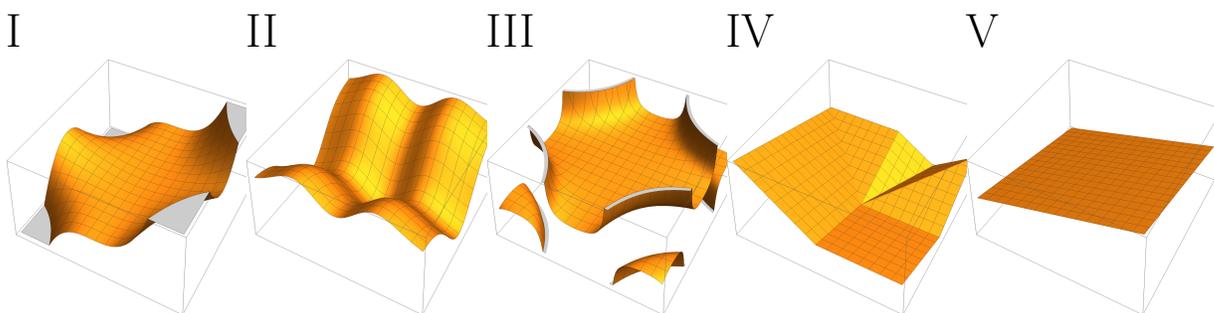
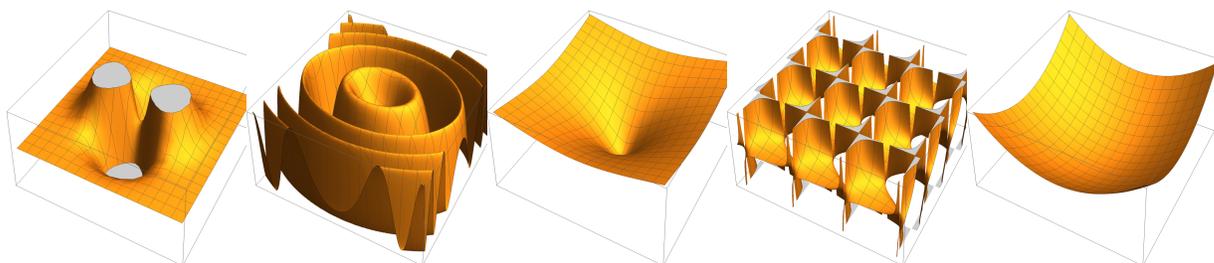


Homework 4: Functions of 2 and 3 variables

This homework is due Friday, 9/16 rsp Tuesday 9/20/2016.

1 Match the following graphs with the functions $f(x, y)$.



VI	VII	VIII	IX	X
$f(x, y) =$		I-X	$f(x, y) =$	I-X
$x^2 + y^2$			$\sin(x^2 + 2y^2)$	
$ x - y - x $			$\exp(-x^2)x^2 - \exp(-y^2)$	
$x^2 + x^3y^2$			$x - y$	
$\exp(-x^2 - y^2)(x^2 - y^2)$			$\sec(xy)$	
$\log(x^2 + y^2 + 1)$			$\tan(x)/\tan(y)$	

2 Define the function $f(x, y) = 1 + x^2y^2e^{-x^2-y^2}$.

a) What are the traces, the intersections with the coordinate planes? Draw the intersection of the graph with plane $y = 1$, $y = -1$, $x = 1$, $x = -1$.

b) Use the information obtained in a) to plot the graph of the function.

c) Find the domain and range of the function

$f(x, y) = \sqrt{1 - x^2 - y^2} \arccos(x^2 - y^2)$ and plot the graph, where defined.

- 3 a) Plot the graph and contour map of the function $f(x, y) = \frac{x-y}{x^2+y^2}$
 b) Plot the graph and contour map of the function $f(x, y) = \frac{(x/y)}{x^2+y^2}$.
- 4 Find an equation for the surface consisting of all points P for which the distance from P to the x -axis is twice the distance from P to the yz -plane. Identify the surface.
- 5 a) Draw the surface $4y^2 + z^2 - x - 16y - 4z + 20 = 0$.
 b) Draw the surface $x - z^2 + y^2 + 4y = 1$.

Main definitions

The **domain** D of a function $f(x, y)$ is the set of points where f is defined, the **range** is $\{f(x, y) \mid (x, y) \in D\}$. The **graph** of $f(x, y)$ is the surface $\{(x, y, f(x, y)) \mid (x, y) \in D\}$ in \mathbb{R}^3 . The set $f(x, y) = c = \text{const}$ is **contour curve** or **level curve** of f . The collection of contour curves $\{f(x, y) = c\}$ is the **contour map** of f . A function of three variables $g(x, y, z)$ can be visualized by **contour surfaces** $g(x, y, z) = c$, where c is constant. **Traces**, the intersections of the surfaces with the coordinate planes help to draw them. Examples: The elliptic paraboloid $z - x^2 - y^2 = 0$ and hyperboloid $z - x^2 + y^2 = 0$ are examples of graphs $z - f(x, y) = 0$. The one sheeted hyperboloid $x^2 + y^2 - z^2 = 1$ and two sheeted hyperboloid $x^2 + y^2 - z^2 = -1$ or cylinder $x^2 + y^2 = 1$ are examples of surfaces of revolution $x^2 + y^2 - g(z) = 0$.