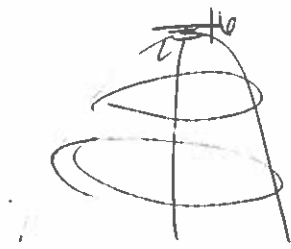


EXTREMA

Critical Points

$$f_x = f_y = 0 \text{ or undefined}$$



$$f(x,y) = 16 - x^2 - y^2 - 2y + 3x$$

$$f_x = -2x + 3 = 0$$

$$f_y = -2y - 2 = 0$$

$$x = 3/2$$

$$y = -1$$

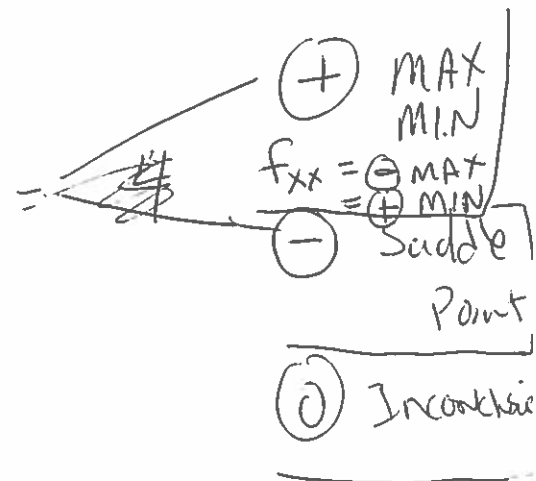
$$D = f_{xx} f_{yy} - f_{xy}^2$$

Ex

$$f_{xx} = -2$$

$$f_{yy} = -2$$

$$f_{xy} = 0$$



Saddle Point

$$f(x,y) = 16 - x^2 + y^2$$

CRITICAL.

(0,0)

$$f_x = -2x = 0$$

$$f_y = +2y = 0$$

$$f_{xx} = -2$$

$D = -4$ saddle.

$$f_{yy} = 2$$

$$f_{xy} = 0$$

Ex

$$f(x,y) = 2x + 3y$$

$$f_x = 2 \neq 0 \quad \text{NO Cnts.}$$

$$f_y = 3 \neq 0$$

Ex

$$f(x,y) = x^4 - y^4$$

$$f_x = 4x^3 = 0 \quad x = 0$$

$$f_y = 4y^3 = 0 \quad y = 0$$

$$f_{xx} = 12x^2$$

$$f_{yy} = 12y^2$$

$$f_{xy} = 4x^3y^3 - \text{circled } 0 = 0 \quad \text{increases}$$

EX $f(x,y) = x^3y + x^2y^2 + y$

$f_x = 3x^2y + 2xy^2 = 0$

$f_y = x^3 + 2x^2y + 1 = 0$

$y = \frac{1-x^3}{2x^2}$

$$3x^2 \left(\frac{1-x^3}{2x^2} \right) + 2x \left(\frac{1-x^3}{2x^2} \right)^2 = 0$$

$$x = \# , \# , \#$$

$$(1, 1, 1)$$

$$(0, 1)$$

$$x = 1 \quad y = -\frac{1}{\sqrt[3]{2}}$$

$$\left(-\frac{1}{\sqrt{2}}, \sqrt[3]{\frac{256}{2}}\right)$$

$$y = 0$$

$$y = \frac{3/2}{2 \cdot 2^{2/3}}$$

$$f_{xx} = 6xy + 2y^2$$

$$f_{yy} = 2x^2$$

$$f_{xy} = 3x^2 + 4xy$$

$$= \frac{3}{2^{8/3}}$$

$$D(0,1) = (2)(0) - 0 = 0 \text{ Inconclusive}$$

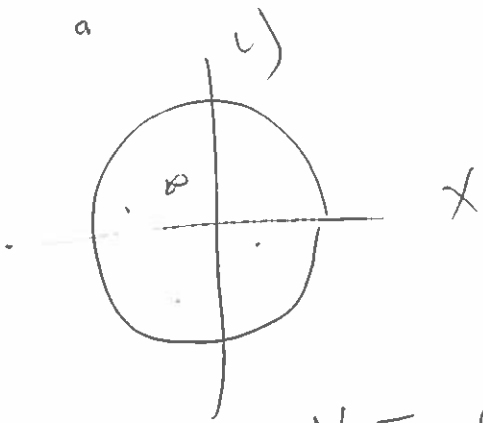
$$D\left(\frac{1}{\sqrt{2}}, \frac{2}{\sqrt{256}}\right) = 1 \times \times + 44$$

$$-1.26 \quad .472$$

$$\left(\begin{array}{l} 6.94 + .44 \\ + \end{array} \right) \left(2 \left(\frac{3}{\sqrt{256}} \right)^2 \right) =$$

