Lab 3 Computer Tutorial Quiz Name____________________________

Answer the following questions to verify your progress.

1. What does the function =IMREAL(X) do?

A. It calculates the product of the imaginary and the real parts of X

B. The syntax is really =IMREAL(a,b) and it produces a complex number with a as imaginary and b as real part

C. It renders the real part of the complex number X

D. It swaps the real and imaginary parts of X

2. What are the four roots of the equation $x^4=1$?
(Write out your answer in the space provided)

3. In step 12 you calculated the root of $x^{15}=1$. You could consider each root as a vector originating from the origin. The set of solutions then looks like the spokes of a bicycle wheel. What is the vector sum of all solutions? (Integer please)

Vector sum = _________________.

4. In last weeks computer lab we have seen the hyperbolic 'trumpets' around a calibration line. Make a sketch showing how you would determine the errors in the value of an unknown using the line with trumpets.

Excel Spreadsheet Assignment

An analyst determines the absorbance of a solution known to contain 4 organic compounds X=A, B, C and D at four different wavelengths λ= 435,472, 513 and 570 nm.

The extinction coefficients ε_λ(X) for the 4 compounds at these 4 wavelengths are known (units lit/mol):

	A	B	C	D
435	325	3.5	0.1	100
472	50	200	590	0.1
513	1290	700	4.3	12
570	2	0.1	24	1350

The values she finds for the absorbance in a cuvette with L=1cm are:

435	0.070259
472	0.480401
513	0.791769
570	0.433884

What are the four concentrations?

(*Hint*: Absorbance A= ε_λLc is an additive quantity, so you can write out the problem as a set of linear equations. Then write this as a matrix formula and see if you can solve it by matrix algebra.

Hint: the equations have the form

$$A_1 = \varepsilon_{11}c_1 + \varepsilon_{12}c_2 + \varepsilon_{13}c_3 + \varepsilon_{14}c_4$$

$$A_2 = \varepsilon_{21}c_1 + \varepsilon_{22}c_2 + \varepsilon_{23}c_3 + \varepsilon_{24}c_4$$

$$A_3 = \varepsilon_{31}c_1 + \varepsilon_{32}c_2 + \varepsilon_{33}c_3 + \varepsilon_{34}c_4$$

$$A_4 = \varepsilon_{41}c_1 + \varepsilon_{42}c_2 + \varepsilon_{43}c_3 + \varepsilon_{44}c_4$$

We can write these compactly in matrix form as:

$$\boldsymbol{A} = \boldsymbol{\varepsilon c}$$

Where the knowns are the vector A of absorbances and the matrix of the extinction coefficients. We can solve for the concentrations using the matrix inverse:

$$\boldsymbol{\varepsilon^{-1}A} = \boldsymbol{\varepsilon^{-1}\varepsilon c}$$

Which tells us that

$$\boldsymbol{c} = \boldsymbol{\varepsilon^{-1}A}$$