Math 170 Calculus I

Exam I Review ∘ Exam I: Friday, February 9, 2018

Exam I will be based on material from Chapter 0 and Sections 1.1-1.3. A few sample problems are below. *There may be additional questions, directly from the homework, that do not appear on this sheet - be sure to review that as well!*

You will be expected to know:

- what a **function** is, and how to determine if a graph is a function or just a relation from its graph
- what is meant by the **domain** and **range** of a function, and how to find them
- how to find the inverse of a function, if it exists, and how to check that your inverse is correct
- the graphs of e^x and $\ln(x)$, and the relationship of these functions
- how to expand a logarithmic expression into a sum of logarithmic expressions that cannot be further simplified
- how to solve logarithmic and exponential equations
- whether the **limit** of a function $f(x)$ exists as x approaches a, ∞, and $-\infty$
- what is meant by a **one-sided limit**
- how to find the limit of a polynomial or rational function at a point, or at $\pm\infty$
- the "limit laws" of Theorem 1.2.2

Some sample problems:

1. Find the domain of each of the following functions:
   (a) $f(x) = \dfrac{2x+1}{x^2-7x+12}$ (b) $f(x) = \sqrt{x^2-4}$ (c) $f(x) = 8x^3+3x-1$

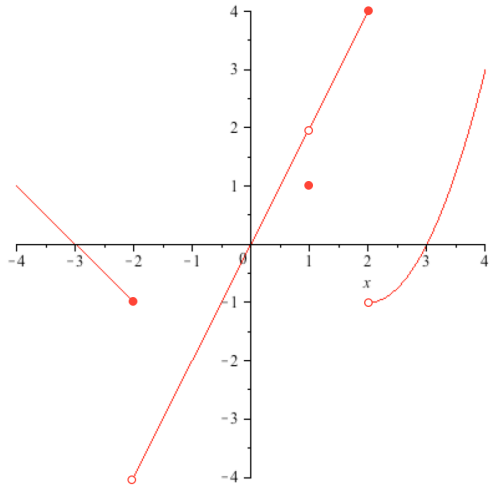
2. If $y = x^2+7x-2$, find any values of x where $y = -14$.

3. Find $(f \circ g)(x)$ and $(g \circ f)(x)$, and simplify completely, if
   (a) $f(x) = 3x$ and $g(x) = 2x+5$
   (b) $f(x) = \dfrac{x}{2x+3}$ and $g(x) = \dfrac{1}{x-4}$
   (c) $f(x) = \sqrt{x}$ and $g(x) = x^2-8x+16$

4. If $f(x) = 2(x-1)^3+4$, find functions g and h so that $f = g \circ h$.

5. (a) Decide if the function $f(x) = 6x-8$ has an inverse, and if so, find it.
   (b) Verify that you have found the inverse of $f(x)$.

6. Refer to the graph of the function $f(x)$ below:



   (a) Find $f(-2)$, $f(0)$, $f(1)$, and $f(4)$

   (b) Find $\lim_{x\to -2} f(x)$, $\lim_{x\to -2^+} f(x)$, $\lim_{x\to 1} f(x)$, $\lim_{x\to 0} f(x)$, and $\lim_{x\to 2^-} f(x)$

   (c) Find the roots of $f(x)$

7. Expand in terms of sums, differences, and multiples of smaller logarithms that cannot be further reduced.

   (a) $\ln\left(\dfrac{x^5}{\sin^3(x^4)}\right)$ (b) $\ln\left(\dfrac{\sqrt[4]{x-4}}{x^2+1}\right)$

8. Rewrite as a single logarithm: (a) $\frac{1}{3}\log(x) - 4\log(x+1) + \log 100$ (b) $\ln 5 + 3\ln 2 - \ln 16$

9. Solve for x: (a) $\ln(x^3) = 5$ (b) $\log_{10}(1+x) = 2$

10. Find $f(0)$, $f(-6)$, and $f(2)$ if $f(x) = \begin{cases} x-3, & x < -2 \\ x^2, & -2 \le x \le 5 \\ 3x+6, & x > 5 \end{cases}$

11. Find the limits:

   (a) $\lim_{x\to 3} \dfrac{4x-12}{x^2-x-6}$ (b) $\lim_{x\to 0^+} \dfrac{1}{x^2} + 3$ (c) $\lim_{x\to\infty} \dfrac{7x^2+2x-3}{4x^2+5x+11}$

12. Draw a sketch of a function $f(x)$ with the following properties:

   (a) $\lim_{x\to\infty} f(x) = 5$, $\lim_{x\to -\infty} f(x) = -5$

   (b) $\lim_{x\to 0} f(x)$ does not exist

   (c) $f(0) = 3$

   (b) $\lim_{x\to 3} f(x) = 4$