Lab 11: Complex Numbers TIMS Answer Sheet

Follow the procedures in the document "Lab 11 – Complex Numbers TIMS - Procedure" and prepare a report on your ePortfolio. The report should include the following sections (Note: all figures must be labelled correctly):

Introduction:

This section should include a brief introduction to the lab including the objectives of the lab.

The purpose of this lab was to garner a better understanding of what complex numbers are and represent. This was done through using real signals in the TIMS software.

Procedures:

This section should be written to describe the steps taken for each part of the lab. The report should include answers to the following questions:

Pre-lab Exercise

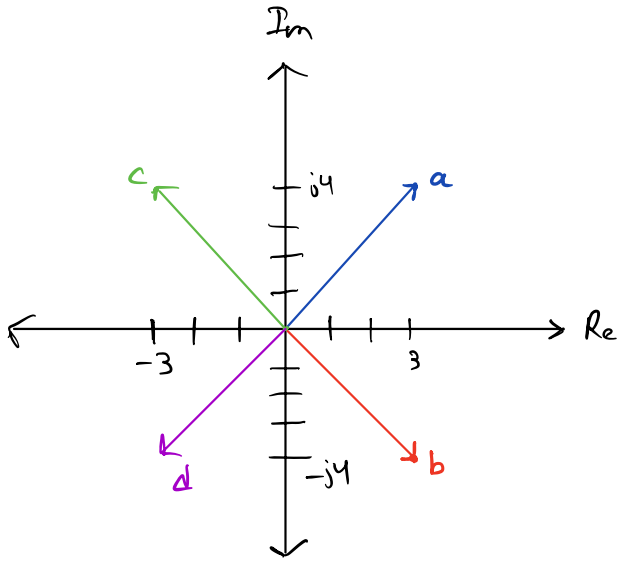
Express each vector in Polar form and graph.

a. 3 + j4

b. 3 – j4

c. -3 + j4

d. –3 – j4



A.1.5) Sum = ARB1+ARB2 =

- Sum = 1+j1 = sqrt(2) at angle 45 degrees

A.1.8) Change the ARB2 phase to -90◦, press “Load ARB”, and record the complex number for the summed value. Record the complex number in both rectangular and polar form.

- 1-j1 = sqrt(2) at angle -45 degrees

A.2.3) Explain why the XY plot displays a circle.

- The XY plot shows the voltage values of both ARB1 & ARB2 plotted against each other. The output forms a circle because since the two sine waves are 90 degrees apart, when one ARB is at a peak or valley, the other is at 0. When applied to all voltage values, the output is a circle.

A.2.4) How does this correspond to what you see on the PicoScope?

- The output is a vertical line. If the Y axis is treated as imaginary, and the X real, the XY plot output looks much like the 0+j1 vector which represents ARB2 except the line goes from -1 to 1 and not 0 to 1.

A.2.5) How does this correspond to what you see on the PicoScope?

- The output is a horizontal line. If the Y axis is treated as imaginary, and the X real, the XY plot output looks much like the 1+j0 vector which represents ARB1 except the line goes from -1 to 1 and not 0 to 1.

A.2.6) Write the equation for signals at ARB1 and ARB2 as a function of time in the form: Acos(□t + □)

- ARB1: 1cos(t – 15)
- ARB2: 1.2cos(t + 75)

B.2) Create the functions described in B.1 and B.2. Include both Matlab “.m” files in your submission.

C.1) Use the MATLAB functions that you created to add the two phasors.

- 1.2765 + j0.9003

C.4) Comparing the output sum signals from steps 3 and 4, are the results as expected? Explain.

