1. Find the following:
   (a) \[ \int \sin^{100}(x) \cos(x) \, dx \]
   (b) \[ \int \frac{3x^2 - 16x + 5}{\sqrt{x^3 - 8x^2 + 5x + 3}} \, dx \]
   (c) \[ \int \left( x - \frac{3}{2} \right) \sin(x^2 - 3x) \, dx \]
   (d) \[ \int x \ln x^3 \, dx \]
   (e) \[ \int_{0}^{\frac{\pi}{2}} \tan^5 x \sec^2 x \, dx \]
   (f) \[ \int_{2}^{4} f'(x) \sin(f(x)) \, dx \]
      if \( f \) is a continuous function on the interval \([0, 20]\) such that \( f(0) = 3, f(2) = 1, f(4) = 7, \) and \( f(20) = 5. \)
   (g) \[ \int_{1}^{3} (2x - 8)e^{-x} \, dx \]
   (h) \( \bar{f} \), the average value of \( f(x) = x^2 \) over the interval \([3, 8]\).

2. Consider the region \( R \) in the xy-plane where \( x \geq 0 \) bounded by the graphs \( y = x^3 \) and \( y = x^5. \)
   (a) Calculate the area of \( R. \)
   (b) Calculate the centroid of \( R. \)

3. Find the arc length of the part of the curve \( y = 2x^{\frac{3}{2}} \) between the points \((1, 2)\) and \((4, 16)\).

4. Consider the region \( Q \) in the xy-plane bounded by the graphs \( y = x \) and \( y = (x - 2)^2. \) Find the volume of the solid obtained by revolving \( Q \) about the x-axis.