

$$10) |p+q|^2 + |p-q|^2 = 2|p|^2 + 2|q|^2$$

$$|p+q|^2 = |p+q| \cdot |p+q| = |p|^2 + 2pq + |q|^2$$

$$|p-q|^2 = |p-q| \cdot |p-q| = |p|^2 - 2pq + |q|^2$$

$$(|p|^2 + 2pq + |q|^2) + (|p|^2 - 2pq + |q|^2) = 2|p|^2 + 2|q|^2$$

★ Perpendicular

$$p = (1, 0) \quad q = (0, 1)$$

$$|p| = \sqrt{1^2 + 0^2} \quad |q| = \sqrt{0^2 + 1^2}$$

$$p+q = (1, 1) \quad p-q = (1, -1)$$

$$|p+q| = \sqrt{1^2 + 1^2} \quad |p-q| = \sqrt{1^2 + (-1)^2}$$

$$(\sqrt{2})^2 + (\sqrt{2})^2 = 2 \cdot (\sqrt{1})^2 + 2 \cdot (\sqrt{1})^2$$

$$p = (1, 0) \quad q = (1, 1)$$

$$|p| = \sqrt{1^2 + 0^2} \quad |q| = \sqrt{1^2 + 1^2}$$

$$p+q = (2, 1) \quad p-q = (0, -1)$$

$$|p+q| = \sqrt{5} \quad |p-q| = \sqrt{1}$$

$$(\sqrt{5})^2 + (\sqrt{1})^2 = 2 \cdot (\sqrt{1})^2 + 2 \cdot (\sqrt{2})^2$$

★ Non-Perpendicular