Homework Four

Calculus I

College of the Atlantic

Due Friday, October 11, 2024

There are two parts to this assignment.

Part 1: WeBWorK. Do Homework 04A, 04B, and 04C 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.

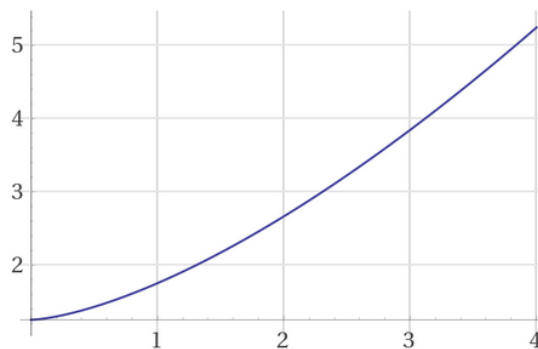Here are some non-WeBWorK problems.

Figure 1: The position of a object (in meters) as a function of time (in seconds).

1. An object's position as a function of time is shown in Fig. 1. Use this graph to estimate:

   (a) The average speed between $t = 1$ and $t = 3$.
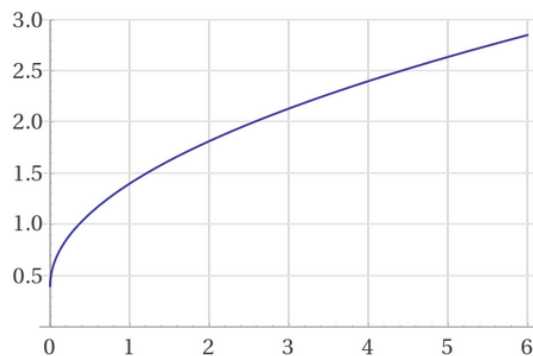   (b) The average speed between $t = 1$ and $t = 2$.

Figure 2: The position of a object (in meters) as a function of time (in seconds).

2. An object's position as a function of time is shown in Fig. 2. On this graph draw:

   (a) A line whose slope is equal to the average speed of the object from $t = 1$ to $t = 4$.
   (b) A line whose slope is equal to the instantaneous speed at $t = 3$.

3. The position of a cat is given by $s(t) = t^3 + 2$, where t is measured in seconds and s is measured in meters.

   (a) Find the average speed of the cat between time 2 and time $2 + h$ if:
       i. $h = 0.1$
       ii. $h = 0.01$
       iii. $h = 0.100$
   (b) What do you think is the instantaneous speed of the cat at time $t = 2$?

4. Find the derivative of $f(x) = x^3 + 2$ at $x = 2$ using algebra. That is, start with the definition of the derivative:

$$f'(x) = \lim_{h \to 0} \frac{f(2 + h) - f(x)}{h} \ . \tag{1}$$

   Then use algebra to simplify the expression on the right. After a bit of work, the h downstairs will cancel and you'l be able to evaluate the limit. Do not use any shortcuts you might have learned in other classes, nor should you use a calculator to plug in values of h.

5. Repeat the above problem, but instead find the derivative of $g(x) = 1/x$ at $x = 3$. (This problem will involve a good bit more algebra than the last one.)