1. Which of the points $i$, $2 - i$ and $-3$ is farthest from the origin? Which is closest?

2. Draw an Argand diagram containing the following vectors
   
   (a) $7\text{cis}\left(\frac{3\pi}{4}\right)$
   
   (b) $4\text{cis}\left(-\frac{\pi}{6}\right)$

3. Find the argument of the following complex numbers and write in polar form.
   
   (a) $-1/2$
   
   (b) $-\pi i$
   
   (c) $(\sqrt{3} - i)^2$

4. Show that, for arbitrary $z_1$, $z_2$ and $z_3$, the following is true: $z_1 \cdot z_2 \cdot z_3 = z_1 \cdot z_2 \cdot z_3$

5. Find a counterexample which proves that the "theorem" 
   \[ \text{Arg}(z_1 z_2) = \text{Arg} z_1 + \text{Arg} z_2 \] is false. (You may also want to think about why the "theorem" becomes true when Arg is replaced with arg.) Show that your counterexample is just another example that $\text{arg}(z_1 z_2) = \text{arg} z_1 + \text{arg} z_2$ is true for all $z$.

6. Compute the following
   
   (a) $|{(3 + 4i)(1 + 2i)(i)}|$
   
   (b) $\left| \frac{i(2 + i)^3}{(1 - i)^2} \right|$
   
   (c) $\left| \frac{(\pi + i)^{100}}{(\pi - i)^{100}} \right|$

7. Compute the following roots and state which is the principal root (i.e. $k = 0$) in each case.
   
   (a) $(-16)^{1/4}$
   
   (b) $\sqrt{i - 1}$
   
   (c) $(1 - i\sqrt{3})^{1/3}$

8. Find the four roots of the equation $z^4 + 4 = 0$ and use them to factor $z^4 + 4$ into two quadratic factors with purely real coefficients.
9. Solve the following equations

(a) \( \frac{z}{1-z} = 1 - 5i \)
(b) \( iz = 4 - zi \)
(c) \( 8z^2 + (2 - i)z = 0 \)
(d) \( z^2 + 2z + (1 - i) = 0 \)

10. Find \( z_1 \) and \( z_2 \) and write the answers in exponential form

\[
\begin{align*}
(1 - i)z_1 + 3z_2 &= 2 - 3i \\
i z_1 + (1 + 2i)z_2 &= 1
\end{align*}
\]

11. Find all complex numbers \( z \) such that \( (z + 1)^5 = z^5 \).

12. Give sketches representing the following regions in the complex plane

(a) \(|z - 2 + i| \leq 1\)
(b) \(|2z + 3| > 4\)
(c) \(\text{Im } z = 1\)
(d) \(|z - 4| \geq |z|\)
(e) \((\text{Re } z)^2 > 1\)

13. Using your answers to the previous question, answer the following.

(a) Which of the sets are open?
(b) Which of the sets are bounded?
(c) Which of the sets are domains?
(d) Describe the boundary of each set.

NOTES
All homework sets will be due in class one week from the class they are given out in. You are strongly encouraged to work collaboratively on the homework, though each person must hand in individually-written work.