

Your Name (please PRINT clearly)

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Quiz Section

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Student ID #

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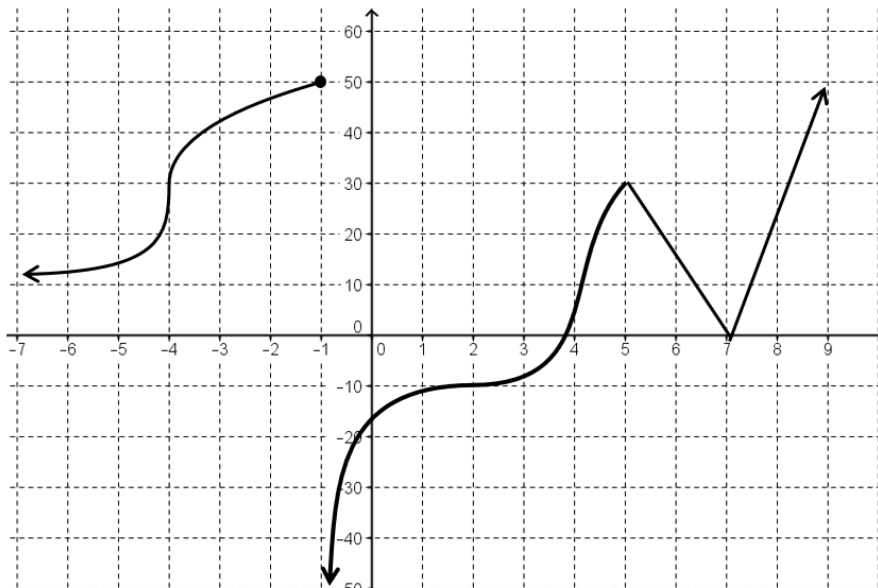
PLEASE READ these instructions:

- This exam is 80 minutes long. Once the exam starts, check that you have a complete exam: there should be 6 problems on 5 pages of questions.
- **All pages are double-sided, except for this cover page and the back of the last page.** You may use the blank sides in this exam for extra room, if needed, but clearly **indicate in the problem area** that more work is on the back of the cover or on the last page.
- This exam is closed book. You may use one two-sided sheet of handwritten notes and a TI-30X IIS calculator. Do not share notes.
- No headphones or electronic devices are permitted. Turn OFF your cell phone and put it away.
- Unless otherwise instructed, remember to **show your work**. If your work is incorrect, incomplete, or unreadable, you may receive little credit, even if the answer itself happens to be correct.
- Simplify your answers but leave them in exact form (e.g.  $\pi\sqrt{2} + \frac{e}{2}$ ). Place a box around your final answer to each question.
- Please stay within the page borders. Exams will be scanned and the far edges may not be readable.
- Read each problem carefully, before and after answering it. Raise your hand if you have a question. Good luck!

Problem	Points
1	11
2	10
3	8
4	5
5	8
6	8
<b>Total</b>	<b>50</b>

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1. (11 points) The graph of a function  $y = f(x)$  is shown below. Use it to answer the questions on this page. In this problem you do not need to show work, except as indicated.



- (a) Does this graph have any **vertical asymptotes**? Circle YES or NO.

If yes, list their equation(s):

- (b) Does this graph have any **vertical tangent lines**? Circle YES or NO.

If yes, list their equation(s):

- (c) List all the values  $a$  where  $f(x)$  is not continuous at  $x = a$ :

- (d) List all the values  $a$  where  $f(x)$  is not differentiable at  $x = a$ :

- (e) Evaluate the following limits, or state that the limit does not exist:

$$\lim_{x \rightarrow 5} f(x) =$$

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

$$\lim_{x \rightarrow 5^+} \frac{f(x) - 30}{x - 5} =$$

- (f) The average rate of change of  $f(x)$  between  $x = 2$  and  $x = 5$  is:

- (g) The instantaneous rate of change of  $f(x)$  at  $x = 2$  is:

2. (10 points) Determine the values of the following limits, or state that the limit does not exist. If it is correct to say that the limit is  $+\infty$  or  $-\infty$ , then you should say so. Show correct work or justification.

(a)  $\lim_{x \rightarrow 0} \frac{\cos(x) - 2}{\sin^2(x)}$

(b)  $\lim_{x \rightarrow 0} \frac{\sin^2(\pi x)}{x^2}$

(c)  $\lim_{x \rightarrow 3} \frac{x^2 - 18x + 45}{2x - 6}$

3. (8 points) Compute the appropriate limits to determine if the function

$$f(x) = \sqrt{9x^2 - x + 1} - 3x$$

has any **horizontal asymptotes**. If yes, list (and box) their equations  $y = b$ . If there are none, state so as your answer. Show all work and use correct limit notation.

4. (5 points) Compute the derivative  $g'(x)$  of the function  $g(x) = (x + \cos x)e^x + 2x\sqrt{x} + \frac{\pi}{2}$ .

5. (8 points) Given the function:

$$f(x) = \begin{cases} cx^2 - x + 3, & \text{for } x \leq -1 \\ x + d, & \text{for } x > -1 \end{cases}$$

(a) Find an equation satisfied by the constants  $c$  and  $d$  if the function  $f$  is continuous at  $x = -1$ .

(b) Compute the values  $c$  and  $d$  for which the function  $f$  is also differentiable at  $x = -1$ .

6. (8 points) Find the equations of all the tangent lines to the curve:

$$y = \frac{x-1}{x+1}$$

which are parallel to the line

$$x - 2y = 3.$$

Show your work and put your answers in the form  $y = mx + b$ .

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