

MTH 151**Exam 1****Fall 2013**

Show all work in a neat and organized fashion. Clearly indicate your answers.
100 points possible.

Problems 4 and 8 are intentionally omitted.

Problems 1 and 6 are graphical problems on separate pages.

Seven problems, 15 points each, maximum possible score 105 out of 100.

2. (15 pts.) Let

$$f(x) = \begin{cases} x^2 - 5, & x \leq 1 \\ x + 2, & 1 < x < 3 \\ 7, & x = 3 \\ 8 - x, & x > 3. \end{cases}$$

State each of the following (or write DNE, if it does not exist).

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

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

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

(d) $\lim_{x \rightarrow 3^-} f(x)$

(e) $\lim_{x \rightarrow 3^+} f(x)$

(f) $\lim_{x \rightarrow 3} f(x)$

3. (15 pts.) Evaluate this limit symbolically (algebraically), neatly showing all significant algebraic steps.

$$\lim_{x \rightarrow -8} \frac{\frac{1}{8} + \frac{1}{x}}{8 + x}$$

5. (15 pts.) Find a and b such that f is continuous everywhere.

$$f(x) = \begin{cases} 8 - x^2, & x < 2 \\ ax + b, & 2 \leq x \leq 6 \\ x^2 - 4x - 3, & x > 6. \end{cases}$$

7. (15 pts.) The flash unit on a camera operates by storing charge on a capacitor and releasing it suddenly when the flash is set off. The data in the table describe the charge Q remaining (in microcoulombs, or μC) at time t , where t is the number of seconds after the flash is set off.

t (seconds)	0.00	0.02	0.04	0.06	0.08	0.10
$Q(t)$ (μC)	100.00	81.87	67.03	54.88	44.93	36.76

(a) Find the average rate at which the charge Q changed from $t = 0.00$ to $t = 0.06$. (You do not have to write a sentence.) Include the units in your answer.

(b) Use the data in the table (without graphing) to estimate the rate at which the charge was changing at $t = 0.06$. (You do not have to write a sentence.) Include the units in your answer.

(c) Use the data in the table (without graphing) to estimate the rate at which the charge was changing at $t = 0.025$. (You do not have to write a sentence.) Include the units in your answer.

9. (15 pts.) Let

$$f(x) = \frac{1}{\sqrt{5x}}.$$

Find $f'(x)$ by using the definition of derivative

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}.$$

Neatly show all significant algebraic steps. You may do parts (a), (b), and (c) separately, if you label them.

(a) $f(x+h) - f(x)$

(b) $\frac{f(x+h) - f(x)}{h}$

(c) $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$