Amherst College
Department of Mathematics and Statistics

MATH 105 TEST #1 FALL 2015

NAME:_____

Read This First!

- This is a closed-book examination. No books, notes, calculators, cell phones, communication devices of any sort, webpages, or other aids are permitted. **Cell phones out of sight.**
- Please read each question carefully. Show **ALL** work clearly in the space provided. You may use the backs of pages for additional work space.
- In order to receive full credit on a problem, solution methods must be complete, logical and understandable
- Answers must be clearly labeled in the spaces provided after each question.
- The exam consists of Questions 1–6, which total to 100 points. Question 7 is a bonus question (5 points extra credit) that is optional.

Grading - For Instructor Use Only

Question:	1	2	3	4	5	6	7	Total
Points:	24	18	20	15	15	8	0	100
Score:								

1. [24 points] Compute the following limits. If $+\infty$ or $-\infty$ is a correct answer, please give it.

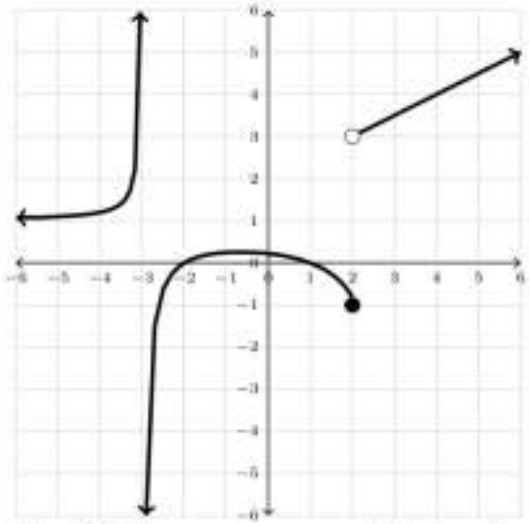
(a) $\lim_{x \to 1} \dfrac{1+x^2}{1+x}$

(b) $\lim_{x \to 1} \dfrac{x-1}{x^2+x-2}$

(c) $\lim_{x \to 4^+} \dfrac{x^2-1}{4-x}$

(d) $\lim_{x \to 1} \dfrac{\sqrt{x^2+1}-\sqrt{2}}{x-1}$

2. [18 points] Consider the following graph:



(a) What is the domain of f? Express your answer in interval notation.

(b) For which x's is $f(x) = 0$?

(c) For which x's is $f(x) < 0$? Express your answer in interval notation.

(d) Is f continuous at 2? Explain you answer using the definition of continuity.

3. [20 points] Consider the function defined by

$$g(x) = \begin{cases} 1/x & x > 0 \\ 1 & x = 0 \\ 2 - x^2 & x < 0. \end{cases}$$

(a) Draw the graph of g.

(b) Use the graph of part (a) to find $\lim_{x \to 0^+} g(x)$, $\lim_{x \to 0^-} g(x)$, $\lim_{x \to 0} g(x)$ and $g(0)$.

4. [15 points] Let

$$f(x) = \frac{x+1}{x+2} \quad \text{and} \quad g(x) = \frac{1-x}{1+x}.$$

Simplify $f(g(x))$ as much as possible.

5. [15 points] Suppose we know the limits

$$\lim_{x\to 2} f(x) = 4, \quad \lim_{x\to 2} g(x) = 3, \quad \lim_{x\to 2} h(x) = 0.$$

(a) What do the limit laws say about $\lim_{x\to 2} \dfrac{f(x)}{g(x)}$?

(b) What do the limit laws say about $\lim_{x\to 2} \dfrac{h(x)}{g(x)}$?

(c) What do the limit laws say about ~~$\lim_{x\to 2} \dfrac{g(x)}{h(x)}$~~? $\lim_{x\to 2} \dfrac{g(x)}{h(x)}$

6. [8 points] Find the equation of the line perpendicular to the line $2x+5y = 10$ that goes through the point $(-\frac{1}{2}, 2)$.

7. [5 points (bonus)] Let $f(x) = 1 - x^2$. Compute

$$\lim_{h \to 0} \frac{f\left(\frac{1}{x+h}\right) - f\left(\frac{1}{x}\right)}{h}.$$