time, t seconds, in meters.



(a) *(1.5 points)* If the bottom of the ladder is sliding away from the building at a constant rate of 0.5 meters per second, at the instant that y is 15 meters, at what rate is the top of the ladder sliding down?

(b) *(2 points)* How fast is the **angle formed between the ladder and the horizontal**, θ, changing at the same instant?

Similar Video: https://youtu.be/m8fMFId6b4A