Math 152 Learning Target Quiz 1

February 19, 2021

Name: _____

Instructions: Read the following instructions carefully.

- You do not need to complete every question. Choose the learning targets that are most important for you and focus on those.
- **You must show ALL of your work in order to earn full credit on any of the learning targets.**
- You may use any calculator you wish, so long as it does not have communications abilities (e.g., iPods, iPads, smartphones, laptops, etc.) or symbolic manipulation capabilities (e.g., TI-89).
- You may not use any notes, notecards, books, formula sheets, etc.
- Feel free to ask any questions you want – especially if instructions are unclear, or if you want advice about which learning targets to attempt.

Learning Target	Assessment
1	
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Given information about a function (either a table of data or a graph), answer questions about its average and/or instantaneous rates of change.

1. For the (blue) graph $y = f(x)$, arrange the following numbers from smallest to largest, and explain your thinking.

   - The slope of the graph at A
   - $f'(x)$ at B
   - The slope of the tangent line at C
   - The slope of the line AB
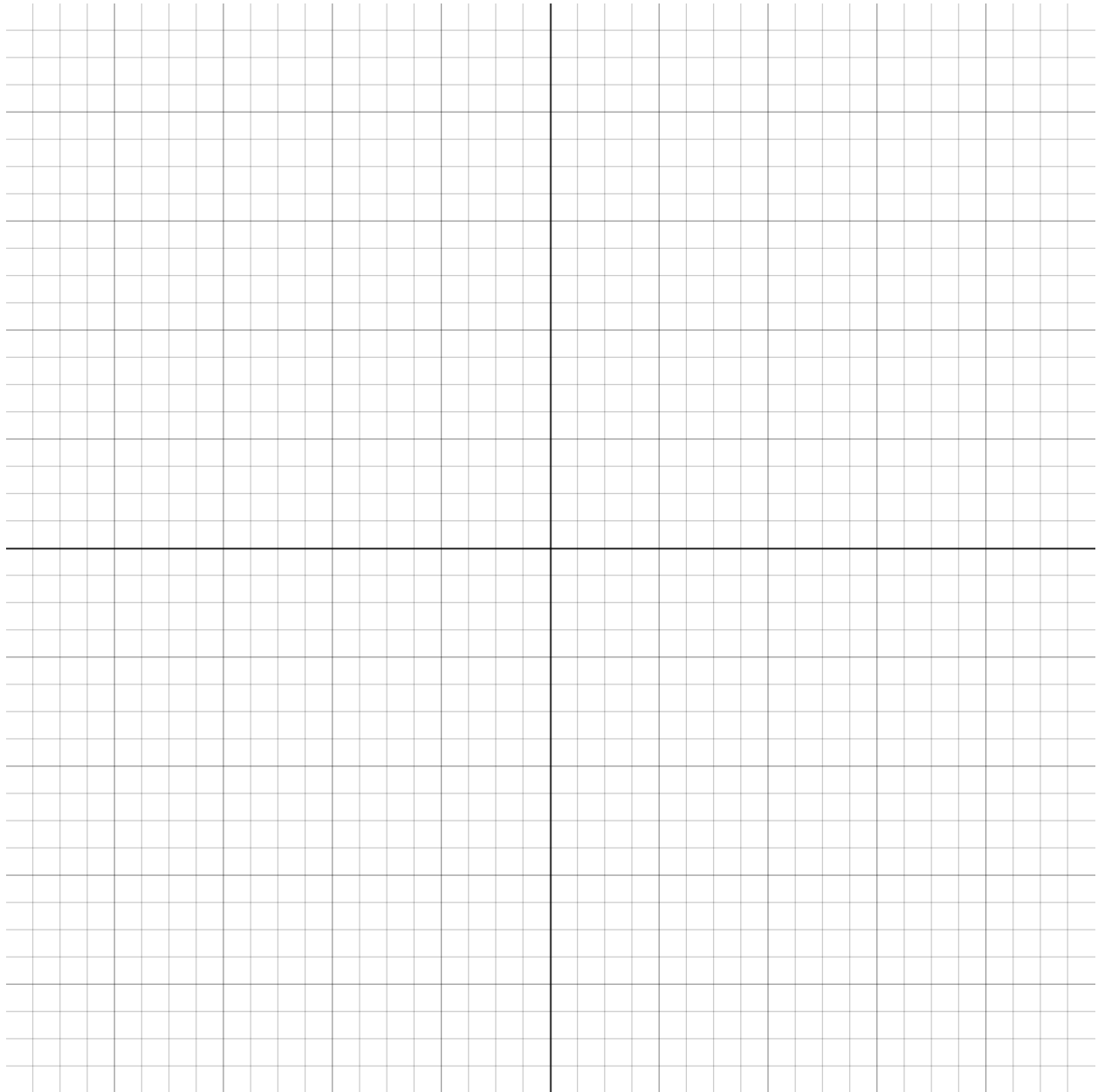   - The number 0
   - The number 1

