# Exam 1

Friday, February 24

1. (20 points) Sketch the graph of a function $f(x)$ with domain $[-3, 2]$ that
   - is continuous at $-2$ from the positive side but not from the negative side,
   - is discontinuous at 2,
   - goes to infinity at 1,
   - is continuous everywhere else on its domain, and
   - is not differentiable at 0.
2. (20 points) Evaluate $\lim_{x \to 0} \frac{1 - \cos x}{x^2}$. Hint: Multiply and divide by $1 + \cos x$.
3. (30 points) Let $y = e^{x/\sqrt{2}} \sin \frac{x}{\sqrt{2}}$. Find $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$, $\frac{d^3y}{dx^3}$, and $\frac{d^4y}{dx^4}$. Hint: Simplify as often as possible. $\frac{d^2y}{dx^2}$ looks a lot like $y$. $\frac{d^4y}{dx^4}$ looks even more like $y$.
4. (30 points) A light is attached to the wall of a building 64 feet above the ground. A ball is dropped from the same height 20 feet away from the side of the building. How fast is the shadow of the ball moving along the ground after 1 second? Recall that the equation for motion with constant acceleration is $y = \frac{1}{2}at^2 + v_0 t + y_0$ and the acceleration due to gravity is $-32$ ft/s$^2$. Hint: Use similar triangles, not sines and cosines.