Final Review Lecture 2
Goal: More Final Review

We will look at the Fall 2011 final today

Final Details: Exam is comprehensive.
Layout: ~8 pages total

~*3 pages*: Trig (ch 15-20)
- triangles
- circular motion
- sinusoidal waves

~*3 pages*: Models (ch 1-4,7,10-12,14)
- lines & circles
- quadratics
- exponentials
- linear-to-linear
- linear motion
- coordinates, distance, speed

~*2 pages:* Function skills (ch 5,6,8,9,13)
- notation
- multi-part
- labeling figures/graphs, height, area
- composition, inverses, algebra
- transformations

Fall 2011 Problem 1

1. You have 300 meters of fencing with which to build two enclosures. One will be a square, and the other will be a rectangle where the length of the base is exactly twice the length of the height.

(a) Give the dimensions of the square and rectangle that minimize the combined area.

(b) What is the maximum combined area?

2. Erika is measuring the height of a tree. She is standing on the ground at some distance from the tree and measures an angle of 63 degrees to the top of the tree. She walks 20 feet further away from the tree and measures an angle of 50 degrees to the top of the tree (this is her second measurement). A year later she comes back to check on the tree and it has grown. She measures the angle from the same location as the second measurement from the year before and now gets an angle of 52 degrees. How much taller is the tree?

3. A weight is attached to a spring suspended from the ceiling. The height h(t) of the weight is a sinusoidal function of time t. At time t = 5 seconds, the weight is at its lowest height of 15 cm. The weight next reaches its highest height of 37 cm at time t = 9.4 seconds. During the first 20 seconds, how much time is the weight above 28 cm?

4. (a) Let $f(x) = \dfrac{x+1}{2x}$ and $g(x) = 7x - 1$.
Find the inverse of $h(x) = f(g(x))$.

(b) Find all linear functions f(x) such that the function
g(x) = f(f(x)) has the properties g(1) = 10 and g(2) = 14.

5. William took a walk near the Circular Dunes. The Circular Dunes is a perfect circle, with a radius of 7 km. William began his walk from a point 11 km due north of the center of the Dunes. He walked due east for one hour, and then due south for three hours. He then walked due west until he left the Dunes. William walked at a constant speed of 3 km/hr.

(a) For what length of time was William in the Dunes?

(b) Suppose William had walked in a straight line from the point where he entered the Dunes to the point where he exited. If he continued along that line, how far west of the center of the Dunes would he be when he was due west of the center?

6. Rosetta is growing a bamboo plant in her apartment. The height of the plant is a linear-to-linear function of time. Thirty days ago, the plant was 14 cm high. Today, the plant is 18 cm high. The plant always increases in height, and will approach (but never exceed) a height of 32 cm.

(a) Find a function representing the height of the plant as a function of time.

(b) Rosetta also has a fast-growing cactus. Today, its height is 9 cm. The cactus grows at a constant rate of 1 cm per day. When will the cactus and the bamboo plant be the same height? Give your answer in days after today.

7. The population of the city of Alk increases by 17 percent every 12 years. In 2010, the population of Alb was 8,000. The population of the city of Bem doubles in the length of time it takes for the city of Alk to triple. In 2005, there were 15,000 people in Bem. When will the cities have the same population? Give your answer in years after 2010.

8. Maria is riding a ferris wheel. Her linear speed is 5 meters per second. After the ride starts, it takes Maria 8 seconds to reach the highest point on the ride. It takes 18.5 seconds from when the ride starts for Maria to reach the lowest point on the ride. The highest point of the ride is 36 meters off the ground. How high above the ground is Maria 120 seconds after the ride starts?