MATH 115 Fall 2018: Assignment 1 **Due at 8:30am on Friday, September 14, 2018**

It is important that you read the assignment submission instructions and suggestions available on LEARN.

1. (**3 marks**) Write the following expressions in standard form.

   (a) $\dfrac{(1-2j)+(2+3j)}{(5-6j)(-1+j)}$

   (b) $j\mathrm{Re}(4-6j) - \mathrm{Im}(2-3j)$

   (c) $|3+4j|\left(\overline{1-2j}\right) + (2+3|j|)\left(\overline{3j+2}\right)$

2. (**5 marks**) Find all $z \in \mathbb{C}$ (in standard form) satisfying $3z^2 = 4\bar{z}$.

3. (**5 marks**)

   (a) Find all $w \in \mathbb{C}$ (in standard form) satisfying $w^2 = 21 + 20j$.

   (b) Find all complex roots of the quadratic polynomial $p(z) = z^2 + (1-4j)z - (9+7j)$ in standard form.

4. (**6 marks**)

   (a) Evaluate $\left(\frac{1}{\sqrt{2}} - \frac{\sqrt{3}}{\sqrt{2}}j\right)^{20}$ using *De Moivre's Theorem*. Express your answer in standard form.

   (b) Find all the complex sixth roots of $-\frac{27}{\sqrt{2}} + \frac{27}{\sqrt{2}}j$. Express your answer(s) in polar form with all angles between 0 and 2π. Show your work.

5. (**4 marks**) Verify that for any $z, w \in \mathbb{C}$, $|z-w|^2 = |z|^2 + |w|^2 - 2\mathrm{Re}(z\bar{w})$.

6. (**3 marks**) Use *De Moivre's Theorem* to show that $\sin(4\theta) = 4\sin\theta\cos^3\theta - 4\sin^3\theta\cos\theta$.

Total: 26 marks.