

**Math 163A****Guide for Test 3**

Here are some sample questions from old tests. Some topics that we covered are not represented by these questions, but are still fair game.

1. Sketch the graph of a single function that has all of the following properties:
  - (a) Continuous and differentiable everywhere except at  $x = -3$ , where it has a vertical asymptote.
  - (b) A horizontal asymptote at  $y = 1$ .
  - (c) An  $x$ -intercept at  $x = -2$ .
  - (d) A  $y$ -intercept at  $y = 4$ .
  - (e)  $f'(x) > 0$  on the intervals  $(-\infty, -3)$  and  $(-3, 2)$ .
  - (f)  $f'(x) < 0$  on the interval  $(2, \infty)$ .
  - (g)  $f''(x) > 0$  on the intervals  $(-\infty, -3)$  and  $(4, \infty)$ .
  - (h)  $f''(x) < 0$  on the interval  $(-3, 4)$ .
  - (i)  $f'(2) = 0$ .
  - (j) An inflection point at  $(4, 3)$ .
  
2. Let  $f(x) = \frac{x^3}{3} - 2x^2 + 3x + 1$ .
  - (a) Find the domain of  $f$ , any discontinuities, any asymptotes, and its  $y$ -intercept.
  - (b) Find the critical points, extrema, and intervals of increase or decrease.
  - (c) Find the intervals where it is concave up, and any inflection points.
  - (d) Graph  $f(x)$ , labeling the points that you found above.
  
3. Analyze and graph the function  $f(x) = x + \frac{9}{x}$ .