1. Power, Maclaurin, and Taylor Series
   (a) Find the Maclaurin series for \( \frac{x^2}{1+x} \).
   (b) Find the Taylor series for \( \cos x \) about \( a = \pi/2 \).
   (c) Find the Taylor series centered at \( c = 0 \) of \( \frac{2}{4-3x} \) and determine its radius of convergence.
   (d) Find the Taylor series centered at zero of the function \( f(x) = \ln(x+5) \).
   (e) Find the Taylor series centered at zero of the function \( g(x) = x^3 \ln(x^2 + 5) \).

2. Compute \( T_3(x) \), the Taylor polynomial of the third order centered at \( x = 0 \), for \( f(x) = \cos(x/\pi) \).

3. Compute \( T_n(x) \), the Taylor polynomial of the \( n \)th order centered at \( x = 0 \), for \( f(x) = e^{3x} \).

4. Let \( f(x) = e^{-x} \). First compute \( T_3(x) \) and then use the error bound to show that \( |f(x) - T_3(x)| \leq x^4/24 \) for all \( x \geq 0 \).

5. Density and average value:
   (a) Find the total mass of a circular plate of radius 20 cm whose mass density is the radial function \( \rho(r) = 0.03 + 0.01 \cos(\pi r^2) \) g/cm\(^2\).
   (b) Find the average value of \( f(x) = \sin(x) \cos(x) \) over \([0, \pi]\).

6. Volume of solid with known cross section:
   Calculate the volume of the following solid. The base is the region enclosed by \( y = 2 - x^2 \) and the \( x \)-axis. The cross sections perpendicular to the \( y \)-axis are squares.

7. Volumes:
   (a) (Disks) Let \( V \) be the volume of a right circular cone of height 10 whose base is a circle of radius 4. Use similar triangles to find the area of a horizontal cross section at a height \( y \). Using this area, calculate the volume \( V \) by integrating the cross-sectional area.
   (b) (Washers) Let \( R \) be a region bounded by \( y = x^2 \) and \( y = 1 \), if \( R \) is rotated about \( x \)-axis, what is the volume of the resulting solid?
   (c) (Cylindrical Shells) \( V \) is obtained by rotating the region under the graph \( y = 3x^2 \) for \( 0 \leq x \leq 2 \) about the \( y \)-axis. Calculate the volume of \( V \).

8. Work:
   Calculate the work against gravity required to build a right circular cone of height 4 m and radius 2 m out of a lightweight material of density 600 kg/m\(^3\). (See also question 7(a).)

9. Trigonometric Integrals:
   (a) \( \int \sin^2(x) \cos^3(x) \, dx \)
   (b) \( \int \tan^3(x) \sec^3(x) \, dx \)