

MAT 136: Calculus I

Weekly Homework 1

NAME:

Instructions

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. You will need to capture your work digitally and then upload a single PDF document (possibly with multiple pages) to BbLearn. There are many free smartphone apps for doing this. I use TurboScan on my iPhone. This assignment is due on **Thursday, August 20 by 8:00pm**.

Problems

- 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

- Compute the average rate velocity over the interval $[.1, .2]$.
 - Compute the average rate velocity over the interval $[.2, .3]$.
 - Using your answers from parts (a) and (b), estimate the instantaneous velocity at $t = .2$ seconds. Justify your technique.
- Let $f(x) = \frac{1}{x-2}$.
 - Compute the difference quotient $\frac{f(x+h) - f(x)}{h}$. Simplify your answer as much as possible.
 - What does the expression in part (a) represent? Be as specific as possible.
 - 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?
 - 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.
 - Suppose the equation for the tangent line to the graph of some function f at $x = 2$ is $y = 5x + 17$.
 - What is $f(2)$? Explain your reasoning.
 - What must be true about the graph of f over a small interval containing $x = 2$? Explain your reasoning.

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

6. Let f be given by the following graph. For (a)–(h), evaluate the given expression. For (i) and (j), find the indicated value. If a value does not exist, write DNE (for “does not exist”). You do *not* need to justify your answers.

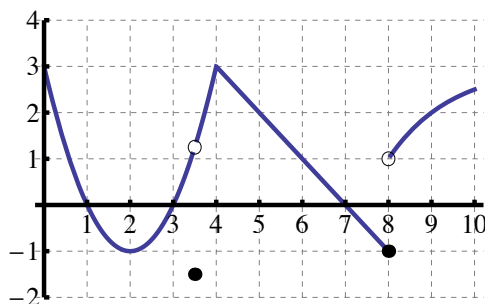


Figure 1: Graph of $y = f(x)$.

(a) $\lim_{x \rightarrow 3.5^-} f(x)$

(b) $\lim_{x \rightarrow 3.5^+} f(x)$

(c) $\lim_{x \rightarrow 3.5} f(x)$

(d) $f(3.5)$

(e) $\lim_{x \rightarrow 8^-} f(x)$

(f) $\lim_{x \rightarrow 8^+} f(x)$

(g) $\lim_{x \rightarrow 8} f(x)$

(h) $f(8)$

(i) Determine the slope of the tangent line at $x = 6$.

(j) Determine the slope of the tangent line at $x = 4$.

7. Consider the following function.

$$f(x) = \begin{cases} \frac{-1}{x-2}, & x > -1 \\ x^2 + 1, & x \leq -1 \end{cases}$$

Evaluate each of the following expressions. If an expression does not exist, specify whether it equals ∞ , $-\infty$, or simply does not exist (in which case, write DNE).

(a) $f(-1)$

(b) $\lim_{x \rightarrow -1^-} f(x)$

(c) $\lim_{x \rightarrow -1^+} f(x)$

(d) $\lim_{x \rightarrow -1} f(x)$

(e) $f(2)$

(f) $\lim_{x \rightarrow 2^+} f(x)$