1.) Sketch the graph of $y = 3x^2 + 2$ on the interval $[0, 1]$. Consider the area of the region below the graph and above $[0, 1]$. Use the limit definition of a definite integral to find the exact area of the region.

2.) Use the limit definition of a definite integral to evaluate $\int_{-1}^{2} (x^2 - 2x + 1) \, dx$.

3.) Determine the following indefinite integrals. Do not use u-substitution.

   a.) $\int \frac{x^2}{x + 1} \, dx$  
   b.) $\int (e^x + 2x) \, dx$  
   c.) $\int 2x \cos(x^2) \, dx$

   d.) $\int \frac{x^2 + 1}{x^3} \, dx$  
   e.) $\int \frac{x^2 + 1}{x + 3} \, dx$  
   f.) $\int \frac{x^2}{x^3 + 1} \, dx$

4.) Evaluate the following definite integrals. Do not use u-substitution.

   a.) $\int_{4}^{9} \frac{1}{x^2} \, dx$  
   b.) $\int_{0}^{1} 3x^1 \, dx$  
   c.) $\int_{1}^{2} \frac{(x + 1)^2}{x} \, dx$

   d.) $\int_{0}^{5} \sqrt{x + 4} \, dx$  
   e.) $\int_{\pi/6}^{\pi/4} \cos(3x) \, dx$  
   f.) $\int_{-1}^{0} \frac{x^2}{x - 1} \, dx$

   g.) $\int_{0}^{\sqrt{3}} xe^{x^2} \, dx$  
   h.) $\int_{0}^{\ln2} \frac{e^x}{e^x + 1} \, dx$  
   i.) $\int_{0}^{1} \frac{1}{e^x} \, dx$

   j.) $\int_{0}^{\frac{\pi}{2}} \cos x \, e^{\sin x} \, dx$  
   k.) $\int_{-1}^{1} 3x^2 \cdot 5x^3 \, dx$  
   l.) $\int_{0}^{\pi/12} 5 \sec^2 3x \, dx$

5.) Differentiate each:

   a.) $F(x) = \int_{-1}^{3x} \sqrt{1 + t^2} \, dt$  
   b.) $F(x) = \int_{\tan x}^{\sec x} 5t^2 \, dt$

6.) Find an equation of the line perpendicular to the graph of

   a.) $F(x) = 3 + \int_{0}^{x} 2e^{t^2} \, dt$ at $x = 0$.

   b.) $F(x) = \int_{2x}^{x^2} \sqrt{t^2 + 5} \, dt$ at $x = 2$.

7.) Find the average value of each of the following functions over the given interval. Draw a sketch showing the connection between your answer and the definite integral.

   a.) $f(x) = x^3 + 1$ on $[-1, 1]$  
   b.) $f(x) = 5 + \sqrt{x}$ on $[0, 4]$
8.) If \( \int_{-2}^{1} f(x) \, dx = 3 \) and \( \int_{-2}^{3} f(x) \, dx = -2 \). What is the value of \( \int_{3}^{1} f(x) \, dx \)?

9.) A long and thin corn stalk is 100 inches long. Its density \( x \) inches from its base is given by \( f(x) = 2 - (1/100)x \) ounces per inch. Set up a definite integral and compute the exact weight of the corn stalk.

10.) Find the area of the region bounded by the graphs of the given equations.
   
   a.) \( y = x, y = 2x, \) and \( x = 2 \)  
   
   b.) \( y = e^x, x = 0, \) and \( y = 2 \)  
   
   c.) \( x = y^2 \) and \( x = 9 \)  
   
   d.) \( y = x, y = 0, y = 2, \) and \( y = (1/2)x - 2 \)

11.) Assume that \( f \) is an odd function and \( \int_{-2}^{1} f(x) \, dx = 3 \). What is the value of \( \int_{-1}^{2} f(x) \, dx \)?

12.) The speed \( s \) (in miles per hour) of a jogger at time \( t \) (in hours) is given by \( s(t) = t + \sqrt{t} \).
   
   a.) Find the jogger’s average speed between \( t = 0 \) hrs. and \( t = 4 \) hrs.
   
   b.) Find the total distance traveled by the jogger between \( t = 0 \) hrs. and \( t = 4 \) hrs.

THE FOLLOWING PROBLEM IS FOR RECREATIONAL PURPOSES ONLY.

13.) Count the total number of squares (including overlapping squares) in the following diagram.