1. Consider the region bounded by the graph of $f(x) = \sqrt{1-x}$, the x-axis, and the y-axis. This region is then rotated about the y-axis.

   (a) Find the volume of the resulting solid using the disk/washer method.

   (b) Find the volume of the resulting solid using the shell method.

2. Integrate the following.

   (a) $\displaystyle\int \sqrt{x}\ln x \; dx$

   (b) $\displaystyle\int \frac{\sin x}{1 + \cos x} \; dx$

   (c) $\displaystyle\int \frac{\arctan x}{1 + x^2} \; dx$

   (d) $\displaystyle\int_0^1 x^2 e^x \; dx$

   (e) $\displaystyle\int_0^4 \frac{1}{(4-x)^{\frac{3}{2}}} \; dx$

3. Determine whether the following series are absolutely convergent, conditionally convergent, or divergent.

   (a) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n n 2^n}{3^{n+1}}$

   (b) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n (n^2 + 5n^3)}{\sqrt{n + 9n^4 + 4n^2}}$

   (c) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{\cos n}$