• Average Amount in the Account=
\[ \frac{1}{b-a} \int_a^b f(x) \, dx \]

• Continuous flow of money
\[ A(t) = \int_a^b f(t) \, dt \]

• Future Value of an Annuity: Continuous flow of money
\[ S \approx \int_0^T P e^{r(T-t)} \, dt \]

• Area between two curves, if \( f(x) \geq g(x) \):
\[ \int_a^b [f(x) - g(x)] \, dx \]

• Consumers’ Surplus: For demand function \( d \) and point \((x_m, d_{mp})\) on the graph of \( d \), where \( x_m \) is the market demand and \( d_{mp} \) is the market price,
\[ C.S. = \int_0^{x_m} [d - d_{mp}] \, dx \]

• Producers’ Surplus: For supply function \( s \) and point \((x_m, d_{mp})\) on the graph of \( s \), where \( x_m \) is the market demand and \( d_{mp} \) is the market price,
\[ P.S. = \int_0^{x_m} [d_{mp} - s] \, dx \]

1. Find the average value of the function:
\[ f(x) = x^3 \]
on the interval \([-1, 1]\)
ans: 0

2. If \( F(0) = 1 \), what is \( F(2) \)?
   a) What is \( F(8) \)?
   ans: 11
   ans: 28.5

3. Area Between Two Curves
   a) find the area between \( f(x) = \sqrt{x} \) and \( g(x) = x^2 \)
   ans: \( \frac{1}{3} \)
   b) find the area between \( f(x) = -x \) and \( g(x) = 2 - x^2 \) on the interval \([-1, 3] \)
   ans: \( \frac{10}{3} \)

4. Lynnette deposits $5,000 into an account paying 6.5% annual interest compounded continuously. What is the average amount in her account, assuming no withdrawals, over the next 3 yrs?

5. Troy and Greta open a college savings account for their new son Quinn, and at the first of each 3rd month they deposit $750. If the account earns 6.45% annual interest, compounded continuously, how much will be in the account when Quinn heads for college in 18 years?

6. Find the area between the functions pictured below, \( f(x) = -2x^2 + 8 \) and \( g(x) = -2x + 4 \).

7. Evaluate the function
\[ f(x, y) = \sqrt{8 - x - y^2} \]
at
   a. \((2, 1)\)
   ans: 
   b. \((-4, 2)\)
   ans: 
   c. \((-1, 0)\)
   ans: 

8. Find the domain:
   a. \( f(x, y) = \frac{y}{x-2y} \)
   b. \( f(x, y) = \sqrt{8 - x + y} \)
   c. \( f(x, y) = 3x^2 \sqrt{y} \)
   d. \( f(x, y) = \sqrt{16 + x^2 + y} \)

9. Find the surface area of a closed rectangular box whose volume is 1000 \( ft^3 \) as \( S(x, y) \)
10. A company sells gadgets and widgets. The gadgets sell at \( p = 120 - 2x - 3y \) and the widgets sell at \( q = 200 - x - 5y \), where \( x \) is the number of gadgets sold and \( y \) is the number widgets sold. Find the revenue function, \( R(x, y) \), and the value of \( R(10, 20) \).

11. Partial Derivatives: find \( f_x \) and \( f_y \)
   a. \( f(x, y) = 3x + 4y^2 - 2xy \)
   b. \( f(x, y) = \sqrt{8 - x^2 - y^2} \)
   c. \( f(x, y) = x^4 \cdot e^{2xy} \)
   d. \( f(x, y) = \frac{x}{y^2 - 1} \)
   e. \( f(x, y) = \ln (x^2 + 4y) \)

   a. \( f(x, y) = 3x^2 + 4y^2 - 2x^2 y^3 \)
   b. \( f(x, y) = e^{x-2y} \)
   c. \( f(x, y) = \ln(2x + y^2) \)


15. Harry’s Habidashery has a supply function of

   \[ s(x) = 0.2x^2 + 20, \]

   and a demand function

   \[ d = -x^2 + 500. \]

   Find:
   - the equilibrium point.
   - the consumers’ surplus at equilibrium demand.
   - the producers’ surplus at equilibrium demand.