1. Estimate the value of $\int_{-5}^{7} x^2 dx$ using 6 subintervals and
   (a) the midpoint rule (b) the trapezoidal rule (c) Simpson's rule

2. Evaluate the integrals (if convergent).
   (a) $\int_{2}^{\infty} e^{-x} dx$ (b) $\int_{-\infty}^{0} \sin x dx$
   (c) $\int_{3}^{5} \frac{1}{x-5} dx$ (d) $\int_{0}^{13} \frac{1}{\sqrt{|x-4|}} dx$

3. Find the lenth of the curve:
   (a) $y = \ln x,\ \ 1 \leq x \leq \sqrt{3}$ (b) $x = y^{3/2},\ \ 4 \leq y \leq 9$

4. Find the area of the surface obtained by rotating
   (a) $y = x^3,\ \ 0 \leq x \leq 2$ about the x-axis,
   (b) $y = 1 - x^2,\ \ 0 \leq x \leq 1$ about the y-axis,
   (c) $x = \sqrt{1-y^2},\ \ 0 \leq y \leq 1$ about the x-axis,
   (d) $x = \sqrt{y},\ \ 1 \leq y \leq 9$ about the y-axis.

5. Find all constants c and k such that $y = ce^{kx}$ is a solution of $y'' + y' - 12y = 0$.

6. Sketch
   (a) a direction field for $y' = \frac{x}{y}$,
   (b) solution of $y' = \frac{x}{y}$ satisfying $y(0) = 1$,
   (c) solution of $y' = \frac{x}{y}$ satisfying $y(0) = -2$.

7. Solve the differential equation
   (a) $y' = \frac{x}{y}$ (b) $y' = \frac{xy}{2\ln y}$

8. A bacteria cultute starts with 800 bacteria and the growth rate is proportianal to the number of bacteria. After 3 hours the population is 2700. Find the number of bacteria after 5 hours.

9. Eliminate the parameter to find a Cartesian equation of the curve. Sketh the curve and indicate with an arrow the direction in which the curve is traced as the parameter increases.
   (a) $x = 2\cos\theta,\ y = \sin^2\theta$ (b) $x = e^t,\ y = e^{-t}$

10. Find an equation of the tangent line to the curve $x = \sin t,\ y = \sin(t + \sin t)$ at $(0, 0)$.

11. (a) Plot the point whose polar coordinates are $\left(1, \frac{2\pi}{3}\right)$. Find the Cartesian coordinates of this point.
    (b) Find polar coordinates (with $r > 0$) of the point whose Cartesian coordinates are $(\sqrt{3}, -1)$.