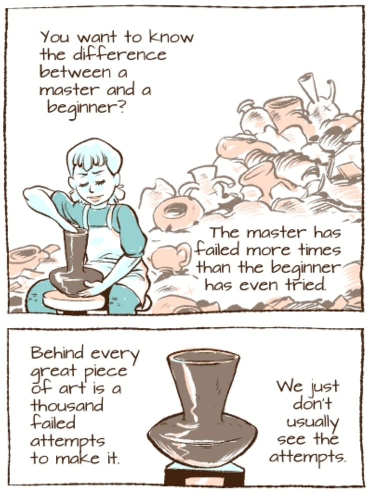


Dec 3-8:13 AM

Angle Between Two Vectors **u** and **v**:

$$\cos\theta = \frac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\|\vec{v}\|} \quad \text{or} \quad \theta = \cos^{-1}\frac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\|\vec{v}\|}$$

Q: What would need to be true in order for **u** and **v** to be perpendicular? (Hint: What would θ need to equal?)

A: 90° angle between the vectors

Dec 2-4:58 PM

Look at the 5 different options for θ drawn on p. 440.
We will focus on the 3rd possibility...

Definition. The vectors **u** and **v** are "orthogonal" (perpendicular) if $\vec{u}\cdot\vec{v} = 0$

Dec 2-5:02 PM

Example

Determine if the two vectors are orthogonal.

$\cos\theta = \frac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\|\vec{v}\|}$ 0

$\vec{u} = \langle 10, 4\rangle$

$\vec{v} = \langle 2, -5\rangle$

$\vec{u}\cdot\vec{v} = (10)(2) + (4)(-5)$

$20 + -20$

0

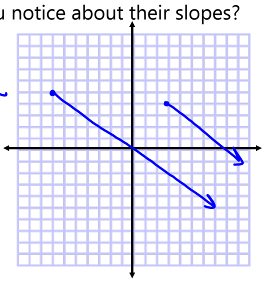
$\boxed{\text{Orthogonal}}$

Dec 2-5:05 PM

Q: Can you figure out the condition necessary for two vectors **u** and **v** to parallel? Hint: What do you notice about their slopes?

A: Slopes are same
Direction are same

$\theta = 180^\circ$ or 0°



Dec 2-5:06 PM

Example

Determine whether or not **u** and **v** are parallel.

$\vec{u} = \langle 8, 4 \rangle$

$\vec{v} = \langle -2, -1 \rangle$

① $\vec{u} \cdot \vec{v} = 8(-2) + 4(-1)$
$= -16 + -4$
$= -20$

② $\|\vec{u}\| = \sqrt{8^2 + 4^2}$
$= \sqrt{64+16}$
$= \sqrt{80}$

③ $\|\vec{v}\| = \sqrt{(-2)^2 + (-1)^2}$
$= \sqrt{5}$

$\theta = \cos^{-1}\left(\frac{-20}{\sqrt{80} \cdot \sqrt{5}}\right)$

$\theta = \cos^{-1}\left(\frac{-20}{\sqrt{400}}\right)$

$\theta = \cos^{-1}(-1)$

$\theta = 180^\circ$

Parallel

p. 445: #33 (HW)

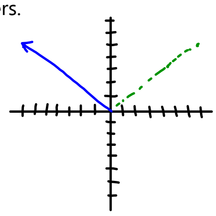
Dec 2-5:08 PM

Example

Find two vectors in opposite directions that are orthogonal to vector $\vec{u} = \langle -7, 5 \rangle$. There are many answers.

$\vec{v} = \langle 5, 7 \rangle$

$\vec{v} = \langle -5, -7 \rangle$



p. 446, #53 (HW)

Dec 2-5:13 PM

HOMEWORK

...due tomorrow; the underlined portion is what we completed today...

6.4 (p. 445): 1-31 (odd), <u>33-37 (odd), 53, 55</u>

Dec 2-4:50 PM