Discussion Problems for Math 180

Thursday, February 26, 2015

Review

1. Complete the square: $x^2 - 2x$
2. (a) What are the volume V and surface area A of a sphere with radius r?
   (b) What is the volume V of a cylinder with radius r and height h?
3. Calculate derivatives:
   (a) $\cos \ln x$
   (b) $\sqrt{3x + \sin(x)}$
   (c) $\frac{1}{2} \tan^{-1}\left(\frac{x+2}{2}\right)$

This time

4. The sides of a square grow at a rate of 2 cm per minute. At the time that the square is 4 cm by 4 cm,
   (a) how fast is the area of the square growing?
   (b) ... the perimeter ...?
   (c) ... the length of the diagonal ...?
5. High atop university hall, your TA inflates a water balloon from a hose which pumps out water at a rate of 628 mL/s. Assuming that the water balloon remains perfectly spherical while inflating, how fast is the diameter of the balloon expanding when the balloon is 10 cm across? Use the approximation $\pi \approx 3.14$ to get an approximate answer. (Recall that $1\,\text{mL} = 1\,\text{cm}^3$.)
6. A water balloon dropped from the top of University Hall will be at a height of

   $$h(t) = 102\,\text{m} - (5\,\text{m/s}^2)t^2$$

   at time t. (This equation neglects the very significant effects of air resistance, but we're going to roll with it for now.)
   (a) How long will it take for the balloon to hit a roughly two meter-tall student on the head?
   (b) How fast will the balloon be moving upon impact?