Directions: Show your work, and write clearly.

1. Evaluate the integral.
   (a) \[ \int_{\pi/9}^{\pi/6} \sin(3x) \, dx \]
   (b) \[ \int_0^{12} \frac{x \, dx}{\sqrt{x^2 + 25}} \]
   (c) \[ \int_0^4 \frac{x \, dx}{(9 + x^2)^2} \]
   (d) \[ \int_0^{\pi/6} \sin(2x) \sqrt{\cos(2x)} \, dx \]
   (e) \[ \int \frac{\tan^2(\sqrt{x}) \, dx}{\sqrt{x}} \]
   (f) \[ \int_{1/3}^{1/4} \frac{\csc^2(\pi x) \, dx}{\sqrt{\cot(\pi x)}} \]
   (g) \[ \int_{1/4}^{1/6} \frac{\sec^2(\pi x) \, dx}{\tan^2(\pi x)} \]
   (h) \[ \int \frac{x + \sqrt{x}}{\sqrt{x}} \, dx \]
   (i) \[ \int \frac{1 + \frac{1}{x}}{4x^2} \, dx \]
   (j) \[ \int_{\frac{1}{2}}^{\frac{1}{2}} \csc(\pi x) \cot(\pi x) \, dx \]

2. Evaluate the definite integral by applying a limit process.
   (a) \[ \int_2^5 (2x - 1) \, dx \]
   (b) \[ \int_1^3 (x^2 + 3x) \, dx \]

3. Determine the area of the indicated region. Shade and include a sketch of the region.
   (a) A region is bounded by the graph of \( y = x^2 - 6x + 5 \) and the \( x \)-axis.
   (b) A region is bounded by the graph of \( y = -x^2 - x + 2 \) and the \( x \)-axis.
   (c) A region is bounded by the graphs of \( y = x^2 + x - 2 \) and \( y = 2x + 4 \).
   (d) A region is bounded by the graphs of \( y = 4\sqrt{x} \) and \( y = x \).
   (e) A region is bounded by the graphs of \( y = 2x - 1 \), \( y = 5 \), and \( x = 0 \).
   (f) A region is bounded by the graphs of \( y = 2x - 6 \) and \( y = x^2 - 2x - 3 \).
   (g) The region below the graph \( y = \cos(x) \) for \( 0 \leq x \leq \frac{\pi}{2} \), and above the \( x \)-axis.
   (h) The region below the graph \( y = \sin(x) \) for \( 0 \leq x \leq \pi \), and above the \( x \)-axis.
   (i) A region is bounded by the graphs of \( y = 1 + 2\sqrt{x} \), \( y = 1 \), and \( x = 4 \).
   (j) A region is bounded by the graphs of \( y = x^2 - 4x + 3 \) and \( y = 3 \).
4. A solid is generated when the indicated region is revolved about the $x$-axis. Then determine the volume of the solid

(a) Region in #3(b)
(b) Region in #3(d)
(c) Region in #3(e)
(d) Region in #3(h)

5. Find the volume of the solid with the indicated base and cross-sections.

(a) The base of a solid is the the region bounded by the graphs of $y = \sqrt{x - 1}$, $y = 0$, and $x = 5$. The cross-sections of the solid perpendicular to the $x$-axis are squares.

(b) The base is bounded by the graphs of $y = x^2 + 3$, the line $x = 1$, and the coordinate axes. The cross-sections of a solid that are perpendicular to the $x$-axis are squares.

(c) The base is in the first quadrant bounded by the graphs of $y = x^2 + 1$, $y = 5$, and $x = 0$. The cross-sections of the solid perpendicular to the $x$-axis are semicircles.