1. Use vector algebra and the properties of the dot product to prove the Pythagorean theorem.

Hints:

1. Refer to the above diagram.

2. Note that the length of the hypotenuse is given by $\|u + v\|^2$.

3. Recall that $\|u + v\|^2 = (u + v) \cdot (u + v)$.

4. Simplify $(u + v) \cdot (u + v)$, and note that $u \cdot v = 0$. 