Math 111 Exam #1
Sept. 27, 2017

Time: 1 hour and 10 minutes
Instructions: Show all work for full credit.
No outside materials or calculators allowed.
Extra Space: Use the backs of each sheet
for extra space. Clearly label when doing so.

Name: _____

ID #: _____

Instructor/Section: _____

*"I pledge by my honor that I have abided by the
NJIT Academic Integrity Code."*

_____ (Signature)

Problem	Value	Score
1	15 pts.	
2	20 pts.	
3	20 pts.	
4	20 pts.	
5	15 pts.	
6	10 pts.	
TOTAL	100	

1. Consider the curve $y = f(x) = x^3 + x + 1$.

(a) Explain (using a theorem) why $f(x) = 0$ for some x in the interval [-1,1]. **(5 pts.)**

(b) Find the tangent line to the curve at (0,1). **(10 pts.)**

2. Evaluate the following limits, allowing $+\infty$ and $-\infty$ as possible values of a limit. If the limit does not exist, explain why. Show all work. **(5 pts. each)**

(a) $\lim_{x \to 0} \dfrac{\tan(3x)}{\sin(x)}$ (b) $\lim_{x \to 4} \dfrac{4-x}{5-\sqrt{x^2+9}}$ (c) $\lim_{x \to \infty} \left(e^{-x} + \tan^{-1}(x)\right)$ (d) $\lim_{x \to 2} \dfrac{x^3-4x}{x^2-2x}$.
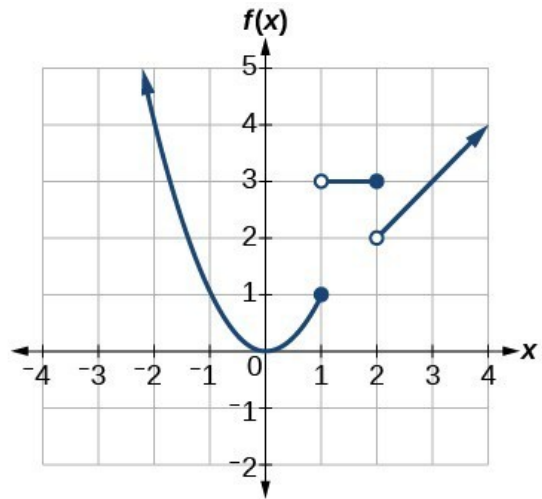
3. For what values of a and b is the function defined as

$$f(x) = \begin{cases} (x^2 + 2x - 15)/(x-3), & x < 3 \\ ax + b, & 3 \le x \le 5. \\ 0, & 5 < x \end{cases}$$

continuous on the whole real line $(-\infty, \infty)$? Show all work. **(20 pts.)**

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4. Given the graph of the piecewise function
$f(x)$, answer the following: **(10 pts. each)**

a. Find $\lim_{x \to 1} f(x)$ or explain why it
does not exist (Show all work,
including left and right limits)

b. Find f '(2.5), the derivative of the
function at x = 2.5

5. Find all horizontal, vertical and slant (oblique) asymptotes for the following function. Show all work involving limits and other methods. **(15 pts.)**

$$f(x) = \frac{x^2 - x}{x - 2}.$$

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6. Use the limit quotient definition to find the derivatives of each of the following functions, and show all work:

(a) $y = f(x) = x^2 + 1$ **(4 pts.)**

(b) $y = g(x) = (x+1)^{-1}$, for $x \neq -1$. **(6 pts.)**