$$+ \quad +$$

Boundary



$$\begin{aligned}x &= \cos t \\y &= \sin t \\0 \leq t &\leq 2\pi\end{aligned}$$

$$f_x = -2x - 2$$

$$f_y = -2y + 3$$

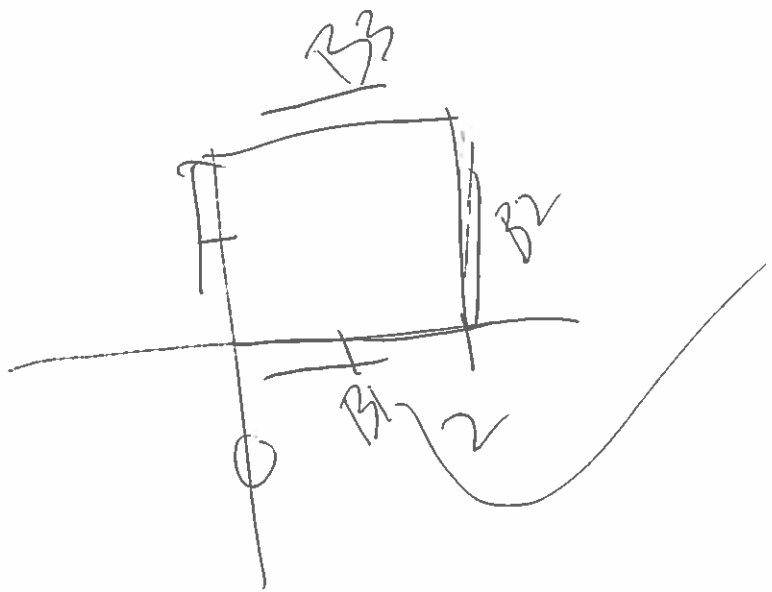
$$(-1, 3/2)$$

$$f(x, y) = 16 - x^2 - y^2 - 2x + 3y$$

$$f(t) = 16 - (\cos t)^2 - (\sin t)^2 - 2(\cos t) + 3\sin t$$

$$t = 2.15 \dots \quad f(t) = 18.60 \quad \text{MAX}$$

$$t = 5.3 \quad f(t) = 11.39 \quad \text{MIN}$$



$$0 \leq x \leq 2 \quad B_1 \quad f(x,0)$$

$$y=0 \quad 0 \leq x \leq 2$$

$$0 \leq y \leq 2 \quad B_2$$

$$x=2$$

$$0 \leq x \leq 2 \quad B_3$$

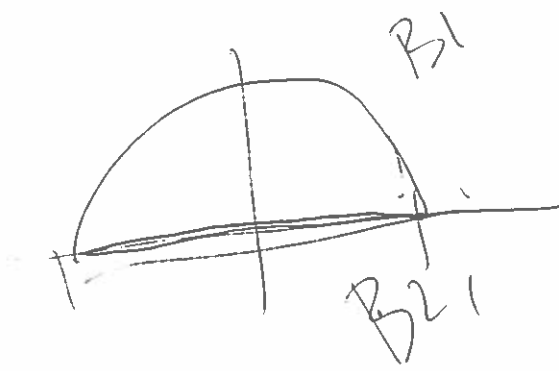
$$y=2$$

$$0 \leq y \leq 2 \quad B_4$$

$$x=0 \quad f(0,y)$$

$$0 \leq y \leq 2$$

$f(x,y)$



$$x = \cos t$$

$$y = \sin t \quad 0 \leq t \leq \pi$$

$$y=0$$

$$-1 \leq x \leq 1$$

<p>GROUP NAME: _____</p> <p>Logo: _____</p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: <u>Shawnee</u></p>
<p>Date: _____</p> <p>Topics: _____</p>	<p>Writer/Prep: <u>P...</u></p> <p>QC/Leader: <u>J...</u></p>

Instructions:

$$f(x,y,z) = 15x^2 - 4.5xy + 15y^3$$

$$f_y = 45y^2 - 4.5x = 0$$

$$f_{xx} = 0 \quad x$$

$$90y - 4.5x = 0$$

$$20x = 20x$$

$$D = (90x)(10y) - (-45)^2 = 8100xy - 2025$$

<p>GROUP NAME: <u> E.A. 10/22 </u></p> <p>Logo: _____</p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: _____</p>
<p>Date: _____</p> <p>Topics: _____</p>	<p>Writer/Prep: _____</p> <p>QC/Leader: _____</p>

Instructions:

$$+ = \dots = 2x^2 - 1 \dots$$

$$= 2x^2 - 1 + 2(x^2 + x - 1) = 0$$

$$= -4x^2 - 2x + 1 = 0$$

$f(x) =$

<p>GROUP NAME: <u>42</u></p> <p>Logo: _____</p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: <u>Ben</u></p>
<p>Date: _____</p> <p>Topics: _____</p>	<p>Writer/Prep: <u>Kyle</u></p> <p>QC/Leader: <u>Gary</u></p>

Instructions:

$z = f(x, y)$
 $a = 3$

$$2(xy + yz + xz) = 54$$


$$z = f(x, y)$$

$$V(x, y) = x \cdot y \cdot f(x, y)$$

$$V_x = \dots$$

$$V_y = \dots$$

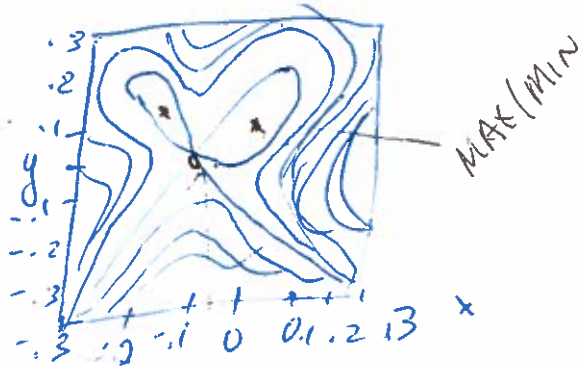
→ Find criticals

<p>GROUP NAME: <u>Team OP</u></p> <p>Logo: </p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: _____</p>
<p>Date: <u>10.9.13</u></p> <p>Topics:</p>	<p>Writer/Prep: <u>Olga Smitik</u></p> <p>QC/Leader: <u>Javier Blance</u></p>

Instructions:

Connect Problem #4

Use plot to guess the locations of all extrema & saddle points



Answer C

Extrema @
App. $(\pm 0.1, 0.1)$

saddle $(0, 0)$

Saddle