\[
\begin{align*}
(1) & \quad (0, 0, 1) \\
(2) & \quad (x, (y-1), (x, y))
\end{align*}
\]

\[
\begin{align*}
1 \div x = \frac{1}{5} \quad & \Rightarrow (x, (y-1), (x, y)) = (1, (y-1), (x, y)) \\
0 = x - 1 & \Rightarrow y = 2 \\
x - 1 & = 0 \\
x + 1 - 2 & = 0 \\
1 = h \\
(1) \quad & \Rightarrow (y - 1) = 0 \\
\therefore & \Rightarrow (y - 1) = 0
\end{align*}
\]

\[
\begin{align*}
\begin{cases}
x^2 + 3x + 3y^2 - 6y & = 0 \\
x^2 + 3x + 3y^2 - 6y & = 0 \\
x^2 + 3x + 3y^2 - 6y & = 0 \\
x^2 + 3x + 3y^2 - 6y & = 0 \\
x^2 + 3x + 3y^2 - 6y & = 0
\end{cases}
\end{align*}
\]

\[
\begin{align*}
f(x, y) & = 3x^2 + 3y^2 - 3x^2 - 3y^2 + 4 \\
& = 4
\end{align*}
\]

The Jacobian matrix is:

\[
\frac{\partial f}{\partial x} = \begin{pmatrix}
2x & 6y \\
6x & 6x
\end{pmatrix}
\]

\[
\text{For } \lambda = 0 \text{ and critical points:}
\]

\[
f(0, 0) = 14
\]

\[
\lambda = 1
\]

1. Classify critical points.
Graph (left on x-axis, right on y-axis)

| d | 76 | 36 |
| p | 6  | -6 |

\[
\int (6y - 6)(6y - 6) = \int f(x, y) \, dC
\]

\[
\int f(x, y) \, dC = \frac{1}{2}x^2 - \frac{1}{2}y^2 \]

\[
\int_0^1 (x^2 + y^2) \, dC
\]
So test tells us nothing.

\[ (x, y) = (0, 0) \]

\[ D(0, 0) = (12x^2 + 12y^2) - 0^2 \]

Guesses

2nd der Test at (0, 0)

We can see that \( f \) has a local minimum at (6, 0).

\[ w(x, y) = x + y^2 \]

Then

\[ w(x, y) = f \]
Consider \( z(t) = f(x(t), y(t)) \)

\[
\begin{align*}
\dot{y}(t) &= y_0 + 6t \\
x(0) &= x_0 + a(t)
\end{align*}
\]

\( L \) is defined \( l(x_0, y_0) \)

Why does \( \frac{d}{dt} \) work here? (Illustrate below)
\[
\begin{align*}
\text{If } \frac{\partial^2 f}{\partial x \partial y} & > 0, \quad \frac{\partial^2 f}{\partial y \partial x} > 0, \quad \text{and } \frac{\partial^2 f}{\partial x^2} > 0, \quad \text{then we are in case 2.} \\
\text{Apply Cauchy-Riemann.} \\
\end{align*}
\]
Theorem: \( f \) is continuous at all pts in a closed, bounded set \( S \subset \mathbb{R}^2 \).

Let \( f(x) = x^3 \) be a smooth function on \( \mathbb{R} \).

\( S = \{ x \in \mathbb{R}^2 : (x_1)^2 + (x_2)^2 = 1 \} \) is a smooth curve.

Since \( f \) is continuous at all pts \( (x,y) \) in \( S \), we want to maximize some objective function.

Constraint Optimization
If you mix fate on side.

Doctor, (5)

\[ z = f(x, y) \text{ on disc with center} \]

Then face generally increases if side closed & backed

\[ \text{scc } \times \text{back} \]

\[ \text{scc } \bigtimes \text{back} \]

\[ \text{scc } \times \text{back} \]
Find critical pts \[f_{xx} = 2, f_{yy} = -2, f_{xy} = 1\] & inside

\[\text{(not on boundary)}\]

\[\triangle \text{trise}\]

\[\text{area and } (x, y) \text{ given } S = 1\]

\[h + x - y = b\]

\[f(x, y) = x^2 - y^2\]

\[\text{Test Max/Min Value of } 6\text{ at } (x, y) = (1, 1)\]
The diagram area where \( t = 1 \)

\[
\begin{align*}
(2t', 1-t') &= 2 \\
(3t, 0) &= [0, 1] \\
(2t, t) &= [0, 1] \\
(1-t, 2t) &= \text{line segment}
\end{align*}
\]

Parameterize

\[
f(t) = 4t^2 - (1-t)^2 - 2t + (1-t)
\]

Let \( x = x(t) \) and \( y = y(t) \)

\[
egin{align*}
(x(0)) &= x = 2 \\
(x(1)) &= 2 - x \\
(y(0)) &= -y = 0 \\
(y(1)) &= y
\end{align*}
\]

Max value

\[
f(\theta) = -\theta^2 + \theta
\]

Triangle (do each edge separately)

Find Min Max Value of edge edges of
is more along dot product

must stay on surface, so best constant can be

but want to like to more in $\text{det } \mathbf{v}(\mathbf{p})$:

$\mathbf{v} = x^3 + 2x + h = 2$

$p = 3x^2 + \pi$
\[ F(x, y) = 0 \]
\[ z = x^2 + 2y^2 + z - 1 \]

Calculate this:

\[ \frac{\|\Delta F\|^2}{\|\Delta T\|^2} \left( \frac{\Delta T \cdot \Delta F}{\Delta T} \right) - \text{proj} \]
(no result to maximum pullback)

| 1 | \( x = \sqrt{2} \) |
| 2 | \( 1 - \frac{h}{2} \) |
| 3 | \( \sqrt{1 - 2y + z} = z \) |

\[
\begin{align*}
1 - 2y + z &= 2z - 2 - 1 - y \\
x &= z \\
y &= (x + 2z) \quad \text{or} \quad x = 2z \\
\end{align*}
\]

\[
\begin{align*}
\Delta \text{OP parallel to } EF(1,2,2) = 2x, 4y + 2, -1
\end{align*}
\]