

MA121-003

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wednesday, December 5

- 6.3 today
- final exam REVIEW
- FINAL EXAM: MONDAY, DECEMBER 10
1:00 - 4:00 pm SAS2203
- please do the class evaluation
(before 8:00 am on 12/10)

MAX / MIN / SADDLE POINT
FOR $f(x, y)$:

1.) find f_x , f_y , f_{xx} , f_{yy} , f_{xy} :

2.) set $f_x = 0$ & $f_y = 0 \Rightarrow (a, b)$

3.) D TEST (2nd DERIV TEST)

$$D = f_{xx}(a, b) \cdot f_{yy}(a, b) - [f_{xy}(a, b)]^2$$

a.) if $D > 0$ & $f_{xx}(a, b) < 0$
 $\rightarrow (a, b, f(a, b))$ is a MAX

b.) if $D > 0$ & $f_{xx}(a, b) > 0$
 $\rightarrow (a, b, f(a, b))$ is a MIN

c.) if $D < 0 \rightarrow (a, b, f(a, b))$
is a SADDLE POINT

d.) if $D = 0 \rightarrow$ TEST FAILS

example:

$$f(x, y) = x^2 + xy + 2y^2 - 7x$$

1.) find $f_x, f_y, f_{xx}, f_{xy}, f_{yy}, f_{yx}$:

$$f_x = \underline{2x + y - 7} = 0$$

$$f_y = \underline{x + 4y} = 0$$

$$f_{xx} = 2 \quad f_{yy} = 4 \quad f_{xy} = f_{yx} = 1$$

2.) solve $f_x = 0$ and $f_y = 0$

$$2x + y - 7 = 0$$

$$x + 4y = 0$$

$$x = -4y$$

SUBST.

$$2(-4y) + y - 7 = 0$$

$$-8y + y - 7 = 0$$

$$-7y = 7$$

$$y = -1$$

$$x = -4y = -4(-1) = 4$$

(4, -1) actually (4, -1, f(4, -1)) is a possible max/min/saddle

3.) D-TEST:

$$D = f_{xx}(4, -1) \cdot f_{yy}(4, -1) - [f_{xy}(4, -1)]^2$$

$$D = (2) \cdot (4) - 1^2$$

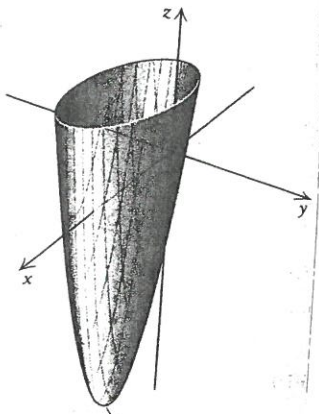
$$D = 7$$

4.) D=7 and $f_{xx}(4, -1) = 2$

(since D > 0 and $f_{xx}(4, -1) > 0$,
this is a relative MINIMUM.)

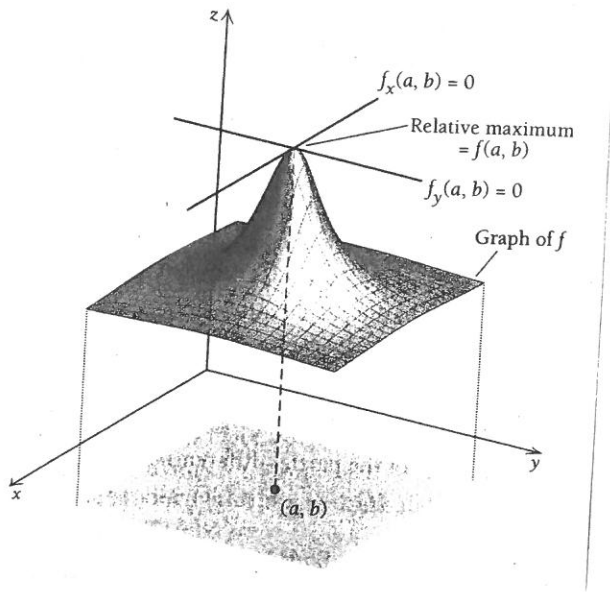
$$\begin{aligned} f(4, -1) &= 4^2 + 4(-1) + 2(-1)^2 - 7 \cdot 4 \\ &= 16 - 4 + 2 - 28 \\ &= \underline{-14} \end{aligned}$$

thus $(4, -1, -14)$ is a relative MIN

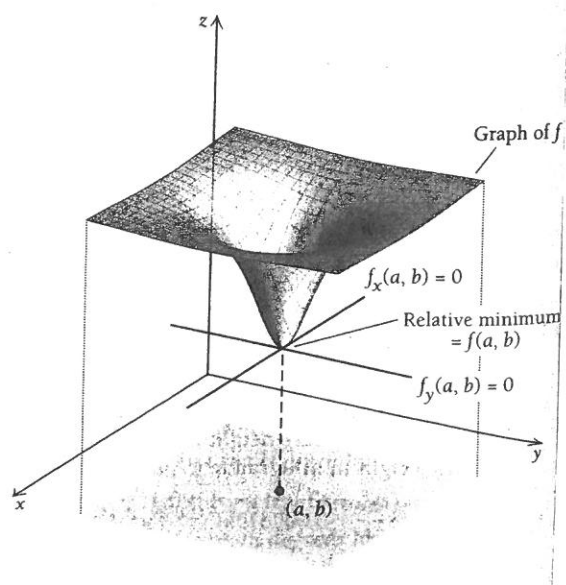


Relative minimum: $(4, -1, -14)$
 $z = f(x, y) = x^2 + xy + 2y^2 - 7x$

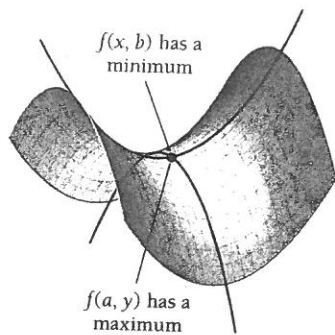
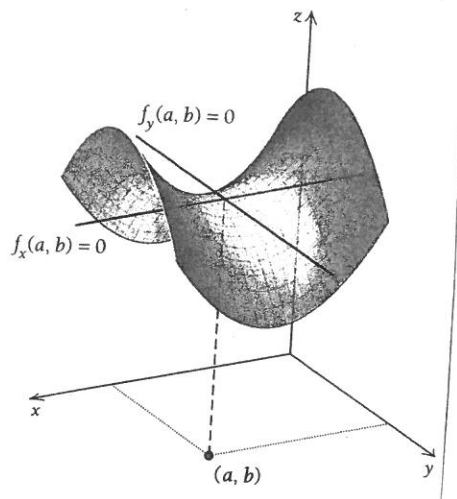
RELATIVE MAX:



RELATIVE MIN:



SADDLE POINT:



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TEST #4 RESULTS

A's 74 (35.2%) } 61.9%
B's 56 (26.7%) }

C's 42 (20%)

D's 18 (8.6%) } 18.1%
F's 20 (9.5%) }

AVE: 80.05