1 | orthogonal def

Two vectors  $u, v \in V$  are called *orthogonal* if  $\langle u, v \rangle = 0$ 

- 2 | results
- 2.1 | orthogonal ~= perpendicular
- 2.2 | Axler 6.12 orthogonality and zero
- 2.2.1  $\mid$  0 is orthogonal to every vector in V
- 2.2.2  $| \mathbf{0}$  is the only vector in V that is orthogonal to itself
- 2.3 | Axler 6.13 Pythagorean Theorem

Suppose u and v are orthogonal vectors in V. Then

$$||u + v||^2 = ||u||^2 + ||v||^2$$

2.3.1 | proof with more algebra written out

$$||u+v||^2 = \langle u+v, u+v \rangle$$

$$= \langle u, u+v \rangle + \langle v, u+v \rangle$$

$$= \langle u, u \rangle + \langle u, v \rangle + \langle v, u \rangle + \langle v, v \rangle$$

$$= ||u||^2 + ||v||^2$$

Taproot • 2021-2022 Page 1