1. (1 points) If \( z = a + bi \) what do we call \( a - bi \)?

Solution: It is known as the complex conjugate of \( z \) and can be written \( \bar{z} \).

2. (4 points) Evaluate the following expressions. Your final answer should be in the form \( a + bi \).  
   a. \((1 + i)(\sqrt{3} - i)\)

Solution: We distribute the expression, keeping in mind that \( i^2 = -1 \).  
So \((1 + i)(\sqrt{3} - i) = \sqrt{3} + \sqrt{3}i - i + 1 = (\sqrt{3} - 1) + (\sqrt{3} - 1)i\)

b. \(\frac{3}{4 - 3i}\)

Solution: We recall that to divide two complex numbers, we multiply the top and bottom by the complex conjugate of the denominator. So

\[
\frac{3}{4 - 3i} = \frac{3}{4 - 3i} \left( \frac{4 + 3i}{4 + 3i} \right) = \frac{12 + 9i}{16 + 9} = \frac{12}{25} + \frac{9}{25}i
\]

3. (4 points) Evaluate \((\frac{1}{2} + \frac{1}{2}i)^{10}\) using polar coordinates.

Solution: We note that, in polar coordinates we have \( r = \sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2} = \frac{1}{\sqrt{2}} \).

Also, the angle that \((\frac{1}{2} + \frac{1}{2}i)\) makes with the positive x-axis is \( \theta = \frac{\pi}{4} \) (draw a picture if you aren’t convinced of this). So we have that

\[
\left(\frac{1}{2} + \frac{1}{2}i\right)^{10} = \left(\frac{1}{\sqrt{2}}\right)^{10} \left(\cos \left(10 \left(\frac{\pi}{4}\right)\right) + \sin \left(10 \left(\frac{\pi}{4}\right)\right)i\right)
\]
\[
= \frac{1}{32} \left(\cos \left(\frac{5\pi}{2}\right) + \sin \left(\frac{5\pi}{2}\right)i\right)
\]
\[
= \frac{1}{32}i
\]

4. (1 points) Simplify \( e^{i\pi} + 1 \).

Solution: We have that \( e^{i\pi} + 1 = \cos(\pi) + \sin(\pi)i + 1 = -1 + 1 = 0 \).