1. Express \( \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} (1 + \cos x) \, dx \) as a limit of Riemann sums. Do not evaluate the limit.

2. Use four rectangles to estimate the area under the curve of \( f(x) = 4 - x^2 \) on \([-2, 2]\) by using midpoints.

3. Express the sums \( \sum_{i=1}^{n-1} \frac{i^3}{n^2} \) in closed form.
4. Evaluate each of the following integrals:

(a) \[ \int_{0}^{\pi/2} \frac{dx}{1 + \tan^2 x} \]

(b) \[ \int_{0}^{2} 4 \left| 2x - 1 \right| \, dx \]

(c) \[ \int_{\pi/4}^{\pi/2} \frac{dx}{\sqrt{1 - \cos^2 x}} \]
(d) $\int_{-1}^{0} \frac{dx}{x^2 + 2x + 2}$.

(e) $\int \frac{dx}{\sqrt{x}(1 + \sqrt{x})}$.

(f) $\int \frac{\sec^2 x \, dx}{\tan x \sqrt{\tan^4 x - 1}}$. 
(g) \( \int_e^{e^2} \frac{dx}{x \ln x} \).

(h) \( \int \sqrt{1 + \tan x} (1 + \tan^2 x) \, dx \).

(i) \( \int \frac{x + 1}{\sqrt{4 - x^2}} \, dx \).
5. Find \( \frac{d}{dx} \int_{\sqrt{3}}^{2} \frac{\sqrt{x^2 - 3}}{x} \, dx \).

6. Find the area bounded by the curve \( y = \tan x \), the x-axis, \( x = -\frac{\pi}{3} \), and \( x = \frac{\pi}{3} \).

7. Set up an integral that can be used to find the area bounded by the graphs of \( x = y^2 - y \) and \( x = y - y^2 \).
8. Set up an integral that can be used to find the area bounded by the x-axis, the curve 
\[ y = \frac{1}{\sqrt{3x} + 1} , \] and the lines \( x = 0 \), \( x = 5 \).

9. If the area bounded by the graph of \( y = f(x) \), \( a \leq x \leq b \), and the x-axis is equal to 
\( b^2(b - a) \), then \( f(x) \) is equal to:

10. Find the slope of the tangent to the curve \( y = \int_0^{\sqrt{x}} e^{-t^2} dt \), \((x > 0)\) at \( x = 4 \).
11. The base of a solid is a circle of radius 4 and center at the origin. If every cross section perpendicular to the y-axis is a square, then find the volume of the solid.

12. Set up the volume generated by rotating the region bounded by $y = x^4$, $x = 1$, and the x-axis about the y-axis.

13. Find the volume of the solid obtained by rotating the region bounded by $y = x^3$, $y = 0$, and $x = 1$ about the line $x = 2$. 
14. Find the volume of the solid obtained by rotating the region bounded by \( y = \frac{1}{x^{2/5}} \) and the x-axis, \( 1 \leq x \leq 2 \), about the x-axis.

15. Set up the volume generated by rotating the region bounded by \( x = y^2 \) and \( x - y = 2 \) about the line \( x = 4 \).

16. Each of the regions \( A \), \( B \), and \( C \) bounded by the graph of \( f \) and the x-axis has area equal to 3. Find the value of \( \int_{-4}^{2} [f(x) + 2x + 3] \, dx \).