

# Discussion Problems for Math 180

November 6, 2014

1. 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 diagonal?
2. A five-foot-tall man leans against a wall to take a nap. After a while, his feet start sliding away from the wall at a rate of one inch per minute. His head remains against the wall, and his body remains rigid, like so:



- (a) How fast is his head sliding down the wall when it's four feet above the ground?
  - (b) ... three feet above the ground?
  - (c) How fast is his head sliding right as it hits the ground? (This will require some thought.)
3. If your friend finished the 26-mile-long Chicago Marathon in 4 hours (an average of 6.5 miles per hour), can you be sure that she was moving at exactly 6.5 miles per hour at some point in time? Why or why not?
  4. (a) Does the function
$$f(x) = x^5 + x$$
have any critical points? Why or why not?
    - (b) How about
$$g(x) = 3840x^4 - 140194x^3 - 12304x^2 + 250x - 17?$$
  5. (a) What is the volume,  $V$ , of a sphere with radius  $r$ ?
    - (b) How many cubic centimeters are there in a milliliter?
    - (c) 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.