1. Use a transformation to evaluate \( \int \int_R \frac{e^{y+3x}}{y-2x} \, dA \), where \( R \) is the rectangle enclosed by the lines \( y = 2x + 1 \), \( y = 2x + 5 \), \( y = 1 - 3x \) and \( y = -1 - 3x \).

2. Find the surface area of the portion of the surface \( z = 4y + 3x^2 \) that lies between \( y = 2x \), \( y = 0 \) and \( x = 2 \).
3. Evaluate the double integral \( \int_0^x \int_0^{\ln x} y \, dy \, dx \), by interchanging the order of integration.

4. Let \( D \) be the solid enclosed by \( z = y + 3, x^2 + 9z^2 = 9 \) and \( y = 0 \).

   (a) Sketch the solid region \( D \).

   (b) Set-up [do not solve] the triple integral in Cartesian coordinates necessary to find the volume of the region \( D \).
5. Using spherical coordinates, find the volume of the solid region \( E \) bounded by the sphere \( x^2 + y^2 + z^2 = 4 \) and the planes \( z = 0 \) and \( z = 1 \).

6. Using cylindrical coordinates, evaluate \( \int \int \int_{E} \frac{y}{x} \, dV \), where \( E \) is the region bounded between \( z = x^2 + y^2 \) and \( z = 0 \) and inside \((x - 2)^2 + y^2 = 4\).
7. Find the volume of the tetrahedron bounded by the coordinate planes and the plane with points (3, 2, 0), (2, 0, 2) and (0, 0, 3).

8. Set up and evaluate using Green's Theorem a line integral for the Total Work done in moving a point through the Force field \( \vec{F} = (x^2y)i + xj \) around the triangular region bounded by the x-axis, \( x = 1 \) and the line \( y = 2x \), in a counter-clockwise fashion.
9. Use a suitable potential function to evaluate the line integral
\[ \int_C (3x + y + 1) \, dx + (x + 4y + 2) \, dy \] where \( C \) is any curve connecting \((-1,2)\) to \((0,1)\).

10. Given that \((0,0)\), \((-1,1/2)\) and \((-2,1)\) are critical points of \( f(x, y) = x^3 - 2y^2 - 2y^4 + 3x^2y \), use the second derivative test to classify them.
11. Given \( f(x, y) \) is a differentiable function with \( x = r \cos \theta \) and \( y = r \sin \theta \), show that \( f_\theta = -f_x r \sin \theta + f_y r \cos \theta \).

12. For the space curve \( \vec{r}(t) = \langle e^t, e^{(-t)}, \sqrt{2}t \rangle \):
   Calculate the arclength for \( 0 \leq t \leq 1 \).
13. Given \( f(x, y) = e^{-x} \sec y \):
   (a) Find the tangent plane at the point \( P(0, \pi/4) \).

   (b) Use the linear approximation to approximate \( f(.01, \pi/4 - .01) \).

   (c) Calculate the directional derivative of \( f(x, y) \) at \( P(0, \pi/4) \) toward the direction of the origin.