Math 152 - Week-In-Review 3
Sinjini Sengupta

1. Set up the integral(s) to find the volume of the solid obtained by rotating the region bounded by the curves $y = \sin x$, $y = 0$, $x = 0$ and $x = \pi/4$, about the following:

   (a) the y-axis.

   (b) the x-axis.

   (c) the line $x = \pi$.

(d) the line $x = -\pi/2$.

(e) the line $y = -3$.

2. Set up the integral to find the volume of a solid whose base is the region bounded by the parabola $y = 8 - 8x^2$ and the x-axis and where the cross sections perpendicular to the y-axis are isosceles triangles with base equal to height.

3. A spring has a natural length of 20 cms. If a force of 25N is required to keep it stretched to a length of 30 cms, how much work would be required to stretch the spring from 25 cms to 40 cms?

4. A force of 10 pounds is required to hold a spring stretched 4 inches beyond its natural length. How much work is required to stretch the spring from its natural length to 6 inches beyond itsnatural length?

5. A uniform cable 40 feet long is hanging over the side of a building that is 500 feet tall. The cable weighs 60 pounds.

   (a) How much work would be required to pull up 10 feet of cable?

   (b) If there is a weight of 80 pounds attached to the bottom of the cable, how much work would be required to pull up 25 feet of cable?

6. If 6J of work are required to stretch a spring from 10 cms to 12 cms and 10J of work are required to stretch the spring from 12 cms to 14 cms, find the natural length of the spring.

7. A rope 20 meters long weighing 2 kilograms per meter is used to lift up 360 kilograms of coal from the bottom of a mine shaft. How much work is required to pull up the coal to the top of the mine?

8. A cylindrical tank, 6 meters tall with a diameter of 3 meters is half full of water. There is a 0.5 meter spout at the top of the tank.
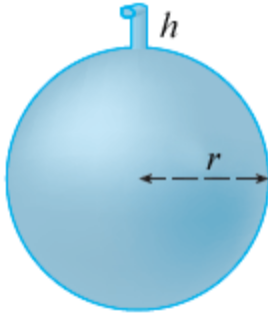
   (a) Set up the integral to find the work required to pump all the water out from the top of the tank.

   (b) If the tank is full of olive oil which has a density of 960 kilograms per cubic meter, how much work would be required to empty half the tank?

9. A 12 meter long tank in the shape of a triangular trough is full of water. Its vertical cross sections are isosceles triangles with base equal to its height of 4 meters.There is a 2 meter spout at the top of the tank. Set up the integral to find the work required to pump out the top 1.5 meters of water from the tank.
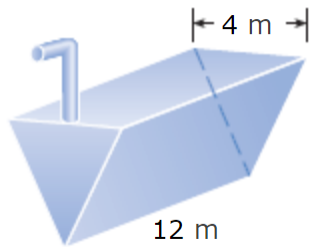
10. A spherical tank with a radius r of 5 meters is completely full of water. The tank has a 0.5 meter spout h at the top.

(a) Set up an integral to find the work required to empty the full tank of water.

(b) Set up an integral to find the work required to empty only half the tank of water.

(c) If you initially started out with only half a tank of water, set up an integral to find the work required to empty the tank.

11. Evaluate the indefinite integral $\displaystyle\int xe^{-2x}\ dx$.

12. Evaluate the indefinite integral $\displaystyle\int e^{3x}\cos x\ dx$.

13. Evaluate the indefinite integral $\displaystyle\int x^3 \ln x \; dx$.

14. Evaluate the definite integral $\displaystyle\int_1^{\sqrt{3}} \arctan\left(\frac{1}{x}\right) dx$.

15. Evaluate the definite integral $\displaystyle\int_0^\pi e^{\cos t}\sin 2t\ dt$.