Instructions: You have 20 minutes to solve the following problems and the total score is 10 points. Below, \( i^2 = -1 \).

1. Express \( \frac{1 + i \sqrt{3}}{1 - i \sqrt{3}} \) as \( re^{i\theta} \) where \( r > 0 \) and \( \theta \) is real. Draw the Argand diagram. (4 pts)

2. Find the three complex cube roots of \(-1\). (3 pts)

3. Prove \( \sin(2\theta) = 2 \sin \theta \cos \theta \), \( \cos(2\theta) = \cos^2 \theta - \sin^2 \theta \) by De Moivre’s Theorem. (3 pts)
Bonus1: True or false? If x is real, $-1 \leq \cos x \leq 1$. If x is complex, $-1 \leq \cos x \leq 1$ (2 pts).
Calculate $\cos(i)$ (1 pt)
Bonus2: Give an example that $e^z$ can be negative if z is a complex number. (1 pt)
Prove $e^z$ is never zero if z is complex. (Hint: Assume $z = a + bi$) (2 pts)