Level Curves and Contour Plots in Python Programming

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Introduction:

In the Multivariate Calculus and other Mathematical equation when we want to draw a graph of the given equation we used contour plots. There are various given equations which we discussed in this research implemented using python. A contour line or an isoline of a two variable function is a curve along which the function has a constant value. It is a cross-section of the three-dimensional graph of the function f (x, y) parallel to the x, y plane. For example, contour lines are used in geography and meteorology. In cartography, a contour line connects points of equal height above a certain level, such as the mean sea level. The contour of a two-variable function is a curve that connects points with the same values.

Keywords: Pycharm, Numpy, Matplotlib

About Python Programming

Python For programming purposes we use the programming language Python. It's a good general language with many tools and libraries available and it's free. This is a good option to learn programming and testing new codes.

1. 1. Using Python on University Computers A number of Python tools are available on a standard university desktop computer. We will use Python mainly through Spyder, which allows us to write, execute, test, and debug Python code in one place. To start Spyder, enter Spyder in the search bar, or go to Start, All Programs, Programming Languages, Anaconda, and then select Spyder.

2. If you use Python on your own free Python computer, you can install and run it on any computer (tablet or phone) of your choice. In fact, many will already have Python installed for use with other software. But for programming, it's better to have an installation that works together, that you can easily experiment with, and that does not interrupt the other programs if you change something. For these reasons, we recommend that you install the anaconda distribution.

What are Contour Plots?

Contour plots (sometimes referred to as layer plots) indicate a three-dimensional surface in a two-dimensional plane. Draw two XY prediction curves on the Y axis and one Z response variable in the form of contours. These contours are sometimes referred to as Z-layers or isofeedback values.

This type of chart is commonly used in mapping where the contour lines of a topological map show the same heights. Many other students use contours, including astrology, meteorology, and physics. Contours generally indicate the height (such as the height of geographic features), but can also be used to indicate density, brightness, or electrical potential.

Contour drawing is a graphical technique for representing a three-dimensional surface by drawing constant Z-sections, called contours, in a two-dimensional format. That is, given a value for z, lines are drawn to join the (x, y) coordinates at which this z value appears.

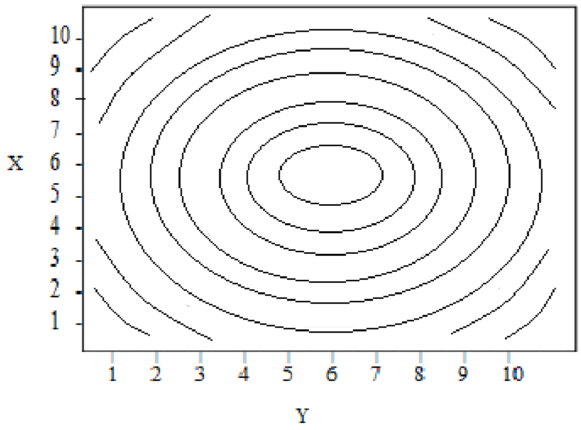
A contour plot is appropriate if you want to see how some value Z changes as a function of two inputs, X and Y:

z = f(x, y)

A contour line (also isoline, isoplet, or isarithm) of a two-variable function is a curve along which the function has a constant value so that the curve connects points of equal value. It is a flat section of the three-dimensional graph of the function f (x, y) parallel to the plane x, y. In cartography, a contour line (often called simply "contour") connects points of equal height (height) above a certain level, such as mean sea level. An overview map is a map illustrated by contour lines, for example, a topographic map showing valleys and hills as well as slope or slope smoothing. The contour interval of a contour map is the height difference between successive contour lines.

Contours are curves, straight lines, or a combination of the two lines of a map that describe the intersection of a real or hypothetical surface with one or more horizontal planes. The configuration of these contours allows the card readers to derive the relative slope of a parameter and to estimate this parameter at particular locations. Contour lines can be recorded in a three-dimensional model that is visible from the surface, such as when a photometrician sees a stereo model that draws elevation contours, or when interpolated from estimated surface heights through an observation network. Key points of the region. In the latter case, the interpolation method influences the reliability of individual isolines and their representation of slopes, valleys and peaks.

The most common form is the **rectangular contour plot**, which is (as the name suggests) shaped like a rectangle



Rectangular contour plot showing a symmetrical surface with a central peak.

Implementation of equations:

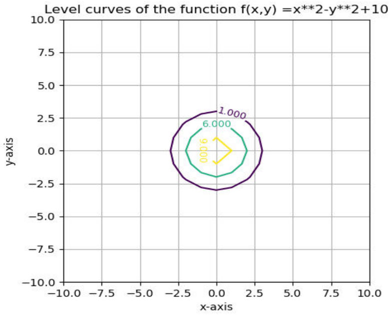
1. **10- x^{**2} – y^{**2} when z = 1, z = 6, z =9**

