

Supplementary Exercises for Section 11.3

1. Let  $\mathbf{x}$  and  $\mathbf{y}$  be perpendicular vectors. Prove that  $|\mathbf{x}|^2 + |\mathbf{y}|^2 = |\mathbf{x} + \mathbf{y}|^2$ . What is this result better known as?
2. Let  $\mathbf{x} = \langle 1, 1, 0 \rangle$  and  $\mathbf{y} = \langle 2, 4, 2 \rangle$ . Find a unit vector that is orthogonal to both  $\mathbf{x}$  and  $\mathbf{y}$ .
3. Prove that the diagonals of a rhombus intersect at right angles.
4. Suppose that  $\mathbf{z} = |\mathbf{x}|\mathbf{y} + |\mathbf{y}|\mathbf{x}$  where  $\mathbf{x}, \mathbf{y}$  and  $\mathbf{z}$  are all nonzero vectors. Prove that  $\mathbf{z}$  bisects the angle between  $\mathbf{x}$  and  $\mathbf{y}$ .