Math 112 Exam #1
September 28, 2016

Time: 1 hour and 25 minutes
Instructions: Show all work for full credit.
No outside materials or calculators allowed.
Extra Space: Use the backs of each sheet
for extra space. Clearly label when doing so.

Name: _____

ID #:   _____

Instructor/Section: _____

*"I pledge by my honor that I have abided by the*
NJIT Academic Integrity Code."

_____ (Signature)

Problem(s)	Score	Total

1. Sketch the region bound by y = ln(x), y=0, and x=e. Then set up the integral to find the volume of the figure formed by rotating this area about the line y=3. Show a sketch of the region being revolved. DO NOT SOLVE THE INTEGRAL. **(10 points)**

2. Suppose that a spring has a natural length of 1 foot and that a force of 10 pounds is required to hold it compressed to a length of 6 inches. How much work is done in stretching the spring from its natural length to a total length of 2 feet? (**10 points**)

3. Suppose a line segment from the origin to the general point (r,h) is rotated about the y-axis as shown, creating a right circular cone. Find the volume of this cone in terms of r and h by using either the method of cross sections or method of cylindrical shells (**12 points**)
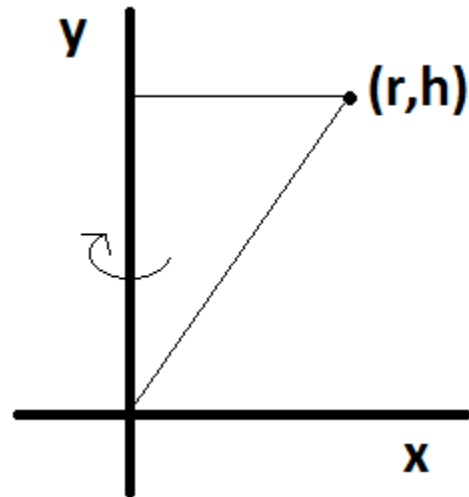
4. Find the volume of the figure formed by rotating the area bound between $y = x^2$ and $y = 2x$ around the y-axis. Use any method. **(10 points)**

5. Find the volume of the figure formed by rotating the area bound by the x-axis and the cubic $y = x^2 - x^3$ about the y-axis. (**12 points**)

6. Evaluate $\int \frac{\cos(\sqrt{3x})}{\sqrt{x}} dx$ (**8 points**):

7. Find the arc length of the curve $x = \frac{1}{6}y^3 + \frac{1}{2y}$ between y=1 and y=2 **(12 points)**

8. Find the surface area of the paraboloid formed when the curve $x = y^2$, $0 \le y \le \sqrt{2}$ is revolved around the x-axis. **(12 points)**

9. Suppose that a cylindrical tank is buried upright underground on one of its circular bases. The tank has a height of 6 meters and a radius of 2 meters. Suppose the top of the tank is exactly 3 meters below the earth's surface. If the tank is half filled with water weighing approximately 10,000 N/m³. Find the work needed to pump all the water in this tank to the ground's surface. **(14 points)**