Instructions: Please write your solutions to the problems below on a clean piece of paper (not this piece of paper). You will not need more than one page (front and back) to write your answers. Show the steps taken to arrive at each answer. Do not include scratch work, doodles, scribbles, crossed out work, etc.; instead, carefully write your solutions after you have figured out the answers and checked them over.

1. The graph of the function $f(x)$ is shown below. Four points, $O = (0, 0)$, $A = (2, f(2))$, $B = (3, f(3))$, and $C = (5, f(5))$ lie on the graph of this function. Answer each of the questions shown below.
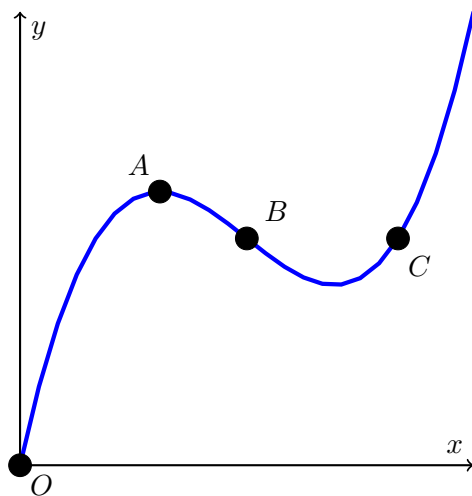
(a) Is $f'(3)$ positive, negative, or zero?

(b) Let m_1 be the slope of the secant line through A and B and let m_2 be the slope of the tangent line through A. Which is larger, m_1 or m_2?

(c) Is the average rate of change of $f(x)$ between A and C positive or negative?

(d) Is the instantaneous rate of change of $f(x)$ larger at $x = 3$, larger at $x = 5$, or about the same?

(e) At which of the four points, O, A, B, or C, is the derivative of $f(x)$ closest to being zero.

2. Let $f(x) = \frac{1}{2} - x^2$. Consider the following program:

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LINE 1: LET a = 0
LINE 2: LET b = 1
LINE 3: LET guess = (a + b) / 2
LINE 4: COMPUTE f(guess)
LINE 5: IF f(guess) = 0 THEN PRINT guess AND STOP
LINE 6: IF f(guess) > 0 THEN LET a = guess AND GOTO LINE 3
LINE 7: IF f(guess) < 0 THEN LET b = guess AND GOTO LINE 3
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(a) Make a table of the values of **guess** and $f(\textbf{guess})$ until the absolute value of $f(\textbf{guess})$ is smaller than 0.01. You may use your calculator or computer to solve this problem. If you are not sure how to start this problem, please ask for help.

(b) What happens to the value of **guess** for the function $f(x) = \frac{1}{2} - x^2$ assuming that the program could run forever?

(c) Will the program, as written, terminate in a finite amount of time? Explain your reasoning.