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.

\[
\begin{align*}
\text{a.) } & \int x^2(x+1) \, dx & \text{b.) } & \int (e^x + 2^x) \, dx & \text{c.) } & \int 2x \cos(x^2) \, dx \\
\text{d.) } & \int \frac{x^2 + 1}{x^3} \, dx & \text{e.) } & \int \frac{x^2 + 1}{x + 3} \, dx & \text{f.) } & \int \frac{x^2}{x^3 + 1} \, dx
\end{align*}
\]

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

\[
\begin{align*}
\text{a.) } & \int_{1}^{9} \frac{1}{x^2} \, dx & \text{b.) } & \int_{0}^{1} 3^{x+1} \, dx & \text{c.) } & \int_{1}^{2} \frac{(x+1)^2}{x} \, dx \\
\text{d.) } & \int_{0}^{5} \sqrt{x+4} \, dx & \text{e.) } & \int_{0}^{\frac{\pi}{4}} \cos(3x) \, dx & \text{f.) } & \int_{-1}^{0} \frac{x^2}{x-1} \, dx \\
\text{g.) } & \int_{0}^{\sqrt{\ln 3}} xe^{x^2} \, dx & \text{h.) } & \int_{0}^{\ln 2} \frac{e^x}{e^x + 1} \, dx & \text{i.) } & \int_{0}^{1} \frac{1}{e^x} \, dx \\
\text{j.) } & \int_{0}^{\frac{\pi}{2}} \cos x \, e^{\sin x} \, dx & \text{k.) } & \int_{-1}^{1} 3x^2 \cdot 5x^3 \, dx & \text{l.) } & \int_{0}^{\frac{\pi}{12}} 5 \sec^2 3x \, dx
\end{align*}
\]

5.) Differentiate each:

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

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

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

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

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.

\[
\text{a.) } f(x) = x^3 + 1 \quad \text{on } [-1, 1] \quad \text{b.) } f(x) = 5 + \sqrt{x} \quad \text{on } [0, 4]
\]
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 time \( t \) hours 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 \( x - \)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.