

# Homework Seven

## Calculus I

### College of the Atlantic

Due Friday, October 28, 2022

There are two parts to this assignment.

**Part 1: WeBWorK.** Do Homework 07A and 07B on WeBWorK. The WeBWorK page is here: <https://webwork-hosting.runestone.academy/webwork2/coa-feldman-es1024-fall12024> I recommend doing the WeBWorK part of the homework first. This will enable you to benefit WeBWorK's instant feedback before you do part two.

**Part 2: Non-WeBWorK problems.** Here are some instructions for how to submit this part of the assignment.

- Do the problems by hand using pencil (or pen) and paper. There is no need to type this assignment.
- Make a pdf scan of your work using genius scan or some similar scanning app. Please make the homework into a single pdf, not multiple pdfs.
- Submit the assignment on google classroom. Please don't email it to me.
- If you want, you can do the non-WeBWorK problems in pairs and submit only one assignment for the two of you.

Here are some non-WeBWorK problems.

1. (a) Find the equation of the line tangent to  $f(x) = \ln(x)$  at  $x = 1$ .  
  
(b) What is the value of the tangent line at  $x = 1.01$ ,  $x = 1.1$ , and  $x = 2$ ?  
  
(c) What are the values of  $\ln(x)$  at  $x = 1.01$ ,  $x = 1.1$ , and  $x = 2$ ?  
  
(d) Are the values of the tangent line above or below  $\ln(x)$ ? How is your answer related to the concavity of  $\ln(x)$ ? A sketch of the function and the tangent line will be helpful.

2. Consider the scenario illustrated in the figure: a metal bar of length  $\ell$  is attached to a point P on the edge of a circle of radius  $a$ . The point Q, at the other end of the metal rod, slides back and forth along the  $x$  axis. Note that the triangle OPQ is *not* a right triangle.
- (a) Find an expression for  $x$  as a function of the angle  $\theta$ . Your answer will have an  $a$  and  $\ell$  in it.
- (b)  $x(\theta)$  for the values  $a = 3$  and  $\ell = 8$ . Does the plot make sense?
- (c) Suppose the circle is rotating at a rate of 2 radians per second, and that  $a = 3$  cm and  $\ell = 8$  cm.
- How fast is the point Q moving when  $\theta = \pi/4$ ?
  - How fast is the point Q moving when  $\theta = \pi/2$ ?
  - How fast is the point Q moving when  $\theta = \pi$ ?
  - How fast is the point Q moving when  $\theta = 3\pi/2$ ?
- (d) Do the signs and magnitudes of the speeds you found above make sense? Explain briefly.

