1. Find the length of the curve $x(t) = 3t - t^3$, $y(t) = 3t^2$, $0 \le t \le 2$.
2. Find the area of the surface obtained by rotating the curve $y = x^3$, $0 \le x \le 2$ about the x-axis.
3. Find the area of the surface obtained by rotating the curve $x = \sqrt{2y - y^2}$, $0 \le y \le 1$ about the y-axis.
4. (a) Sketch the curve $r = 2(1 + \cos\theta)$ in polar coordinates.
   (b) Find the length of the polar curve $r = 2(1 + \cos\theta)$.
5. Find the area of the region that lies inside both curves $r = 3\cos\theta$ and $r = 3\sin\theta$.
6. Find the following limits

   a) $\lim_{n\to\infty} \dfrac{\sqrt{n}}{\ln n}$

   b) $\lim_{n\to\infty} \dfrac{1 - 2n^2}{\sqrt[3]{n^6 + 1} + 2n^2}$

   c) $\lim_{n\to\infty} (\sqrt{n+1} - \sqrt{n})$

   d) $\lim_{n\to\infty} \dfrac{(-1)^n \sqrt{n}}{n^2 + 1}$

7. Given the n-th partial sum of the series $\sum_{n=1}^{\infty} a_n$ by $s_n = \dfrac{n}{2n+1}$, find a_4. What is the sum of the series?
8. Find the sum of the series

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

   b) $\sum_{n=3}^{\infty} \dfrac{1}{n^2 - 4}$

9. Which of the following series is convergent?

   a) $\sum_{n=1}^{\infty} \dfrac{n^2}{n^{5/7} + 1}$

   b) $\sum_{n=1}^{\infty} \dfrac{\cos^2 n}{3^n}$

   c) $\sum_{n=1}^{\infty} n e^{-n^2}$

10. Approximate the sum of the series $\sum_{n=1}^{\infty} n e^{-n^2}$ by using the sum of first 4 terms. Estimate the error involved in this approximation.