1. Consider the curve $y = e^{2x}$ between the points $(\frac{1}{2}, e)$ and $(1, e^2)$.

   Set up but do not evaluate integrals which represent the following quantities.
   a) The length of the curve.

   b) The surface area when the curve is rotated about the $x$-axis. Your answer must be an integral with respect to $x$.

   c) Give another integral which represents the surface area when the curve is rotated about the $x$-axis. Your answer must be an integral with respect to $y$.

2. Determine whether the sequence $\{a_n\}$ converges. If it converges, find the limit.

   $$a_n = \frac{\sin(\ln(n))}{e + \sqrt{n}}$$
3. A vertical trapezoidal wall is shown. The dotted lines form a square of side length 20 m and the base is 60 m long. The top is 10 m under the water. Set up but do not evaluate an integral which represents the hydrostatic force on the dam. You must label your coordinates clearly on the vertical axis to the right.

Use $\rho$ kg/m$^3$ for the density of water and $g$ kg m/s$^2$ for the acceleration due to gravity.

4. Determine whether the following series converges. If it converges, find its sum.

$$\sum_{n=1}^{\infty} \frac{2 \cdot e^n}{\pi^{n-1}}$$
5. Determine whether the following series converges:
\[ \sum_{n=1}^{\infty} \frac{\ln(n)}{n^2} \]

6. Determine whether the following series converges:
\[ \sum_{n=1}^{\infty} \frac{2}{\sqrt{5n^4 + 3}} \]

7. The cross-section of a small lake is measured at 4-meter intervals. The length of each cross-section (in meters) is given below.

Estimate the area of the pond using Simpson’s rule. Do not simplify your answer.
8. Let $R$ be the region bounded by the curves
   \[ y = 1 - x^2 \text{ and } y = 0.\]
   a) Sketch the region $R$ and find its area.

   b) Find the centroid of $R$.  *Hint.* Finding $\bar{x}$ is easy (why?).

   c) Find the volume of the solid formed by revolving $R$ about the line $y = 2$.  (Remember the Theorem of Pappus on page 559: volume = the area of $R$ times the distance traveled by the centroid as it revolves once around the axis.)