Differential Equations and Matrix Algebra I
Worksheet #5
Professor Broughton

Name:__________________  Box #:__________________

1. complex arithmetic

Let $z = 2 + 3i$, $w = 3 + 4i$

\[
\begin{align*}
  z + w &= \\
  z - w &= \\
  zw &= \\
  \frac{z}{w} &= \\
  z\overline{z} &= \\
  z^4 &= \\
  w^{-5} &= 
\end{align*}
\]
2. polar form

Put the following in polar form and plot the point on the axes following.

\[ 2 + 3i = \]
\[ 2 - 3i = \]
\[ -2 + 3i = \]
\[ -2 - 3i = \]
\[ i = \]
\[ -1 = \]
\[ \frac{1}{\sqrt{2}} - \frac{i}{\sqrt{2}} = \]
3. complex arithmetic - geometry

On the axes below plot $z + w$, $z - w$, $\overline{z}$, $zw$, $z/w$ and $z^3$ (because of a printing bug the - signs on the negative part of the axis show up as $\pm$ signs).
4. trigonometric format

Write the following expression in (hyperbolic) trigonometric format

\[
\frac{e^{it} + e^{-it}}{2} = \\
\frac{e^{it} - e^{-it}}{2i} = \\
\frac{e^{(2+3i)t}}{2i} = \\
(4 + i)e^{(2+3i)x} + (4 - i)e^{(2-3i)x} = \\
3e^{(2+3i)x} + 5e^{(2-3i)x} = \\
3e^{5t} - 5e^{3t} =
\]

Write the following expression in exponential format

\[
\cos(x) = \\
e^{3x} \sin 2x = \\
3e^{3x} \sin 2x + 5e^{3x} \cos 2x = \\
3e^{3x} \sinh 2x + 5e^{3x} \cosh 2x =
\]