

College of the Holy Cross, Fall Semester, 2017  
MATH 133, Makeup Midterm 2  
Monday, October 23

Your Name: \_\_\_\_\_

**Instructions:** Please show all work necessary to justify your answers, and write your answers in the spaces provided. Use the back of the preceding page if you need more space for scratch work. There are 100 possible points distributed as below.

Please do not write in the space below

Problem	Points/Poss
1	/ 15
2	/ 25
3	/ 40
4	/ 20
Total	/100

1. An object moves along a straight line path with position given by  $x(t) = 2t^2 + 6t + 4$ , ( $t$  in seconds,  $x$  in feet).

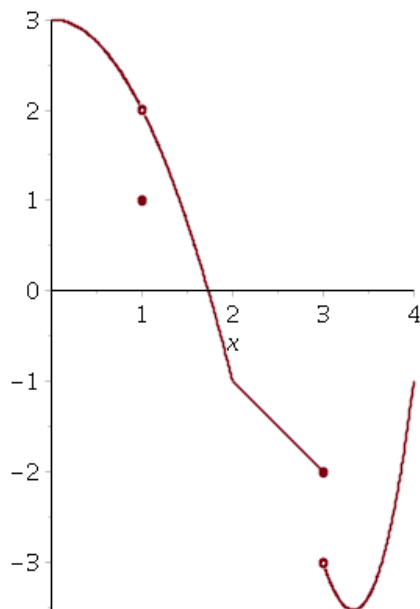
(a) (5) What is the average velocity of the object on the interval  $[1, 4]$ ?

Average velocity = \_\_\_\_\_.

(b) (10) Fill in the following table with average velocities computed over the indicated intervals. Using this information, estimate the *instantaneous velocity* at  $t = 0$ .

interval	$[0, 1]$	$[0, 0.1]$	$[0, 0.01]$	$[0, 0.001]$
ave.vel.				

Estimated instantaneous velocity = \_\_\_\_\_.



2. Answer all parts of this question by referring to the graph  $y = f(x)$  above.

- (a) (5)  $\lim_{x \rightarrow 1^-} f(x) = \underline{\hspace{2cm}}$  and  $\lim_{x \rightarrow 1^+} f(x) = \underline{\hspace{2cm}}$ .
- (b) (5)  $f(x)$  has a jump discontinuity at  $x = \underline{\hspace{2cm}}$ .
- (c) (5) True/False: The limit  $\lim_{x \rightarrow 3} f(x)$  does not exist.  $\underline{\hspace{2cm}}$ . If so, what is the limit? If not, say why not:  $\underline{\hspace{2cm}}$
- (d) (5) True/False:  $f(x)$  has an infinite discontinuity in this part of the graph.  $\underline{\hspace{2cm}}$ . If so, where is it?  $x = \underline{\hspace{2cm}}$ . (If not leave this space blank.)
- (e) (5) True/False:  $f(x)$  has a removable discontinuity shown in this part of the graph.  $\underline{\hspace{2cm}}$ . If so, where is it?  $x = \underline{\hspace{2cm}}$ . (If not leave this space blank.)

3. Compute *any four* of the following limits. (Only the best four will be counted for your total score.)

(a) (10)

$$\lim_{x \rightarrow 1} \frac{x^2 + 5x - 6}{x^2 + 4x - 5}$$

Limit = \_\_\_\_\_

(b) (10)

$$\lim_{h \rightarrow 2} \frac{\sqrt{1+h} - \sqrt{3}}{h-2}$$

Limit = \_\_\_\_\_

(c) (10)

$$\lim_{t \rightarrow \infty} \frac{2t^2 + 5}{t^2 + 3t + 1}.$$

Limit = \_\_\_\_\_

(d) (10)

$$\lim_{x \rightarrow 1} \frac{x^3 + 3x + 1}{7x^3 + x^2 + 4x}.$$

Limit = \_\_\_\_\_

(e) (10)

$$\lim_{t \rightarrow 0} \frac{\sin(t)}{8t}.$$

Limit = \_\_\_\_\_

4. Let  $f(x) = x^2 - 2x + 2$ .

- (a) (5) What is the slope of the secant line to the graph through the points  $(1, 1)$  and  $(3, 5)$ ?

Slope = \_\_\_\_\_

- (b) (5) Give a general formula for the slope of the secant line through the points  $(1, 1)$  and  $(1 + h, (1 + h)^2 - 2(1 + h) + 2)$ .

Slope = \_\_\_\_\_

(c) (5) Find the limit as  $h \rightarrow 0$  of your slope from part (b).

Limit = \_\_\_\_\_

(d) (5) What does your answer in part (c) tell you in terms of the graph  $y = f(x)$ , related lines, etc.?