1. Use double integrals to find the area of the region bounded by the given curves and lines.

   (a) The parabola \( x = y^2 \) and the line \( y = x - 2 \).
      \[ \text{Ans. } \int_{-1}^{2} \left( \int_{y^2}^{x^2} \, dx \right) \, dy \]

   (b) The parabola \( y = x - x^2 \) and the line \( y = x - 2 \).
      \[ \text{Ans. } \int_{0}^{2} \left( \int_{-x}^{x} \, dy \right) \, dx \]

   (c) The axes and the line \( 2x + y = 2a \) \((a > 0)\).
      \[ \text{Ans. } \int_{0}^{a} \left( \int_{0}^{2a} \, dy \right) \, dx \]

   (d) The y-axis, the line \( y = 3x \), and the line \( y = 6 \).
      \[ \text{Ans. } \int_{0}^{2} \left( \int_{3x}^{6} \, dy \right) \, dx \]

   (e) The x-axis, the curve \( y = e^{-x} \), and the lines \( x = 0, x = a \) \((a > 0)\).
      \[ \text{Ans. } \int_{0}^{a} \left( \int_{0}^{e^{-x}} \, dy \right) \, dx \]

   (f) The parabolas \( y = x^2 \) and \( y = 2x - x^2 \).
      \[ \text{Ans. } \int_{0}^{1} \left( \int_{x^2}^{2x-x^2} \, dy \right) \, dx \]

2. Evaluate \( \int \int_{B} \, dxdydz \), where \( B \) is the region bounded by the coordinate planes and the plane \( x + y + z = 1 \).
   \[ \text{Ans. } \int_{0}^{1} \left( \int_{0}^{1-x} \left( \int_{0}^{1-x-y} \, dz \right) \, dy \right) \, dx \]

3. Find the volume of the sphere \( x^2 + y^2 + z^2 = a^2 \).
   \[ \text{Ans. } \int_{-a}^{a} \left( \int_{\sqrt{a^2-x^2}}^{\sqrt{a^2-y^2}} \left( \int_{\sqrt{a^2-x^2-y^2}}^{z} \, dz \right) \, dy \right) \, dx \]

4. Evaluate
   
   (a) \( \int_{0}^{1} \int_{0}^{1} x^{1/2} \, dx \, dy \)
      \[ \text{Ans. } \frac{1}{2} \]

   (b) \( \int_{0}^{1} \int_{0}^{1-x} x \, dz \, dx \)
      \[ \text{Ans. } \frac{1}{4} \]

   (c) \( \int_{0}^{2} \int_{0}^{\pi} \int_{0}^{n4} x \, dz \, dy \)
      \[ \text{Ans. } 24 \]

   (d) \( \int_{0}^{1} \int_{0}^{\sqrt{3}} \int_{0}^{\sqrt{3(y^2+x^2)}} xyz \, dz \, dy \)
      \[ \text{Ans. } \frac{31}{15} \]

   (e) \( \int_{0}^{\sqrt{2}} \int_{0}^{\sqrt{x}} \int_{0}^{1} y^2 \, dy \, dz \)
      \[ \text{Ans. } 2 \]

5. Evaluate \( \int \int \int_{W} \, dz \, dy \, dx \), where \( W \) is the region bounded by the four planes \( x = 0, y = 0, z = 0, \)
   \( z = 1 \), and the cylinder \( x^2 + y^2 = 1 \), with \( x \geq 0, y \geq 0 \).
   \[ \text{Ans. } \int_{0}^{1} \left( \int_{0}^{\sqrt{1-x^2}} \left( \int_{0}^{1} \, dz \right) \, dy \right) \, dx \]
6. Evaluate \( \int \int_W ze^{x+y} \, dx \, dy \, dz \), where \( W = [0,1] \times [0,1] \times [0,1] \).
   Ans. \( \frac{(e-1)^2}{2} \)

