Welcome to the Weekly Review for MATH 2413. This week’s review talks about Optimization and Basic Integration. We would like to thank Patrick Bourque and the Fall 2014 MATH 2413 students for allowing us to film the Weekly Reviews.

The following problems are presented in the Week 12 videos. Thank you!

**Part A: Optimization**

1. Show that the sum of a positive number and its reciprocal is at least 2.

2. Find the point on \( y = \sqrt{x} \) closest to \((4, 0)\)
3. Build a box with square base with a total of $250. The wood for the top and bottom cost $5 per $ft^2$ where as the sides cost $3 per $ft^2$. Find the maximum volume.

4. A square piece of paper is 10 inches by 10 inches. Square corners are cut out and the sides are folded up to produce a box with an open top. Find the maximum volume.
5. An offshore oil well is 3 miles off the coast. The refinery is 5 miles down the coast. It costs twice as much to build a pipe under the water versus on land. What path should the pipe take to minimize cost?

6. Find the maximum volume of a cone inscribed in a sphere of radius R.
Part B: Basic Integration

1. Introduction to the Basic Rules of Integration

2. \[ \int \left( \frac{(\sqrt{x} + 1)(\sqrt{x} + 2)}{\sqrt{x}} \right) \, dx = \]

3. \[ \int \left( \frac{x^4 + x^3 + 7x^2 + 4x + 12}{x^2 + 4} \right) \, dx = \]
4. \( \int \left( \frac{\sec(x) + \tan(x)}{\cos(x)} \right) dx = \)

5. \( \int \left( \frac{\cos(2x)}{\cos(x) + \sin(x)} \right) dx = \)