Note: The dashed line is the line $y = x$.
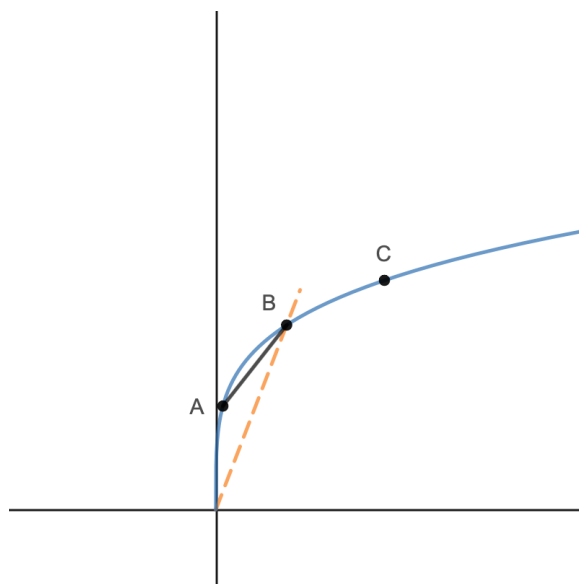
Sketch a graph that has specific behaviors at indicated points and intervals.

2. Sketch the graph of a function f for which $f(0) = 0$; $f'(x) > 0$ for $1 < x < 3$; $f'(x) < 0$ for $x < 1$ and $x > 3$; $f'(x) = 0$ at $x = 1$ and $x = 3$.

**Make sure to label your grid with an appropriate scale!**

Given the graph of a function, answer questions about the function, its derivative, and its second derivative.

3. Consider the graph below. At which of the marked values of x is

    a. $f(x)$ greatest?
    b. $f(x)$ least?
    c. $f'(x)$ greatest?
    d. $f'(x)$ least?
    e. $f''(x)$ greatest?
    f. $f''(x)$ least?

Note that there may be more than one answer. You should clearly explain why your identified point satisfies the stated condition.
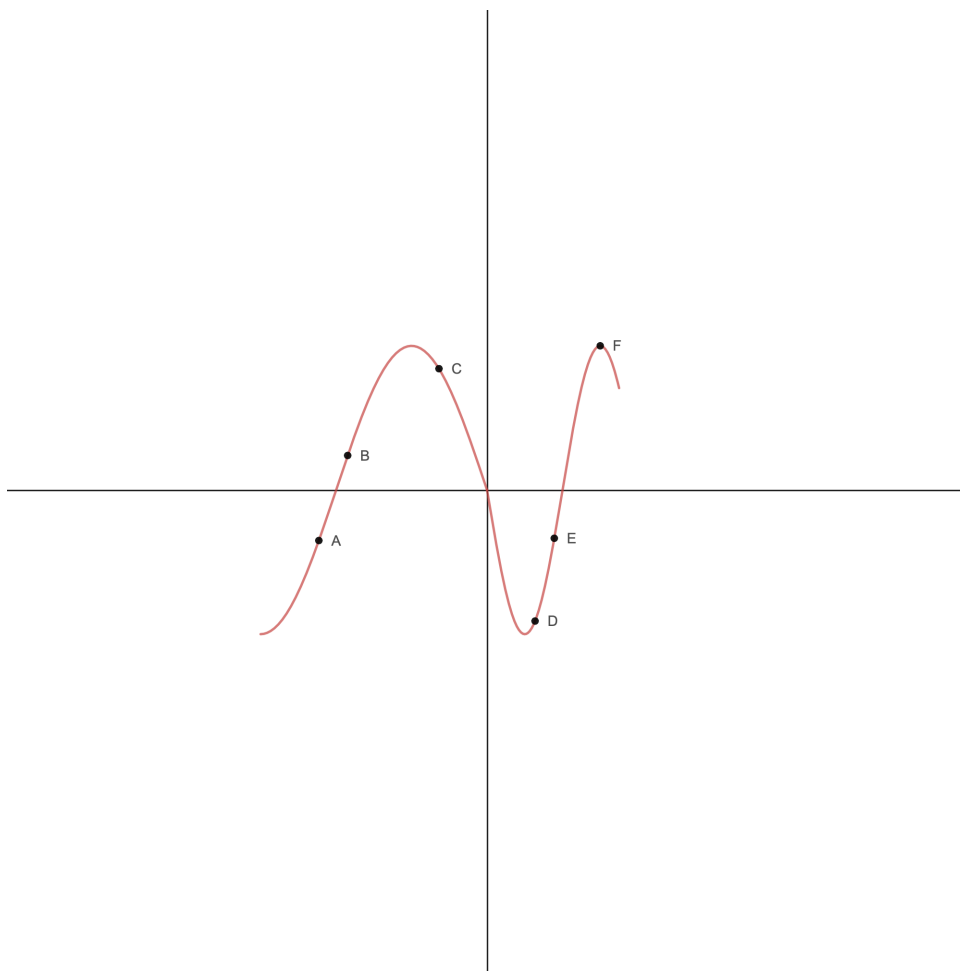
Use the limit definition to find the derivative function.

