Question 19 (7 marks)

Consider the complex equation $2z^6 = 1 + \sqrt{3}i$.

(a) Solve the above equation, giving solutions in polar form $rcis\theta$ where $0 < \theta < \frac{\pi}{2}$. (4 marks)

Now consider the equation $2z^n = 1 + \sqrt{3}i$, where n is a positive integer.

(b)   If $2z^n = 1 + \sqrt{3}i$ has roots so that there are exactly 3 roots (and only 3) that lie within the first quadrant of the complex plane, determine the possible value(s) of n. Justify your answer.   (3 marks)