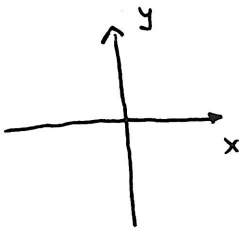
Section 14.1 - Functions of Several Variables

MVC

- A function of two variables:



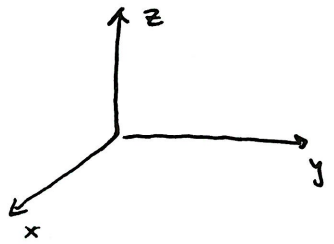
Example 1 Evaluate $f(3,2)$ and sketch the domain

(a) $f(x,y) = \dfrac{\sqrt{x+y+1}}{x-1}$

(b) $f(x,y) = x \ln(y^2 - x)$

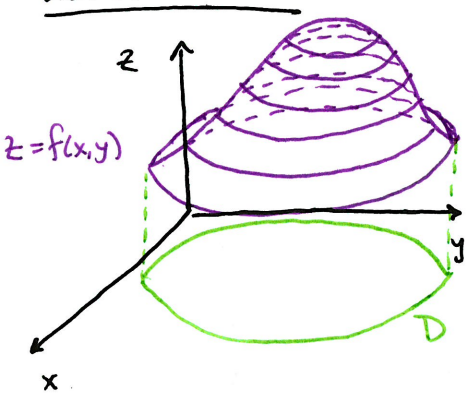
- Graph of $f(x,y)$:

Example 6 Sketch the graph of $g(x,y) = \sqrt{9 - x^2 - y^2}$



See pg. 906 for other Cool Surfaces

- Level Curves:



Why would we look at level curves?

1)

2)

3)

Examples: • Topographic Maps - Pg. 907 figure 12

★ Watch: Augmented Reality Sandbox : youtube.com/watch?v=CE1B7tdGCw0

- Weather maps for Temp - Pg. 908 figure 13
  - ↳ watch weather on News
  - Level curves called isothermals
- Medical Imaging

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Example 10 Sketch the level curves of $f(x,y) = 6 - 3x - 2y$ for $k = -6, 0, 6, 12$

Example 12 Sketch some level curves of $h(x,y) = 4x^2 + y^2 + 1$

- Functions of 3 variables:

- Level Surface:

★ We can't see in 4D but we can visualize how their 3D shadows change!
Think of 4D as a 3D movie watched all at once - you're outside of time

Example 15 Find the level surfaces of the function $f(x,y,z) = x^2 + y^2 + z^2$

- Computer Visualizations:

4D Sphere - Hypersphere: youtube.com/watch?v=BqfwPQvb7KA

4D Cube - Tesseract: youtube.com/watch?v=jGO1ZZ5Lw8s

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- Extra Examples

#32 Match the function with its graph: (Pg. 913)

(a) $f(x,y) = |x| + |y|$

(b) $f(x,y) = |xy|$

(c) $f(x,y) = \dfrac{1}{1+x^2+y^2}$

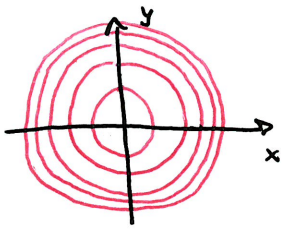
(d) $f(x,y) = (x^2-y^2)^2$

(e) $f(x,y) = (x-y)^2$

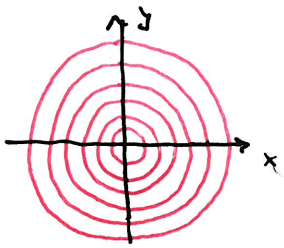
(f) $f(x,y) = \sin(|x|+|y|)$

#36 Two contour maps are shown; one is a cone, one is a paraboloid. Which is which and why?

I



II



#65 Describe the level surfaces of $f(x,y,z) = x + 3y + 5z$

#69 Describe how g is obtained from f:

(a) $g(x,y) = f(x,y) + 2$

(b) $g(x,y) = 2f(x,y)$

(c) $g(x,y) = -f(x,y)$

(d) $g(x,y) = 2 - f(x,y)$