

12-7

Part two

①

Previously we considered extrema  
on an open region

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Now we consider finding extrema  
of  $f(x,y)$  on a closed bounded  
region,  $R$

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Thm A continuous real valued  
function defined on a closed  
bounded set  $R$  attains its absolute  
maximum and absolute minimum  
on the set  $R$ .

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Part 2

(2)

— The procedure —

- 1) In the interior of  $R$ , find critical points as before. Make a list and check it twice.
- 2) Make a list of extrema on the boundary.
- 3) Look through the function values generated by the two lists from (1) and (2).  
The largest value will be the absolute maximum.

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Part two

(3)

Ex: Find the absolute extrema of

$f(x,y) = x^2 + y^2$  on the square

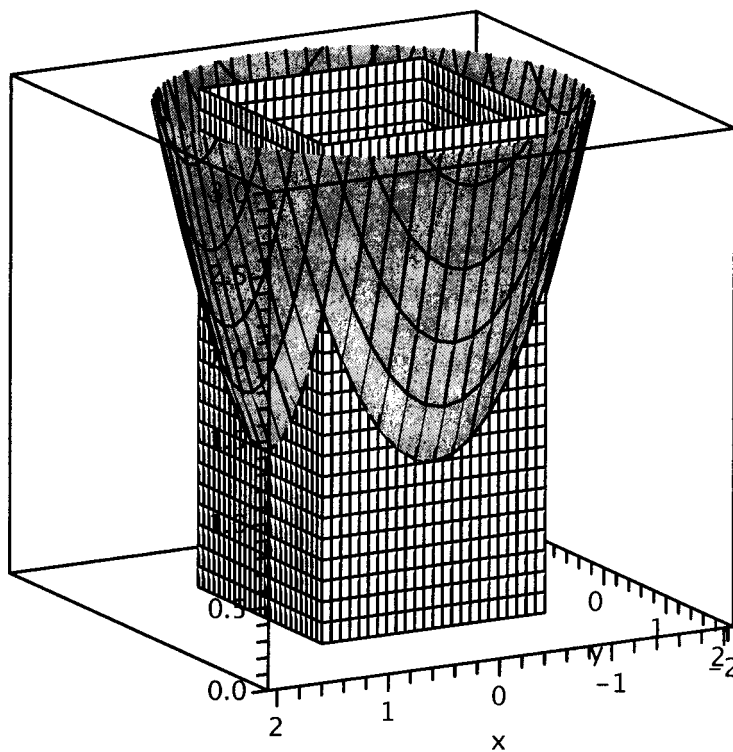
$$R = \{(x,y) \mid -1 \leq x \leq 1 \text{ and } -1 \leq y \leq 1\}$$

1) Interior of the square.  
Use calculus.

2) Boundary of  $R$ .

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> with(plots):  
> paraboloid:=plot3d(x^2+y^2,x=-2..2,y=-2..2,color=red):  
> side1:=plot3d([1,y,z],y=-1..1,z=0..3,color=yellow,transparency=  
0.5):  
> side2:=plot3d([-1,y,z],y=-1..1,z=0..3,color=yellow,transparency=  
0.5):  
> side3:=plot3d([x,1,z],x=-1..1,z=0..3,color=yellow,transparency=  
0.5):  
> side4:=plot3d([x,-1,z],x=-1..1,z=0..3,color=yellow,transparency=  
0.5):  
> Domain:=plot3d([x,y,0],x=-1..1,y=-1..1,color=green,transparency=  
0.5):  
> display3d({paraboloid,side1,side2,side3,side4,Domain},view=0..3,  
axes=boxed);
```



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(5)

ex

Find absolute extrema of  
 $f(x,y) = 2x^2 - 8x + y^2 - 8y + 7$   
 $= 2(x-2)^2 + (y-4)^2 - 17$

on the triangular region

$$x=0, y=4, y=2x$$