4. Recall that $f'(x) = \lim\limits_{h \to 0} \frac{f(x+h)-f(x)}{h}$. Use the limit definition to calculate the derivative of $f(x) = -4x + 17$.

Use the central difference and other estimation techniques to answer questions about applications of the derivative.

5. The temperature, H, in degrees Fahrenheit, of a cup of coffee placed on the kitchen counter is given by $H = f(t)$, where t is in minutes since the coffee was put on the counter.

   a. Estimate the temperature at $t = 35$ minutes.

   b. What are the units of $f'(20)$. What is the practical meaning in terms of the temperature of the coffee?

t	0	10	20	30	40	50	60
H	185	142	115	100	89	84	80

Given the graph of the derivative, answer questions about the function, the first derivative, and the second derivative.

6. Consider the graph of a **derivative** $f'(x)$ below.

    a. At what x-value does $f(x)$ change from increasing to decreasing? Explain.

    b. On what interval is $f(x)$ decreasing? Explain.

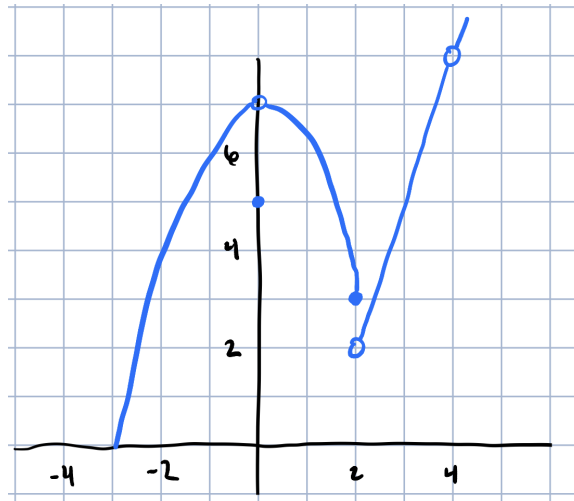   c. On what interval is $f(x)$ increasing? Explain.
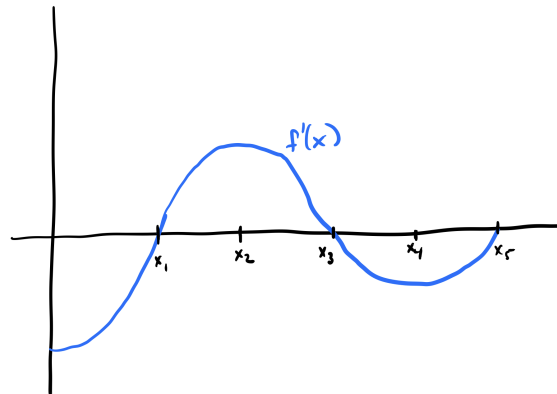
Given the graph of a function, determine the values of indicated limits.

7. Consider the function $f(x)$ below, and calculate the indicated limits. If the limit does not exist, explain why.

    a. $\lim\limits_{x \to 0} f(x)$

    b. $\lim\limits_{x \to 2} f(x)$

    c. $\lim\limits_{x \to 3} f(x)$

Given the graph of a function, determine the x-values where the function is not continuous and the points where it is not differentiable.

8.

Find a local linearization, use it to estimate the function at a nearby point, and answer questions about the accuracy of that estimate.

9. Given $f(x) = \sqrt[3]{x}$, it is known that $f'(x) = \frac{1}{3\sqrt[3]{x^2}}$.

    a. Calculate the local linearization $L(x)$ at $a = 8$.

    b. Use your answer from part (a) to estimate $\sqrt[3]{8.1}$.