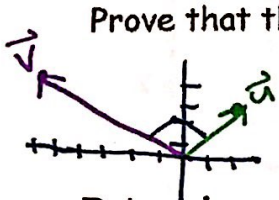
DEFINITION Orthogonal Vectors

The vectors u and v are orthogonal (perpendicular) if and only if $u \cdot v = 0$

The vectors u and v are parallel if and only if $u = kv$ where k is a scalar multiple.

Prove that the vectors $\langle 2,3 \rangle$ and $\langle -6,4 \rangle$ are orthogonal. (Prove $\vec{u} \cdot \vec{v} = 0$.)



$2(-6) + 3(4) = -12 + 12 = 0$ ✓

Determine whether the vectors u and v are parallel, orthogonal, or neither:

a) $u = \langle 2,-7 \rangle$, $v = \langle -4,14 \rangle$

$\vec{v} = -2\vec{u}$

$\langle -4,14 \rangle = -2\langle 2,-7 \rangle$

parallel

b) $u = \langle 2,5 \rangle$, $v = \left\langle \frac{10}{3}, \frac{4}{3} \right\rangle$

$\frac{2}{10/3} \neq \frac{5}{4/3}$

not parallel

$\vec{u} \cdot \vec{v} = \frac{20}{3} + \frac{20}{3}$

$\neq 0$

neither

c) $u = \langle -3,4 \rangle$, $v = \langle 20,15 \rangle$

$\frac{-3}{20} \neq \frac{4}{15}$

not parallel

$\vec{u} \cdot \vec{v} = -60 + 60$

$= 0$ ✓

orthogonal

3-Dimensional Vectors