Math Analysis - Deggeller/Gleason/Tantod Unit 7, Quiz 2 2020 [30 pts] NO CALCULATORS Complex Thinker: _ Period: _D_ Alan Lop

- 1. Simplify: $\frac{\left(-\sqrt{3}+i\right)^{7}}{\left(1-i\right)^{4}}$. Give your answer in a + bi form, simplified completely. (4 pts)
 - $\frac{(2 \operatorname{cis} 150^{\circ})^{2}}{(55 \operatorname{cis} 45)^{9}} = \frac{128 \operatorname{cis} 1050^{\circ}}{4 \operatorname{cis} 180^{\circ}} = 32 \operatorname{cis} 870^{\circ}$ $= 32 \operatorname{cis} 150^{\circ}$ $= 32 \operatorname{cis} 150^{\circ}$

2. $cis \frac{5\pi}{4}$ is a generator of a multiplication group of complex numbers.

a) Write all the elements of the group, $0 \le \theta < 2\pi$ (2 pts)

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b) The group that you named in part (a) is isomorphic to the rotation/reflection group of what geometric figure? (specify "rotation group" OR "rotation/reflection group", along with the geometric figure, in your answer) (2 pts)

rotation youp of a regular octagon

3. The diagram below shows a **unit** circle and the locations of complex numbers **a** and **b**. On the diagram, draw and label reasonable locations for the complex numbers **w**, **x**, **y** and **z**, based on their relationship to **a** and **b**. (2 pts each)

w = a - i $\mathbf{x} = \mathbf{a}\mathbf{b}$ $y = \sqrt{a}$ b z = a + 2b

4. Given complex numbers a = x + yi and b = p + qi, where both a and b are both in the first quadrant, find: [4 pts total]

a)
$$\tan(\operatorname{Arg}(a)) = \frac{4}{x}$$
 b) $\operatorname{Re}(b) + \operatorname{Im}(a) = p^{4}y^{(2)}$ c) $\overline{b} = p^{-2}y^{(2)}$

5. Given the matrix transformation a) Solve for matrix A [2 pts] $\begin{bmatrix} 3 & 1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} 0 & 3 & 2 \\ 4 & -1 & 3 \end{bmatrix} = A$

$$A = \begin{bmatrix} 4 & 8 & 9 \\ -8 & 5 & -4 \end{bmatrix}$$

b) Graph the pre-image (connected with dotted lines) and the image of the transformation (connected with solid lines) on the graph below. [2 pts]



c) Perhaps there is a reflection included in this transformation.

Based on your graphs of this pre-image and the transformed image, describe how you determine whether there is a reflection involved. [1 pt]

It we lasel the portesponding points A, A', B, B' und C, C'. The order of points clockwise in the presimage is A, B, C

but the image has an order A', C', B', so there must have been a reflection to make it that

6. Answer "True" or "False" to each of the following statements. (1 pt each)

- a) Uncountable infinities are always larger than countable infinities.
- b) The set of rational numbers is an example of an uncountable infinity.
- c) There are more integers than there are positive multiples of 10.
- d) The set of all complex numbers under multiplication forms a group.
- e) If two infinite groups have the same cardinality, then they will be isomorphic.