1. Determine whether or not
\[ \mathbf{F} = (e^x y - \cos(x + y) + 1)i + (e^x - \cos(x + y) + 1)j \]
is a conservative vector field. If it is, find a function \( f \) that \( \mathbf{F} = \nabla f \).

Ans.: \( \mathbf{F} \) is:

(If applicable): \( f = \)
2. Evaluate the line integral 
\[ \int_C \mathbf{F} \cdot d\mathbf{r} \]
where \( C \) is given by the vector function \( \mathbf{r}(t) \).

\[ \mathbf{F}(x, y, z) = yi + xj + zk \]

\[ \mathbf{r}(t) = ti + t^2j + 2tk \quad 0 \leq t \leq 1 \]

Ans.: 2
3. Evaluate
\[
\int \int \int_E 7(x^2 + y^2)^2 \, dV
\]
where \( E \) is the solid that lies within the cylinder \( x^2 + y^2 = 4 \), above the plane \( z = 0 \), and below the cone \( z^2 = 9x^2 + 9y^2 \).

Ans.:
4. Evaluate the iterated integral

\[ \int_0^1 \int_x^{2x} \int_0^{x+y} (6x + 6y) \, dz \, dy \, dx \, . \]

Ans.: 4
5. Use the given transformation to evaluate the integral

\[ \int \int_{R} 4(2x + y)^2 \, dA \]

where \( R \) is the triangular region with vertices \((0, 0), (2, -3), (3, -5)\); \( x = 3u - v, \ y = -5u + 2v \).

Ans.: 5
6. Evaluate the iterated integral by converting to polar coordinates.

\[ \int_0^1 \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} xy^2 \, dy \, dx \]

Ans.: 6
7. Evaluate the iterated integral
\[
\int_0^4 \int_{y/2}^2 e^{x^2} \, dx \, dy.
\]
(Hint: Not even Dr. Z. can do \( \int e^{x^2} \, dx \), so you must be clever!)

Ans.: 

\[
\]
8. Calculate the double integral

\[ \int \int_{R} \frac{3xy^2}{x^2 + 1} \, dA \]

\[ R = \{(x, y) \mid 0 \leq x \leq 1, \ -1 \leq y \leq 1 \} \]

Ans.: 8
9. Use Lagrange multipliers to find the maximum and minimum values of the function \( f(x, y) = xy^2 \) subject to the constraint \( 2x^2 + y^2 = 6 \).

maximum value: 

minimum value:
10. Find the local maximum and minimum values, and saddle point(s) of the function \( f(x, y) = x^4 + y^4 - 4xy + 2 \).

Local maximum value(s):

Local minimum value(s)

saddle point(s):