

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-fall2024> 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 ℓ 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 θ . Your answer will have an a and ℓ 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.

i. How fast is the point Q moving when $\theta = \pi/4$?

ii. How fast is the point Q moving when $\theta = \pi/2$?

iii. How fast is the point Q moving when $\theta = \pi$?

iv. 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.

