Worksheet 26 April 27, 2011

Today you're welcome to skip around on the worksheet in preparation of the exam; just be sure your group is working on the same problem.

1. Suppose a squirrel moves along a fencetop, and the speed gun you have set up records the following data:

time	0	1	2	3	4	6	7
velocity	4	3	23	-8	5	-1	3

   (time is in seconds, velocity in cm/s.) Estimate the displacement of the squirrel during his travels. Estimate the total distance he runs.

2. The squirrel now leaps off the fence and falls due to gravity. His target is your ice cream cone, a distance of 1 meter away and 25cm below his position. If he leaps with horizontal velocity 0.5 m/s, what should his initial vertical velocity be to reach his target?

3. Find the number b such that the line $y = b$ divides the region bounded by the curves $y = x^2$ and $y = 4$ into two regions with equal areas.

4. Suppose the regions from the previous problem are rotated about the x-axis. Find the number b so that the resulting two solids have equal volumes.

5. Compute the volume of a right circular cone by realizing the cone as a solid of revolution. You should have the height h left as an unspecified constant in the formula. ("Right" means that the angle at the cone's point is a right angle, "circular" means the cross-sections are circles.)

6. Find the average velocity of a squirrel in the interval $t \in [0, 3]$ if his

   (a) position is given by $p(t) = \ln(1 + t) + \dfrac{1}{1 + t^2}$.

   (b) velocity is given by $v(t) = \sin(\pi t)e^{\cos(\pi t)}$.

   (c) acceleration is given by $a(t) = \dfrac{t}{(1 + t^2)^2}$ and his initial velocity is 5.

7. Prove that a linear function cannot have more than one root. Use this to prove that a quadratic function cannot have more than two roots. Use this to prove that a cubic function cannot have more than three roots. (All of this is assuming your function isn't the constant zero function.)

8. Estimate $\sqrt[4]{2}$.

9. Compute the total distance traveled by a particle with velocity $v(t) = \sin t$ for $0 \leq t \leq 5\pi/2$.

10. Compute the area bounded by the curves $y = x^3 + 4$ and $y = 4x^2 + x$.