## Math 141

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Spring 2011
Name:
Student ID (last 6 digits): XXX-

TA recitation (check one):
Cody Lorton: $\square$ 8:00 Craig Collins: $\square 11: 15$
$\square$ 9:05 $\square 12: 25$

## Make-Up Midterm 1

You have 50 minutes to complete the exam. Do all work on this exam, i.e., on the page of the respective assignment. Indicate clearly, when you continue your solution on the back of the page or another part of the exam.

Write your name and the last six digits of your student ID number on the top of this page. Check that no pages of your exam are missing. This exam has 5 questions and 8 printed pages (including this one and a page for scratch work in the end).

No books, notes or calculators are allowed on this exam!

Show all work! (Unless I say otherwise.) Correct answers without work will receive zero. Also, points will be taken from messy solutions.

## Good luck!

| Question | Max. Points | Score |
| :---: | :---: | :---: |
| 1 | 30 |  |
| 2 | 15 |  |
| 3 | 15 |  |
| 4 | 20 |  |
| 5 | 20 |  |
| Total | 100 |  |

1) Compute the following limits. If they do not exist or are infinite, check if the side limits exist.
(a) [5 points] $\lim _{x \rightarrow 1} \frac{x^{3}-x}{x^{2}-x+1}$
(b) [5 points] $\lim _{x \rightarrow-\infty} \frac{x^{3}-1}{x^{2}-100 x+1000}$
(c) [10 points] $\lim _{x \rightarrow 1} \frac{x^{2}-2 x+1}{|x-1|}$ [Hint: You might need side limits.]
(d) $[10$ points $] \lim _{x \rightarrow 1} \frac{1}{x-1}+\frac{1}{(x-1)(x-2)}$
2) [15 points] Compute the following derivative (using the formulas, no need for limits).

$$
\frac{\mathrm{d}}{\mathrm{~d} x}\left(\frac{x \cdot \sin (x)-\mathrm{e}^{x}}{x^{2}+\sqrt{x}}\right)
$$

No need to simplify! Note that you might get less partial credit if you skip steps and get the wrong answer. [No penalty if the answer is correct.]
3) [15 points] Compute the derivative of $f(x)=\sqrt{2 x+1}$. You cannot use any formulas we haven't seen in class! You must use limits!
4) [20 points] The graph of the position $s$ of particle moving along a straight line with respect to time $t$ for $t \in[0,4]$ is given below.


Determine [for $t \in[0,4]]$ :
(a) Fill the table below with "+" if the corresponding function (velocity or acceleration of the particle) is positive in the respective interval and with "-" if the function is negative.

|  | $(0,0.76)$ | $(0.76,1.38)$ | $(1.38,2.16)$ | $(2.16,3.62)$ | $(3.62,4)$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| velocity |  |  |  |  |  |
| acceleration |  |  |  |  |  |

(b) When was the velocity maximal and when was it minimal?
5) [20 points] Sketch the graph of a function $f(x)$ which satisfies all of the following conditions:

- $f(0)=f^{\prime}(-2)=f^{\prime}(1)=f^{\prime}(9)=0 ;$
- $\lim _{x \rightarrow \infty}=0, \lim _{x \rightarrow 6}=-\infty$;
- $f^{\prime}(x)<0$ on the intervals $(-\infty,-2),(1,6)$, and $(9, \infty)$;
- $f^{\prime}(x)>0$ on the intervals $(-2,1)$ and $(6,9)$;
- $f^{\prime \prime}(x)>0$ on the intervals $(-\infty, 0)$ and $(12, \infty)$;
- $f^{\prime \prime}(x)<0$ on the intervals $(0,6)$ and $(6,12)$.



## Scratch:

