1. $\left(\sqrt{8+i}\right)^{50} = 3^{49} \times (a+ib)$.

Taking mod on both sides.

$$\left|(8+i)^{25}\right| = 3^{49} \times \sqrt{a^2+b^2}.$$

$$\left(\sqrt{65}\right)^{25} = 3^{49} \times \sqrt{a^2+b^2}.$$

$$\boxed{a^2+b^2 = \frac{65^{25}}{3^{98}}}$$