1. (4 points) Find the real and imaginary part of each of these expressions.
   
   (a) \((3i + 1)^2 \left[2 + (4 - i)^2\right]\)
   
   (b) \(\frac{2i(4 + 5i)(2 - 3i)}{(2 + 3i)^2}\)

2. (4 points) Let \(z_1 = 5 + 7i\) and \(z_2 = -6 + 5i\). Calculate real and imaginary part of each of the following terms. Then draw vectors for each term in the sum on an Argand (complex plane) diagram to generate the total vector to verify your answer graphically (be sure to include the diagrams on your homework).
   
   (a) \(z_1 - z_2\)
   
   (b) \(4z_1 - 3z_2 - 4\)

3. (8 points) Express each of the following complex numbers in polar form:
   
   (a) \(3 + 5i\)
   
   (b) \(4 - 3i\)
   
   (c) 4
   
   (d) \(3i\)

4. (4 points) Prove that the magnitude of a complex number \(z\) is equal to \(\sqrt{\Re(z)}\).

5. (6 points) Prove that \(\Re(z) = \frac{(z + z^*)}{2}\) and that \(\Im(z) = \frac{(z - z^*)}{2i}\).

6. (4 points) Use Euler’s formula to prove de Moivre’s theorem.

7. (4 points) Use Euler’s formula to prove that \(\sin(a + b) = \cos(a)\sin(b) + \sin(a)\cos(b)\). Hint - start with \(e^{i(a+b)} = e^{ia}e^{ib}\).

8. (6 points) Use the Cauchy-Riemann equations to determine if the following functions are holomorphic.
   
   (a) \(f(z) = z^2\)
   
   (b) \(f(z) = z^*z\)
   
   (c) \(f(z) = \Re(z)\)