Code :

```
import matplotlib.pyplot as plt
import numpy as np

x = np.linspace(-10, 10, 21)
y = np.linspace(-10, 10, 21)
x, y = np.meshgrid(x, y)
z=10-x**2-y**2
levels = np.array([1, 6, 9])
cs1 = plt.contourf(x, y, z,levels)
cs = plt.contour(x, y, z, levels)
plt.clabel(cs, inline=1, fontsize=9)
plt.grid(True)
plt.axis('scaled')
plt.xlabel('x-axis')
plt.ylabel('y-axis')
plt.title('Level curves of the function f(x,y) =x**2+y**2.')
plt.show()
```

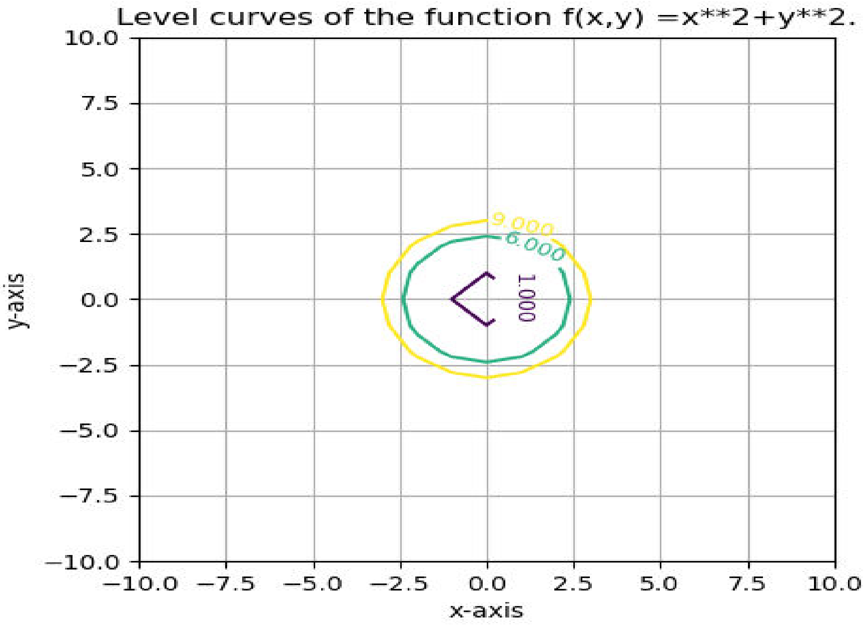
Output:



2. $x^{**2} + y^{**2}$ when z =1, z =6 , z =9

```
import matplotlib.pyplot as plt
import numpy as np
x = np.linspace(-10, 10, 21)
y = np.linspace(-10, 10, 21)
x, y = np.meshgrid(x, y)
z = x ** 2 + y ** 2
levels = np.array([1, 6, 9])
cs = plt.contour(x, y, z, levels)
plt.clabel(cs, inline=1, fontsize=9)
plt.grid(True)
plt.axis('scaled')
plt.xlabel('x-axis')
plt.ylabel('y-axis')
plt.title('Level curves of the function f(x,y) =x**2+y**2.')
plt.show()
```

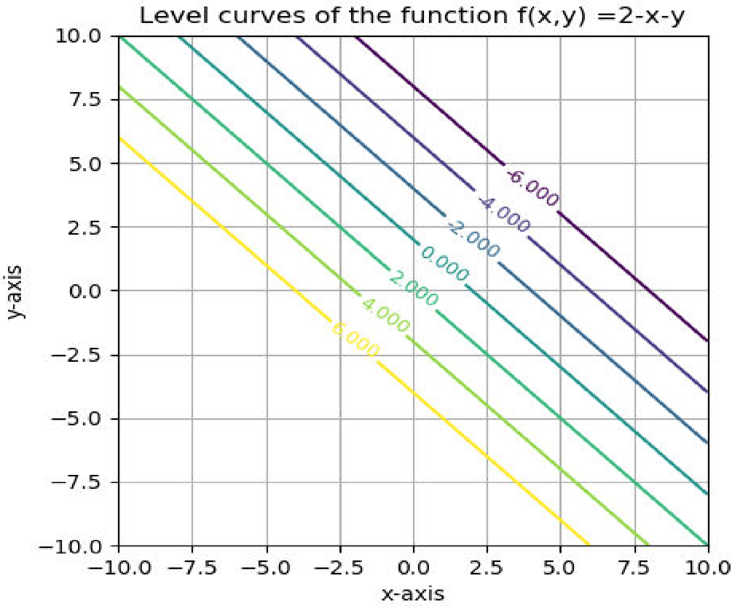
Output:



3. 2-x-y

```
import matplotlib.pyplot as plt
import numpy as np
x = np.linspace(-10, 10, 21)
y = np.linspace(-10, 10, 21)
x,y=np.meshgrid(x,y)
z=2-x-y
levels=np.array([-6,-4,-2,0,2,4,6])
cs=plt.contour(x,y,z,levels)
plt.clabel(cs,inline=1,fontsize=9)
plt.grid(True)
plt.axis('scaled')
plt.xlabel('x-axis')
plt.ylabel('y-axis')
plt.title('Level curves of the function f(x,y) =2-x-y')
plt.show()
```

Output:


Level curves of the function f(x,y) =2-x-y
y-axis
x-axis