

# MAT 136: Calculus I

## Weekly Homework 1

NAME:

### Instructions

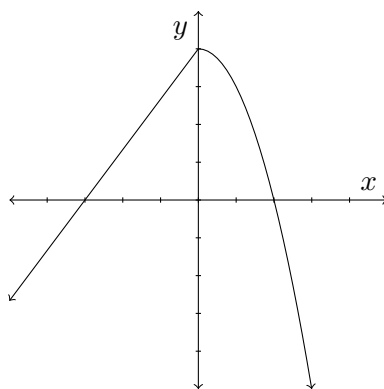
You are allowed and encouraged to work together on homework. Yet, each student is expected to turn in his or her own work.

Reviewing material from previous courses and looking up definitions and theorems you may have forgotten is fair game. However, when it comes to completing assignments for this course, you should *not* look to resources outside the context of this course for help. That is, you should not be consulting the web, other texts, other faculty, or students outside of our course in an attempt to find solutions to the problems you are assigned. This includes Chegg and Course Hero. On the other hand, you may use each other, Discord, me, and your own intuition. **If you feel you need additional resources, please come talk to me and we will come up with an appropriate plan of action.** Please read NAU's [Academic Integrity Policy](#).

Complete each of the following exercises. Your solutions should be complete and neatly written. In particular, you should show all of your work. Write your solutions on your own paper or prepare them digitally. This assignment is due on **Thursday, September 8** at class time.

### Problems

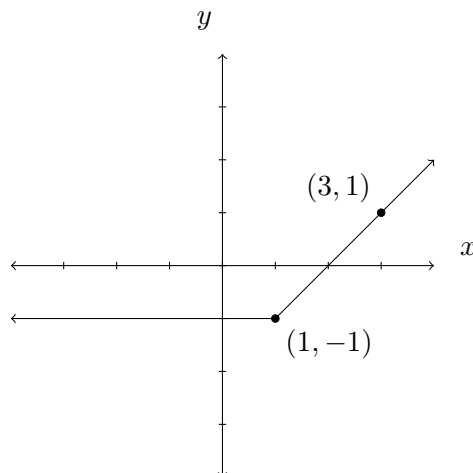
- (Review of Precalculus) Determine an equation of the line that passes through  $(1, -1)$  and is parallel to the line  $x - 5y - 3 = 0$ . It does not matter what form your answer takes.
- (Review of Precalculus) Suppose the graph of the function  $f$  is given below.



Carefully sketch a graph of each of the following.

- $y = f(-x)$
- $y = |f(x)|$
- $y = f(|x|)$
- $y = f(x - 2) + 1$

3. (Review of Precalculus) Consider the function  $f(x) = -\sqrt{2(x+1)} - 3$ . How would you obtain the graph of  $f$  from the function  $g(x) = \sqrt{x}$ ? That is, describe in words the sequence (order matters) of transformations for obtaining the graph of  $f$  from the graph of  $g$ . You do *not* need to sketch the graph of either function.
4. (Review of Precalculus) Consider the graph of the function  $y = f(x)$  given in the figure below. Sketch the graph of the function  $y = 2f(-1-x) + 2$ .



5. (Review of Precalculus) Find the equation of the parabola that has vertex  $(2, -1)$  and passes through the point  $(-1, 6)$ . *Hint:* A useful form for a parabola is  $y = a(x - h)^2 + k$ , where  $a$ ,  $h$ , and  $k$  are fixed real numbers.
6. The position in meters of a particle moving in a straight line (but not necessarily always moving in the same direction) is given for some values of time  $t$  in seconds in the following table. Using the table, answer each of the following questions. Be sure to label your answers with appropriate units.

$t$	0	.1	.2	.3	.4
$p(t)$	0	.2	.1	.7	1.3

- (a) Compute the average velocity over the interval  $[.1, .2]$ .
- (b) Compute the average velocity over the interval  $[.2, .3]$ .
- (c) Using your answers from parts (a) and (b), estimate the instantaneous velocity at  $t = .2$  seconds. Justify your technique.
7. Let  $f(x) = \frac{1}{x-2}$ .
- (a) Compute the difference quotient  $\frac{f(x+h) - f(x)}{h}$ . Simplify your answer as much as possible.
- (b) What does the expression in part (a) represent? Be as specific as possible.
8. Suppose a nugget is thrown in the air from a height of 100 meters on planet Nuggeton and assume that the height of the nugget after  $t$  seconds is given by  $p(t) = -10t^2 + 35t + 100$ , where  $p(t)$  is measured in meters. Find the most simplified expression you can for the average velocity of the ball on the interval  $[2, 2+h]$ , where  $h$  is a small positive number.
9. In an emergency, Batman rushes to destroy a doomsday device 30 miles away turning on the rockets mounted on his Batmobile. His average speed is 200 mph. After saving the world, he leisurely cruises back to the Batcave with an average speed of 100 mph. What is his average speed during the whole excursion?

10. Provide an example of the graph of a function that is continuous everywhere\* but does not have a tangent line at  $x = 0$ . Explain your answer.
11. Suppose the equation for the tangent line to the graph of some function  $f$  at  $x = 2$  is  $y = 5x + 17$ .
  - (a) What is  $f(2)$ ? Explain your reasoning.
  - (b) What must be true about the graph of  $f$  over a small interval containing  $x = 2$ ? Explain your reasoning.

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\*Loosely speaking, this means that we can draw the graph of the function without lifting up our pencil.