Exam 1 Review
Math 170 - Calculus I

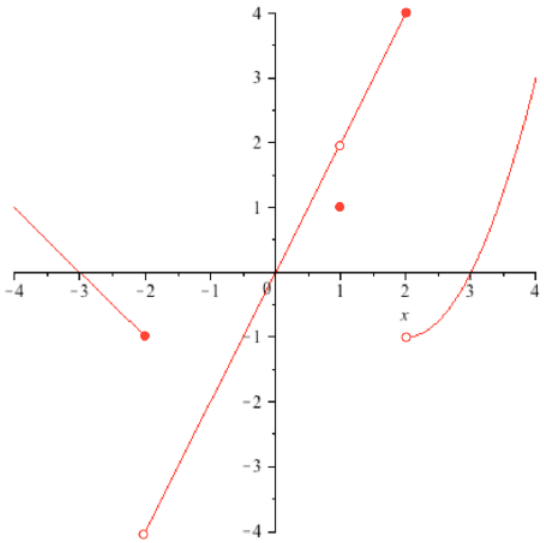
Exam I will be based on the material from Chapters 0 and 1.

You will be expected to know:

- what a **function** is and how to determine if a graph is a function
- what is meant by the **domain** and **range** of a function, and how to find them
- the various transformations of functions (how does adding a constant to $f(x)$ change its graph, etc)
- how to **compose** functions, and whether or not this is a commutative operation
- how to graph some simple functions, including lines and x^2
- what the **inverse of a function** is, and how to decide if a function has an inverse
- how to find the inverse of some simple functions
- the graphs of e^x and $\ln(x)$, and the relationship between these functions
- how to solve equations involving exponentials and logarithmic functions
- 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
- when a function has a **vertical or horizontal asymptote**, and how to find it
- what it means for a function to be **continuous** at a point and on an interval
- the different types of **discontinuities** that may occur (jump, infinite, removable)
- the properties of continuous functions in Theorem 1.5.3
- that all polynomials are continuous everywhere, as are $\sin(x)$ and $\cos(x)$
- where rational functions are continuous
- that the composition of continuous functions is continuous
- that if $f(x)$ is continuous and it has an inverse $f^{-1}(x)$, then $f^{-1}(x)$ is continuous

Some sample problems - please note that these are just some of the types of problems you may see on the exam; this list is **not** exhaustive

1. Find $(f \circ g)(x)$ and $(g \circ f)(x)$ if $f(x) = 3x$ and $g(x) = 2x + 5$
2. Decide if the function $f(x) = 6x - 8$ has an inverse and, if so, find it. Verify that you have found the inverse of $f(x)$.
3. Simplify (write as a single expression): $6\log_4 3 - 4\log_4 5x$
4. Expand $\ln\left(\dfrac{5x^3\sin(x+1)}{6\sqrt{x+3}}\right)$ as a sum and difference of logarithms.
5. Solve the equations for x:
   (a) $e^x - 2xe^x = 0$
   (b) $\ln(1/x) = 10$
6. Find the vertical and horizontal asymptotes, if any, of the function $f(x) = \dfrac{x^2 - 3x}{2x - 2}$
7. Find the limits:
   (a) $\lim\limits_{x\to 3} \dfrac{4x - 12}{x^2 - x - 6}$
   (b) $\lim\limits_{x\to 0^+} \dfrac{1}{x^2} + 3$
   (c) $\lim\limits_{x\to\infty} \dfrac{7x^2 + 2x - 3}{4x^2 + 5x + 11}$
   (d) $\lim\limits_{x\to 0} \dfrac{\sin(4x)}{5x}$
8. Refer to the graph of the function $f(x)$ below:



   (a) Find $f(-2), f(0), f(1),$ and $f(4)$
   (b) Find $\lim\limits_{x\to -2} f(x)$, $\lim\limits_{x\to -2^+} f(x)$, $\lim\limits_{x\to 1} f(x)$, $\lim\limits_{x\to 0} f(x)$, and $\lim\limits_{x\to -2^-} f(x)$
   (c) Find any points x where $f(x)$ is discontinuous, and classify he type of discontinuity
9. Where is the function $f(x) = \dfrac{x^2 - 9}{x^2 + 8x + 15}$ discontinuous?
10. Which of the following functions are continuous everywhere?
    (a) $sin(x^3 + 2x)$
    (b) $3x^2 + \tan(x)$
    (c) $\sqrt{5x + 3}$