New Material:
3d graphing

Jan 18-8:55 PM

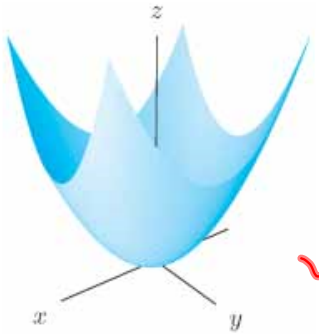
12.2 GRAPHS OF FUNCTIONS OF TWO VARIABLES

Plotting the Graph of the Function $f(x, y) = x^2 + y^2$

To sketch the graph of f we connect points as for a function of one variable. We first make a table of values of f, such as in Table 12.3.

Table 12.3 *Table of Values of $f(x, y) = x^2 + y^2$*

		y						
		-3	-2	-1	0	1	2	3
x	-3	18	13	10	9	10	13	18
	-2	13	8	5	4	5	8	13
	-1	10	5	2	1	2	5	10
	0	9	4	1	0	1	4	9
	1	10	5	2	1	2	5	10
	2	13	8	5	4	5	8	13
	3	18	13	10	9	10	13	18



3d parabola

Figure 12.13 Graph of $f(x, y) = x^2 + y^2$ for $-3 \le x \le 3, -3 \le y \le 3$

use 3-d graphing... website on moodle

Find below some very helpful links.

- News forum
- Wolfram-Alpha (should be wolfram-awesome)
- MIT lessons
- Great 3-d Grapher and contour diagram
- Helpful applets
- More helpful applets
- Sign up for Khan Academy.
- gradients and level curve apps
- Polar Grapher
- Homework Assignment Due Dates

TRANSFORMATIONS

Let $f(x, y) = x^2 + y^2$. Describe in words the graphs of the following functions:

(a) $g(x, y) = x^2 + y^2 + 3$,

(b) $h(x, y) = 5 - x^2 - y^2$,

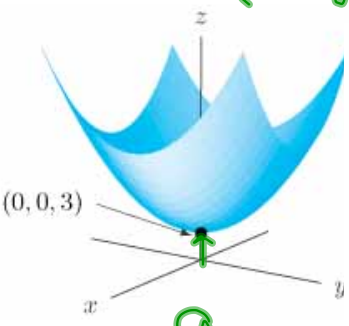
(c) $k(x, y) = x^2 + (y - 1)^2$.

shift up +3 z direction

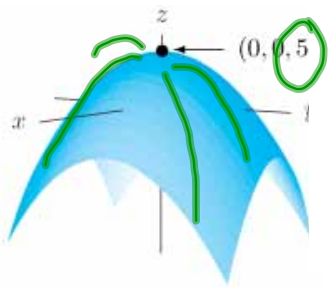
$5-(x^2+y^2)$, 5 → up z

$-$ → flip parabola

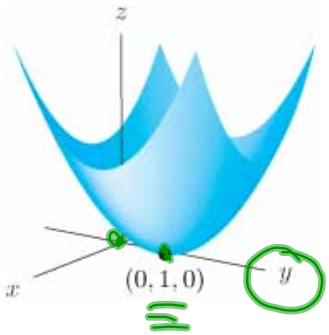
Shift (+1) y direction



g



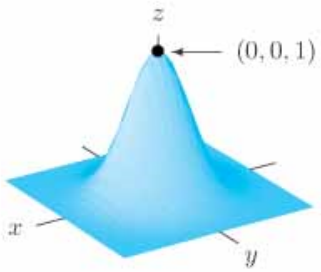
h



=

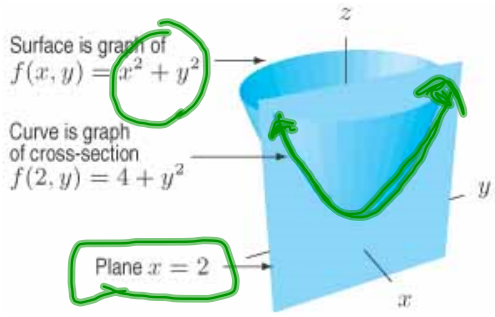
Describe the graph of $G(x, y) = e^{-(x^2+y^2)}$. What symmetry does it have?

- circle
- $x^2 + y^2 > 0$
- $e^{-\#}$
- $0 < G < 1$
- $x = y = 0$



Cross-Sections and the Graph of a Function

For a function $f(x, y)$, the function we get by holding x fixed and letting y vary is called a **cross-section** of f with x fixed. The graph of the cross-section of $f(x, y)$ with $x = c$ is the curve, or cross-section, we get by intersecting the graph of f with the plane $x = c$. We define a cross-section of f with y fixed similarly.



