MATH 331 BA 28/10/1432h

Lab 2

Plot 2D Rectangular

1. Plot $y = x\sin\frac{5}{x}$ and add a caption
2. Plot more than one functions in one figure

   $f(x) = \sin x,$ and $g(x) = \cos(2x)$
3. Plot the following data with the equation $\frac{2792}{647} + \frac{957}{647}x$

$$\begin{bmatrix} 1 & 3 & 4 & 6 & 7 & 7 & 10 & 11 \\ 8 & 7 & 9 & 12 & 15 & 16 & 19 & 21 \end{bmatrix}^T$$

4. To plot a piecewise-defined function

$$f(x) = \begin{cases} x^2 - 1 & \text{if} \quad x < -1 \\ 10 - 10x^2 & \text{if} \quad -1 \le x \le 1 \\ x^2 - 1 & \text{if} \quad 1 < x \end{cases}$$

Parametric Plots

Plot a 2D parametric curve $x = \sin 2t, y = \cos 3t$

$(\sin 2t, \cos 3t)$

Implicit Plots

Plot $(x-2)^2 + (y-3)^2 = 25, \ -3 \le x \le 7$ and $-2 \le y \le 8.$

Polar Coordinates

Plot (a) $\sin 2\theta$ (b) $1 - \cos\theta$ (c) $1 - \sin\theta + 2\sin 3\theta$

Parametric Polar Plots

$(1 - \sin t, \cos t)$

3D Plots of Functions and Expressions

You can plot a wide variety of surfaces with Plot 3D. Examples of Rectangular, Cylindrical, Spherical, Implicit, and Tube plots are presented in this section. Examples of Gradient and Vector Field plots are presented in

Rectangular

$z = \sin x + \cos y$

Implicit Plots

Plot 3D + Implicit

$x^2 + y^2 + z^2 + 1 = (x + y + z + 1)^2$

Domain Intervals $-5 \le x \le 5$, $-5 \le y \le 5$, and $-5 \le z \le 5$, Turn set at -30, and Tilt set at 78.

Curves in Space

A space curve is defined by three functions $x = f(t)$, $y = g(t)$, $z = h(t)$ of a single variable.

a) $x = t, \quad y = 2\sin t, \quad z = t^2$

$$\left[\begin{array}{ccc} t & 2\sin t & t^2 \end{array}\right]$$

b) $x = s\sin s\cos t, \quad y = s\cos s\cos t, \quad z = s\sin t$

$$[s\sin s\cos t, s\cos s\cos t, s\sin t]$$

Plot 3D + Cylindrical

Plot the cylinder $r = 1$ and the cone $r = 1 - z$

spiral staircase $z = \theta$, a 3D cylindrical plot of the vector $[r,\theta,\theta]$, with $0 \le r \le 1$, $0 \le \theta \le 4\pi$

$[r,\theta,\theta]$

Spherical Coordinates

Plot a sphere of radius 2

$\rho(\theta,\phi) = (1.2)^{\phi}\sin(\theta), -1 \le \theta \le 2\pi$ and $0 \le \phi \le \pi$

$[\rho,\theta,1]$