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

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

   g.) $\int_{0}^{\ln3} xe^{x^2} \, dx$  
   h.) $\int_{0}^{ln 2} \frac{e^x}{e^x + 1} \, dx$  
   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.) Consider the region $R$ enclosed by the graphs of the given functions. Describe each region $R$ using
   i.) vertical cross-sections.
   ii.) horizontal cross-sections.
   a.) $y = 2x$, $x = 4$, and $y = 0$
   b.) $y = e^x$, $x = 0$, and $y = e^2$
   c.) $y = 2/x$, $y = 2x$, and $x = 4$
   d.) $y = 2x$, $y = (1/2)x$, and $y = 6 - x$
   e.) $y = x^2$ and $y = 4x + 5$

11.) 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 $y = (1/2)x - 2$

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

13.) 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.

14.) A heavy snow begins to fall at Squaw Valley Ski Resort. If snow falls at the rate of $(1/2)t + 1$ in./hr. for $t \geq 0$, then what is the total accumulated snowfall for $t = 0$ to $t = 8$ hours?

15.) Find the volume of the solid formed by revolving each region bounded by the given graphs about the given axis.
   a.) $y = x^2 - 1$ and the $x$-axis about the $x$-axis
   b.) $y = \sqrt{x}$, $y = 0$, and $x = 4$ about the $x$-axis
   c.) $y = \sqrt{x}$, $y = 0$, and $x = 4$ about the $y$-axis
   d.) $y = 3x$, $y = 6$, and $x = 0$ about the $x$-axis
   e.) $y = 2x$, $y = 5 - (1/2)x$, and $y = 0$ about the $y$-axis
f.) $y = x^2$ and $y = x + 2$ about the line $y = 4$

g.) $y = x^2$ and $y = x^3$ about the line $y = 2$

h.) $y = x^2$ and $y = x^3$ about the line $y = -1$

i.) $y = x^2$ and $y = x^3$ about the line $x = 3$

j.) $y = x^2$ and $y = x^3$ about the line $x = -2$

16.) Find the length of each graph on the given interval.

a.) $y = x^{3/2}$ on the interval $[0, 4]$

b.) $y = (2/3)(x^2 + 1)^{3/2}$ on the interval $[0, 2]$

c.) $y = \frac{x^4}{4} + \frac{1}{8x^2}$ on the interval $[2, 4]$

d.) $y = (1/2)(e^x + e^{-x})$ on the interval $[0, \ln 2]$

THE FOLLOWING PROBLEM IS FOR RECREATIONAL PURPOSES ONLY.

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