$f(x,y)$

$f(2,y) = 4 + y^2$

$z = 4 + y^2$

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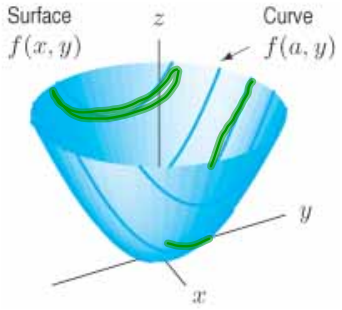


Figure 12.19 The curves $z = f(a, y)$ with a constant: cross-sections with x fixed

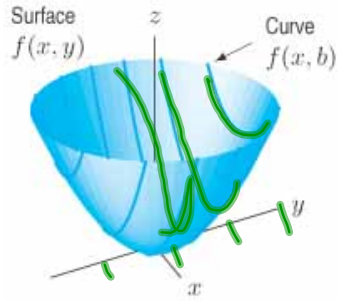


Figure 12.20 The curves $z = f(x, b)$ with b constant: cross-sections with y fixed

Describe the cross-sections of the function $g(x, y) = x^2 - y^2$ with y fixed and then with x fixed. Use these cross-sections to describe the shape of the graph of g.

Fix x

x	g(x,y)
0	$-y^2$
± 2	$4 - y^2$

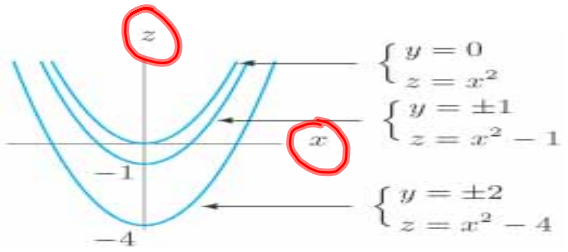


Figure 12.21 Cross-sections of $g(x, y) = x^2 - y^2$ with y fixed

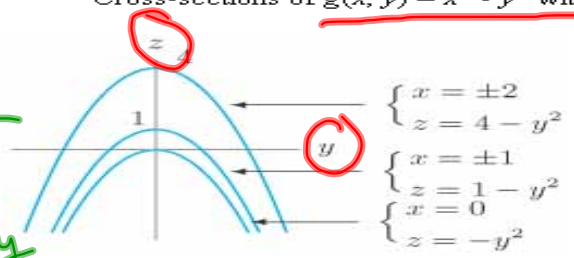


Figure 12.22 Cross-sections of $g(x, y) = x^2 - y^2$ with x fixed

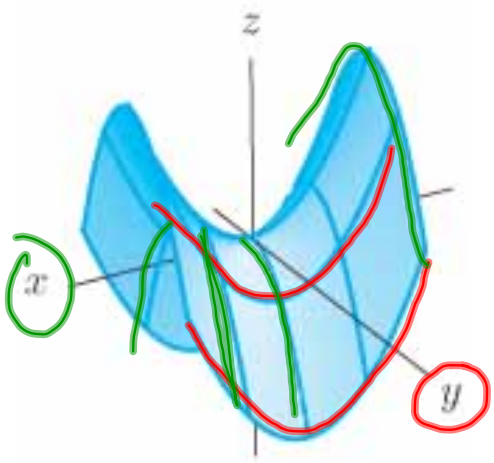


Figure 12.23 Graph of $g(x, y) = x^2 - y^2$ showing cross sections

Saddle

When One Variable is Missing: Cylinders

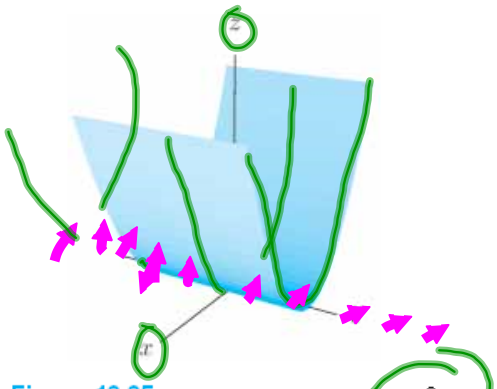


Figure 12.25 A parabolic cylinder $z = x^2$

y can be anything

Graph the equation $x^2 + y^2 = 1$ in 3-space.

