Copying answers and steps is strictly forbidden. Evidence of copying results in zero for copied and copier. Working together is encouraged, share ideas not calculations. Explain your steps. This sheet must be printed and attached to your assignment as a cover sheet. The calculations and answers should be written neatly on one-side of paper which is attached and neatly stapled in the upper left corner. Box your answers where appropriate. Please do not fold. Thanks!

Problem 1 Your signature below indicates you have:

(a.) I have read Chapter 1 of Gamelin: ____________________.

(b.) I have read Cook's Guide to Chapter 1:_________________.

Problem 2 Let $z = 1 + i$ and $\xi = 1 - 7i$ find the **Cartesian forms** of:

(a.) $\dfrac{1}{z} + \dfrac{4+3i}{1-\xi}$

(b.) $z^2 + \dfrac{1}{(z+\xi)^2}$

(c.) $z\xi^2\overline{z}$

(d.) $\dfrac{1}{z^{47}}$

clearly I do not intend you to calculate the 47-th power directly. Remember you can use the polar form of the complex number to simplify certain arithmetic

Problem 3 Show that $|z+w|^2 - |z-w|^2 = 4\mathfrak{Re}(z\overline{w})$ for all $z, w \in \mathbb{C}$

Problem 4 Show $|z+w| = |z| + |w|$ if and only if $z = sw$ for some $s \in (0, \infty)$.

Problem 5 Either convert the given Cartesian equation to a complex equation in $z = x + iy$ and $\overline{z} = x - iy$ or analyze the given complex equation in order to sketch and identify its solution set:

(a.) $2x + 3y = 4$

(b.) $|z+2|^2 = 4$

(c.) $\mathfrak{Re}[(1-i)\overline{z}] = 0$

(d.) $z^2 - 2z = 1 + 3i$

Problem 6 Let $b, c \in \mathbb{C}$. Determine precise conditions for b, c in order that $z^2 + bz + c = 0$ have a solution set z_1, z_2 for which $\overline{z_1} = z_2$. In other words, for what $b, c \in \mathbb{C}$ does the quadratic equation $z^2 + bz + c = 0$ have a solution set which forms a conjugate pair?

Problem 7 Let $\eta = 4 + 4i\sqrt{3}$. Find

(a.) $\eta^{1/2}$ (express the elements in the answer **set** in Cartesian form)

(b.) $\eta^{1/5}$ (you may use complex exponential notation for the elements in the answer **set**)

Problem 8 Find all four solutions of $(Z - 1 - 2i)^4 = 16i$.

Problem 9 Calculate the set of values $\log z$ and the single value $\operatorname{Log} z$ for the following:

(a.) $z = e$

(b.) $z = -1 + \sqrt{3}i$

Problem 10 Since the complex log *function* is multiply-valued the complex power *function* $z^c = e^{c\log(z)}$ is not truly a function. Rather, for a given c, z it is usually the case that z^c is a **set** of values. Show that $(-1)^{1/\pi} = \{e^{(2n+1)i} \mid n \in \mathbb{Z}\}$.