1. Solve the differential equation:

$$y' = \frac{\ln x}{xy}$$

with initial condition $x = 1, y = 2$.

2. Solve the differential equation:

$$y' - 2y = e^x$$

3. One model for the spread of a rumor is that the rate of spread is proportional to the product of the fraction y of the population who have heard the rumor and the fraction who have not heard the rumor.

Write a differential equation that is satisfied by y, and solve it.

4. Determine whether the following sequences converge or diverge. If it converges, find the limit:

(i). $\{\frac{n^3}{n^3+1}\}$

(ii). $\{n^2 e^{-n}\}$

(iii). $\{\sin \frac{n\pi}{2}\}$

(iv). $\{\frac{(-3)^n}{n!}\}$

5. Find the limit of the sequence

$$\sqrt{2}, \sqrt{2\sqrt{2}}, \sqrt{2\sqrt{2\sqrt{2}}}, ...$$