circle; r=1

z can be anything

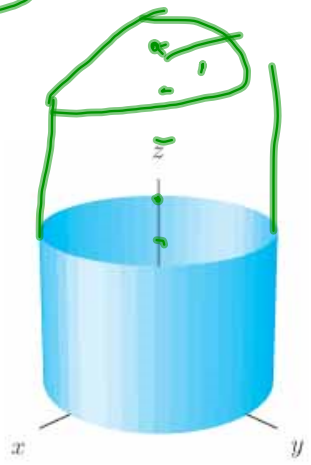
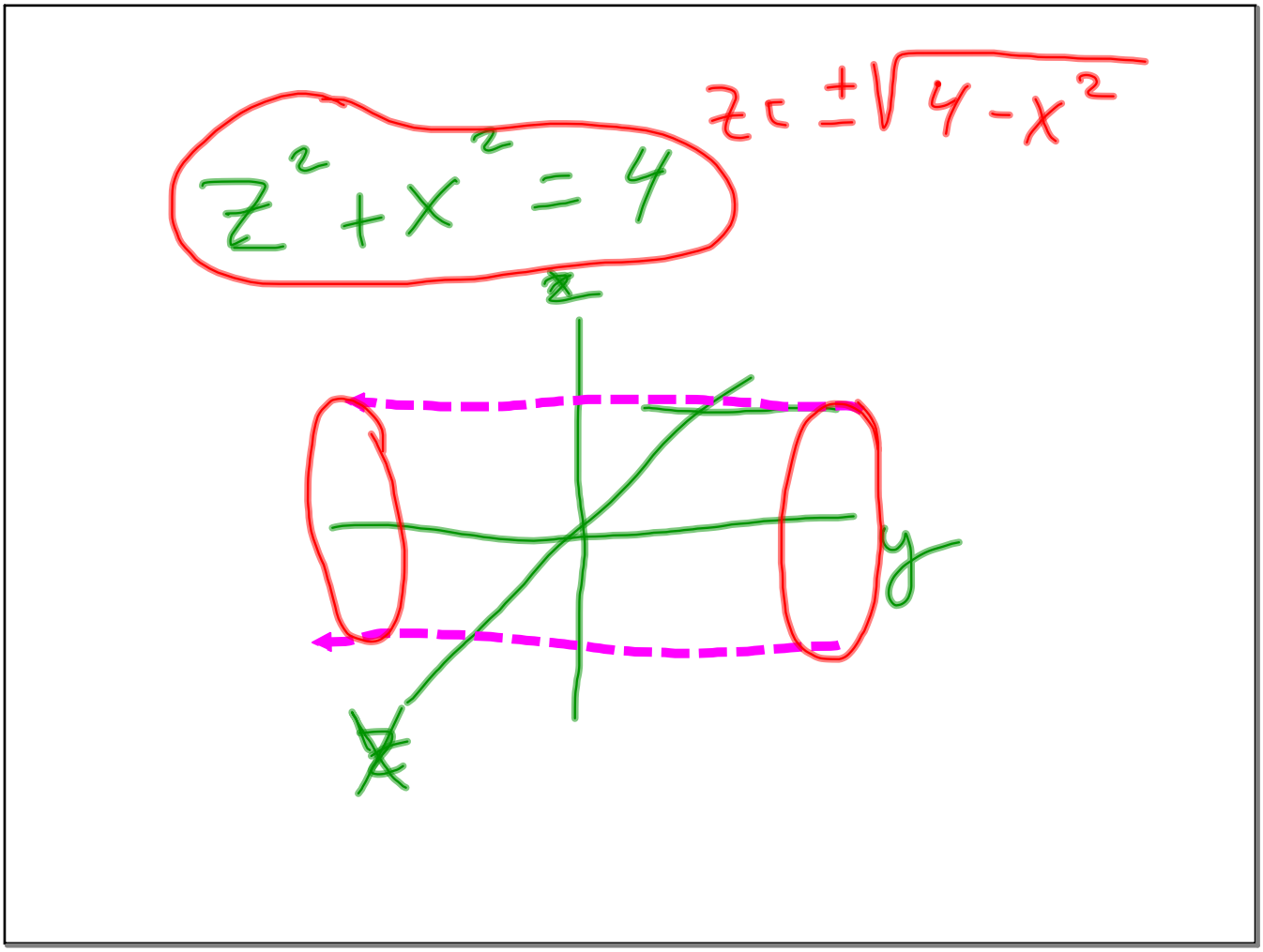


Figure 12.26 Circular cylinder $x^2 + y^2 = 1$



Dec 30-2:44 PM

Graphing 3d

- cross sections
- missing variables
- comp software ☑