1. Find the volume of the solid obtained by rotating the region bounded by $y = x^2 - 3x + 2$, $y = 0$; about the $y$-axis.

2. Suppose that 2 J of work are needed to stretch a spring from its natural length of 30 cm to a length of 42 cm. How much work is needed to stretch it from 35 cm to 40 cm?

3. Find the average value of the function $f(x) = \sin^2(x)\cos(x)$ on the interval $[-\pi/2, \pi/4]$. 

4. Find the volume of the solid obtained by rotating the region bounded by $y = x\sqrt{x^3 + 1}, \; y = 0, \; x = 0, \; x = 2$; about the y-axis.

5. An aquarium 2 m long, 1 m wide, and 1 m deep is full of water. Find the work needed to pump half of the water out of the aquarium.

6. Find the average value $f_{\text{avg}}$ of the function $f(x) = 4x - x^2$ on the interval $[0, 3]$ and determine the value $c$ on $[0, 3]$ such that $f_{\text{avg}} = f(c)$. 
7. Find the volume of the solid obtained by rotating the region bounded by \( y = x^2, \ y = 0, \ x = 1, \ x = 2, \) about \( x = 4. \)

8. A circular swimming pool has a diameter of 24 ft, the sides are 5 ft high, and the depth of the water is 4 ft. How much work is required to pump all the water out over the side?

9. If \( f \) is continuous on \([1, 3]\) and \( \int_1^3 f(x) \, dx = 8, \) show that \( f \) takes on the value 4 at least once on the interval \([1, 3]\).
10. Find the volume of the solid obtained by rotating the region bounded by $y^2 - 6y + x = 0$, $x = 0$; about the x-axis.

11. A cable that weighs 2 lb/ft is used to lift 800 lb of coal up a mineshaft 500 ft deep. Find the work done.

12. Find the number $b$ such that the average value of $f(x) = 2 + 6x - 3x^2$ on the interval $[0, b]$ is equal to 3.
13. Find the volume of the solid obtained by rotating the region bounded by $y = \frac{1}{\sqrt{1+x^2}}$, $y = 0$, $x = 0$, $x = 3$, about the $y$-axis.

14. A bucket that weighs 4 lb and a rope of negligible weight are used to draw water from a well that is 80 ft deep. The bucket starts with 40 lb of water and is pulled up at a rate of 2 ft/s but water leaks out of a hole at a rate of 0.2 lb/s. Find the work done in pulling the bucket to the top of the well.

15. Suppose the average value of a function $f$ on the interval $[0, t]$ is $\tan(t) + t^2$. Find the the function $f(t)$. 
16. A tank, shown below, is full of water. Find the work required to pump the water out of the outlet.
17. A tank, shown below, is full of water. Find the work required to pump the water out of the outlet. (Use the fact that water weighs \(62.5 \text{ lb/ft}^3\)).