1. Find the area between the curves: \( y = 2x \) and \( y = x^4 \).

2. Find the area between the curves: \( y = 2 \sin x \) and \( y = 5 \cos x \) from \( x = 0 \) and \( x = \pi \).

3. Find the volume of the region bounded by \( y = -x^3 + 5x^2 - 2x \) in the 1st quadrant, which is then rotated about the y-axis.

4. Find the volume of the region bounded by \( y = 5 - x^2 \), \( y = 2x \), and the y-axis, which is rotated about \( y = -1 \).
5. Find the arclength of $y = t^4 + 1$, $x = -t^3 - 4$, $0 \leq t \leq 2$.

6. Find the length of the curve $y = \frac{1}{6} (x^2 + 4)^{3/2}$, $0 \leq x \leq 3$.

7. Find the arclength of $y = x^2$, $0 \leq x \leq 2$.

8. Find the average value of $f(x) = x^2 \sqrt{1 + x^3}$ on $[0, 2]$.
9. Let \( f(x) = x^2 - 4x + 2 \) on \([-1, 5]\)
   a) Find the average value of \( f(x) \)

   b) Find \( c \) such that \( f(c) = \frac{1}{2} f_{\text{ave}} \), where \(-1 \leq c \leq 5\)

10. A force of 30 N is required to maintain a spring stretched from its natural length of 12 cm to a length of 15 cm. How much work is done in stretching the spring from 12 cm to 20 cm?

11. Find the centroid of \( (a \text{ semicircle}) \) with \( p = 2 \).
12. A hemispherical tank (see diagram) is full of water, and has a radius of 4 m. Find the work needed to pump the water out of the tank until only a height/depth of 50 cm of water remains in the tank. Use: density of water is 1000 kg/m³.

13. A cone-shaped tank (see diagram) is full of water. Find the work needed to pump the water to a height of 2 ft above the top of the tank. Use: weight of water is 62.5 lb.
14. Find the center of mass given the points: \( P_1(1,1) \), \( P_2(-3,0) \), \( P_3(2,1) \), and \( P_4(1,-2) \) with their associated weights: \( m_1 = 1 \), \( m_2 = 5 \), \( m_3 = 7 \), \( m_4 = 2 \).

Draw a diagram of the situation.