1. Find the following. If the integral diverges, say so. You **must** show all work.

(a) $\int 2x \sin 3x \, dx$

(b) $\int x^2 \sqrt{2 + x} \, dx$

(c) $\int \frac{5}{x \ln x} \, dx$

(d) $\int_0^4 \sqrt{16 - x^2} \, dx$

(e) $\int_0^\infty t \, e^{-3t} \, dt$

(f) $\int_2^4 \frac{x}{x^2 - 4} \, dx$

2. The area bounded by the **x-axis** and the curve $y = \ln x$, $1 \le x \le 6$, is revolved about the y-axis..

   (a) Carefully sketch the area and volume.

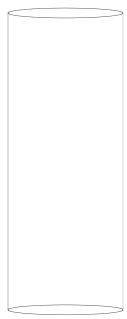
   (b) Set up but do not evaluate an integral for the volume of revolution generated using cylindrical shells.

   (c) Set up but do not evaluate an integral for the volume of revolution generated using annular rings or washers.

3. Use Euler's method with step size h=0.25 to compute the approximate y-values y_1, y_2 of the solution of the initial-value problem $y' = y - 2x,\ y(0) = 1$. Show your work.

n	x_n	y_n	
0	0	1	
1			
2			

4. A water tank is in the form of a right circular cylinder with height 30 feet and radius 5 feet. If the tank is one-third full of water, find the work required to pump all of the water over the top rim. (Note 1 cubic foot of water weighs 62.4 lb.)



5. Find the solution to the initial-value problem $y' = x + xy^2,\ y(0) = 1$

6. Dead leaves accumulate on the ground in a field at a rate of 3 grams per square centimeter per year. At the same time, these leaves decompose at a continuous rate of 75% per year.

    (a) Write a differential equation for the total quantity of dead leaves (per square centimeter) at time t.

    (b) Solve the differential equation assuming the field was initially cleared of leaves.

7. (a) Determine wether $\sum_{n=1}^{\infty} \frac{(-1)^n\, n}{n^2+1}$ converges or diverges. State your reason

(b) Find the sum of the series $\sum_{n=0}^{\infty} \frac{3\, 2^{3n}}{5^{2n+1}}$

(c) Find the sum of the series $\sum_{n=0}^{\infty} \frac{(-1)^n}{n!}$

8. Find the interval of convergence for the power series $\sum_{n=1}^{\infty} \frac{(3x+5)^n}{2^n\, n}$

9. (a) Write $f(x) = \dfrac{1}{1+2x}$ as a (Maclaurin) series.

(b) Using your answer to (a), write $g(x) = \ln(1+2x)$ as a Maclaurin series.

10. Use power series to solve the differential equation $y' + 2y + 1 = 0,\ y(0) = 0$