7. Evaluate \( \int \int_W (x^2 + y^2 + z^2) \, dx \, dy \, dz \), where \( W \) is the region bounded by \( x + y + z = a \) \((a > 0)\), \( x = 0 \), \( y = 0 \), and \( z = 0 \).
   Ans. \( \int_0^a \left[ \int_0^{a-x} \left( \int_0^{a-y} (x^2 + y^2 + z^2) \, dz \right) \, dy \right] \, dx = \frac{a^5}{20} \)

8. Set up a triple integral for the volume of each of the following solid regions.

   (a) The region in the first octant bounded above by the cylinder \( z = 1 - y^2 \) and lying between the vertical planes given by \( x + y = 1 \) and \( x + y = 3 \).
   Ans. \( \int_0^1 \left[ \int_0^{1-y^2} (\int_0^{a-y} \, dz) \, dx \right] \, dy \)

   (b) The upper hemisphere given by \( z = \sqrt{1 - x^2 - y^2} \).
   Ans. \( \int_{-1}^1 \left[ \int_{\sqrt{1-x^2}}^{\sqrt{1-x^2}} (\int_0^{\sqrt{1-x^2-y^2}} \, dz) \, dy \right] \, dx \)

   (c) The region bounded below by the paraboloid \( z = x^2 + y^2 \) and above by the sphere \( x^2 + y^2 + z^2 = 6 \).
   Ans. \( \int_{-\sqrt{2}}^{\sqrt{2}} \left[ \int_{\sqrt{2-x^2}}^{\sqrt{2-x^2}} (\int_{\sqrt{6-x^2-y^2}}^{\sqrt{6-x^2-y^2}} \, dz) \, dy \right] \, dx \)

9. Use the triple integration to find the volumes of the given regions.

   (a) The region in the first octant bounded by the cylinder \( x = 4 - y^2 \) and the planes \( y = z \), \( x = 0 \), \( z = 0 \).
   Ans. \( \int_0^2 \left[ \int_0^{y^2} (\int_0^y \, dz) \, dy \right] \, dx \)

   (b) The region above the xy-plane bounded by the surfaces \( z^2 = 16y \), \( z^2 = y \), \( y = x \), \( y = 4 \), and \( x = 0 \).
   Ans. \( \int_0^4 \left[ \int_0^{\sqrt{y}} (\int_{\sqrt{y}}^{\sqrt{4-y^2}} \, dz) \, dy \right] \, dx \)

   (c) The region bounded by the paraboloids \( z = 8 - x^2 - y^2 \) and \( z = x^2 + 3y^2 \).
   Ans. \( \int_{-\sqrt{2}}^{\sqrt{2}} \left[ \int_{\sqrt{8-y^2}}^{\sqrt{8-y^2}} (\int_{\sqrt{x^2+y^2}}^{\sqrt{y^2}} \, dz) \, dy \right] \, dx \)

   (d) The region bounded by the ellipsoid \( \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \)
   Ans. \( \int_{-b}^{b} \left[ \int_{-a}^{a} (\int_{-c}^{c} \, dz) \, dx \right] \, dy \)

   (e) The region bounded by the cylinder \( z = 4 - y^2 \) and the paraboloid \( z = x^2 + 3y^2 \).
   Ans. \( \int_{-1}^1 \left[ \int_{-4+y^2}^{4-y^2} (\int_{2+3y^2}^{2+3y^2} \, dz) \, dy \right] \, dx \)

   (f) The region bounded by the coordinate planes and the plane \( \frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1 \)
   Ans. \( \int_{-b}^{b} \left[ \int_{-a}^{a} (\int_{-c}^{c} \, dz) \, dx \right] \, dy \)

   (g) The region bounded by the cylinder \( x^2 + y^2 = 4x \), the xy-plane and the paraboloid \( 4z = x^2 + y^2 \).
   Ans. \( \int_0^4 \left[ \int_{-\sqrt{4x-x^2}}^{\sqrt{4x-x^2}} (\int_0^{x^2+y^2} \, dz) \, dy \right] \, dx \)