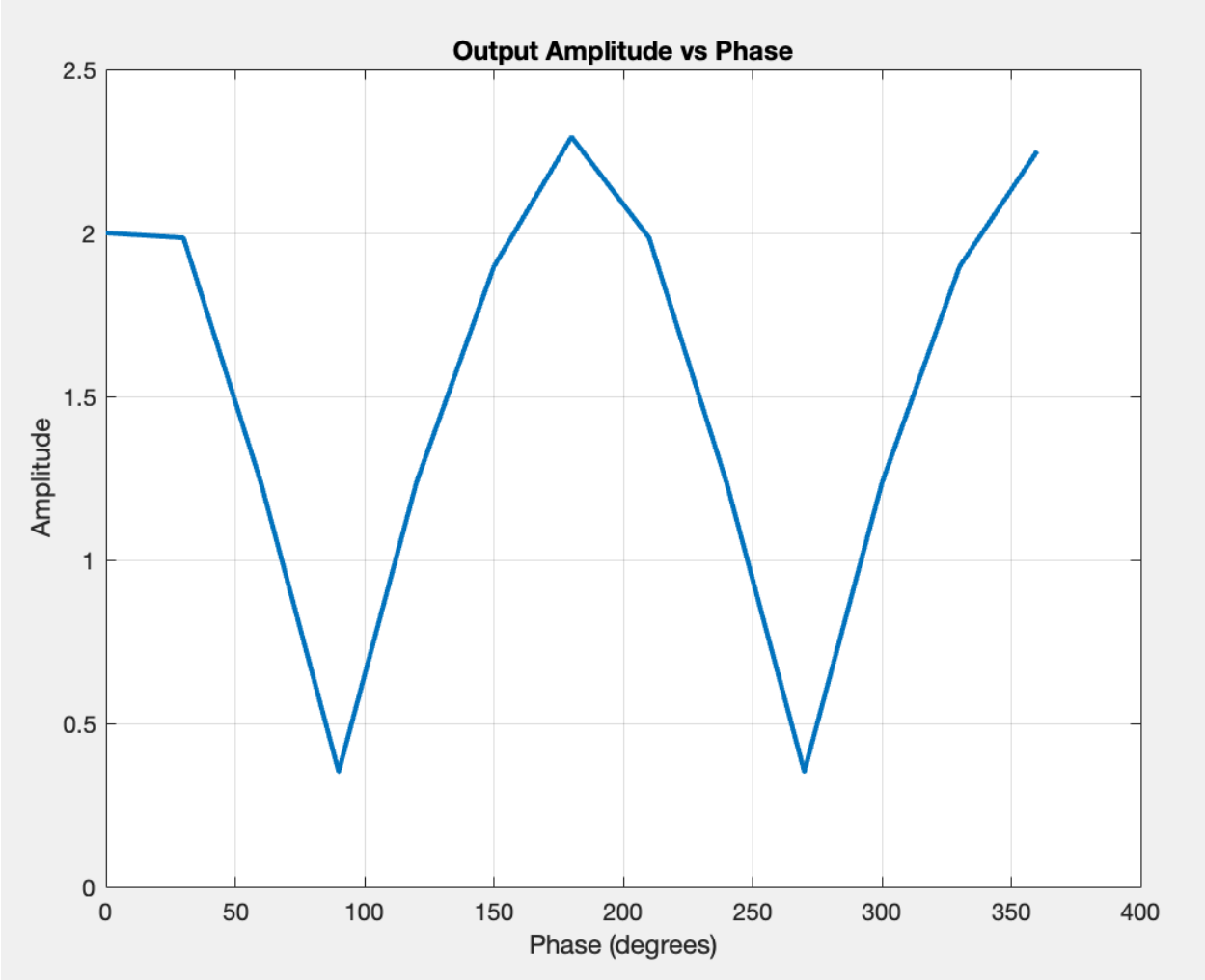
- Yes, shifting the ARB2 signal by 180 degrees in either direction produces the same sinusoid so the two outputs should be the same which is what is observed.

D.8) Record the ChB amplitude in Table 1. The first one is done for you.

Table 1

Phase (degrees)	Output signal amplitude (V)
0	2.0
30	1.985
60	1.235
90	0.353
120	1.235
150	1.897
180	2.294
210	1.985
240	1.235
270	0.353
300	1.235
330	1.897
360	2.25

D.8) Use Matlab to plot your results. Include a title, label the axes, and turn on the grid.



Conclusions:

I enjoyed seeing the visual representation of complex numbers. This approach was helpful in building my understanding. If the real axis represents linear movement, then the imaginary axis represents lateral movement. No major improvements.