1. The GE PE50T09AAH is a 50 gallon electric hot water heater in the shape
   of a right circular cylinder. The heater itself has a diameter of 19 inches and
   a height of 57 inches, which would be a 70 gallon tank, but there are heating
   elements inside of the tank that use up the other 20 gallons. Assume that the
   net effect of those heating elements can be represented by right circular
   cylinder so that the heater is visualized as a cylinder within a cylinder. In
   order for the water to reach the upstairs shower, it must be raised to a height
   15 feet above the top of the tank.

   Use the following conversions factors: There are 231 cubic inches per
   gallon. The weight of water is 62.42796 pounds per cubic foot. One horsepower is
   550 foot-pounds per second.

   Show work. Once you have the integral, you may use the calculator to evaluate.

   a. Find the diameter, to the nearest inch, of the inside cylinder so that the volume of
      the tank is 50 gallons.

   b. How much pressure is exerted on the bottom of the tank when the tank is full?

   c. Find the amount of work required for my wife to use up all the hot water.

   d. How big of a water pump (in horsepower) is needed if the wife can use up all of
      the hot water in 35 minutes?

2. Located on the southwest side of Decatur is Lake Tokorozawa. It is approximately 1500 ft long and 700 ft across at its widest points.

Lake Tokorozawa

Starting in the southwest corner of the area, measurements were taken every 100 feet from west to east and the distance to the north (N) and south (S) shores were measured. These values are given in the table below. They can be thought of as coordinates where (0,0) is the lower left hand corner of the region.
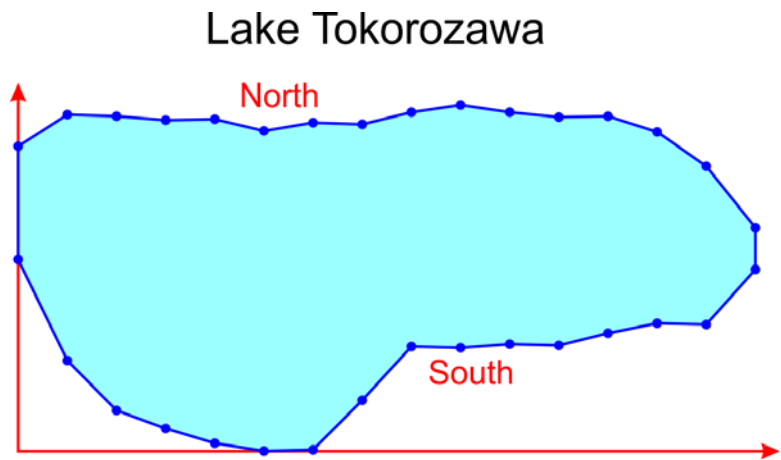
k	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
x_k	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
N_k	621	685	682	674	676	652	669	665	690	704	690	680	682	650	580	454
S_k	390	184	83	46	16	0	2	103	213	210	217	215	240	260	257	370

Create the following table in Excel. Let N and S represent the midpoint of the North segment and South segment respectively. Nl and Sl represent the length of the North and South segments. The first and last intervals are filled in for you as an example.

k	x	N	S	Δx	ΔN	ΔS	Nl	Sl
1	50	653	287	100	64	-206	118.7266	228.9891
			intervals 2 - 14 go here					
15	1450	517	313.5	100	-126	113	160.8602	150.8940

Use the values in the table to **numerically approximate** the following items. Use Microsoft Excel to perform the calculations. Print out your worksheet and include it with the test. For each question, write the formula using summation notation and then give the answer from Excel. Be sure to give the proper units.

Example: *Find the area between the north edge of Lake Tokorozawa and the east-west line at the south end of the lake.*

Answer: $Area \approx \sum N \Delta x = 991,650 \ ft^2$

a. Find the surface area of Lake Tokorozawa using the trapezoid method.

b. Find the perimeter of Lake Tokorozawa. *Hint: you also need to include the lengths of the east and west ends.*

c. Find the volume of the solid that would result if the surface of Lake Tokorozawa is rotated about the east-west line at the south edge of the region.

d. Find the volume of the solid that would result if the surface of Lake Tokorozawa is rotated about the north-south line at the west edge of the region.

e. Find the volume of the solid that would result if the surface of Lake Tokorozawa is rotated about the W Sunset Ave, which lies 965 feet to the north of the east-west line at the south edge of the region.

f. Find the surface area of revolution that would result if the perimeter of Lake Tokorozawa was rotated about the east-west line at the south edge of the region. *Hint: don't forget about the east and west ends of the surface.*

g. Find the coordinates of the center of the lake, as measured from the southwest corner of the region.

h. Use the Theorem of Pappus to find the volume of the solid that would result if the surface of Lake Tokorozawa is rotated about the railroad track that lies about ½ mile to the east of the lake. If you assume the normal x and y axes apply, the equation of the railroad track can be written as $8y = 35(x - 2680)$.