

CS2035b Data Analysis and Visualization - Lab 4

General Lab Instructions to Help Labs Run Smoothly

- Read through the lab instructions **before** coming to the lab.
- Do any required pre-lab preparation.
- Bring a **printed** copy of the lab instructions to the lab.

Overview and Preparation

This (and all subsequent) labs will be using MatLab 2015b as installed in the Health Sciences general computing labs, HSB14 or HSB16. You must attend this lab in HSB14 or HSB16 in order to get assistance from the TA. Attendance will be taken in the lab, failure to attend the lab will result in a lab grade of 0. You can use your UWO login/password to login to these machines. Lab submission is to be done via Owl. Remember, labs are worth 10% of the total grade for this course (there are 11 labs in total this year, you must do 8 to receive full marks).

Look at the plots of these trigonometric functions. Look at the x and y in the plots to better understand trigonometric functions.

Upon completion of this lab, you should have done the following in the MatLab environment:

- Created a file, output04.txt, containing the input and output for the MatLab code run in this lab. Again create output04.txt as a diary file.
- Submit this file (output04.txt) plus all the created images (as a single zip file, images04.zip) via the course Owl page.

Exercise: 2D Plotting

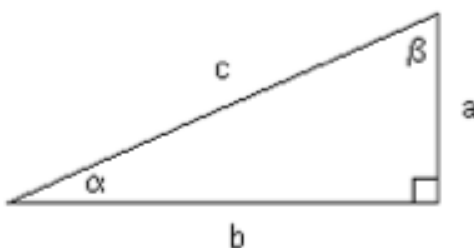
In this exercise, you have to generate some simple 2D plots and save these plots as jpeg images. This lab not only requires to plot these functions but to also “think” about why the curves are as they appear. Consider the Table 1 below.

x range	plot	title	jpg filename
$x=[0:0.1:4]$	<code>plot(x,sqrt(x))</code>	'square root'	sqrt.jpg
$x=[-2:0.1:5]$	<code>plot(x,exp(x))</code>	'exponential function'	exp.jpg
$x=[0.1:0.1:10]$	<code>plot(x,log10(x))</code>	'log10 function'	log10.jpg
$x=[0.1:0.1:10]$	<code>plot(x,log2(x))</code>	'log2 function'	log2.jpg
$x=[-1:0.1:2]$	<code>plot(x,10.^x)</code>	'exponential base10'	expbase10.jpg
$x=[-1:0.1:2]$	<code>plot(x,2.^x)</code>	'exponential base2'	expbase2.jpg
$x=[-2*\pi:\pi/100:2*\pi]$	<code>plot(x,sin(x))</code>	'sine'	sine.jpg
$x=[-2*\pi:\pi/100:2*\pi]$	<code>plot(x,cos(x))</code>	'cosine'	cosine.jpg
$x=[-\pi/2+0.01:0.01:\pi/2-0.01]$	<code>plot(x,tan(x))</code>	'tangent'	tangent.jpg
$x=[[[-0.8:0.01:-0.01], [0.01:0.01:0.8]]]$	<code>plot(x,cot(x))</code>	'cotangent'	cotangent.jpg
$x=[-1:0.01:1]$	<code>plot(x,asin(x))</code>	'arcsine'	arsine.jpg
$x=[-1:0.01:1]$	<code>plot(x,acos(x))</code>	'arccosine'	arccosine.jpg
$x=[-10:0.01:10]$	<code>plot(x,atan(x))</code>	'arctangent'	arctangent.jpg
$x=[[[-0.8:0.01:-0.01], [0.01:0.01:0.8]]]$	<code>plot(x,acot(x))</code>	'arccotangent'	arccotangent.jpg

Table 1: Table of functions to plot

Some Comments:

1. Suppose we have a right triangle given in the figure below.



Then we can define *sin*, *cos*, *tan* and *cot* as:

$$\begin{aligned}\sin(\alpha) &= \frac{\textit{opposite side}}{\textit{hypotenuse}} = \frac{a}{c} \\ \cos(\alpha) &= \frac{\textit{adjacent side}}{\textit{hypotenuse}} = \frac{b}{c} \\ \tan(\alpha) &= \frac{\textit{opposite side}}{\textit{adjacent side}} = \frac{a}{b} \\ \cot(\alpha) &= \frac{\textit{adjacent side}}{\textit{opposite side}} = \frac{b}{a}.\end{aligned}$$

2. Note that the $\tan(-\pi/2)$ is $-\infty$ while the $\tan(+\pi/2)$ is $+\infty$. Thus the range of x is not from $x = [-\pi/2 : 0.01 : \pi/2]$ but rather from $x = [-\pi/2 + 0.01 : 0., 01 : \pi/2 - 0.01]$ to avoid the ∞ problem.
3. If $x = \sin(y)$ then $y = \sin^{-1}(x) = \textit{asin}(x)$.
 If $x = \cos(y)$ then $y = \cos^{-1}(x) = \textit{acos}(x)$.
 If $x = \tan(y)$ then $y = \tan^{-1}(x) = \textit{atan}(x)$.
 If $x = \cot(y)$ then $y = \cot^{-1}(x) = \textit{acot}(x)$.
4. Note that `x = [-pi/2:pi/100:pi/2]; plot(x,cot(x))` would give a warning of division by zero. The reason for this result is that, when $x \rightarrow 0$, $\cot(x) \rightarrow \infty$ as $\tan(0) = 0$ and $\cot(x) = 1/\tan(x)$. The cotangent plot above effectively has 2 domains with `x1=[-0.8:0.01:-0.01]` and `x2=[0.01:0.01:0.8]`. Then `x=[x1, x2]` joins the two domains define by `x1` and `x2` into a single domain. This avoids the zero division problem. Of course `x=[[-0.8:0.01:-0.01], [0.01:0.01:0.8]]` is equivalent.