

Student Workbook

Vectors

Name: _____

Date: _____

Period: _____

Learning Target: I can find the magnitude and direction of a vector, perform vector operations, find unit vectors, and use the dot product to find angles between vectors.

Vocabulary

Term	Meaning
Magnitude	$ v = \sqrt{a^2+b^2}$ — the length of vector $v=\langle a,b \rangle$.
Unit Vector	A vector with magnitude 1, pointing in the same direction as the original.
Dot Product	$u \cdot v = u_1v_1+u_2v_2$ — a scalar (number), used to find the angle between vectors.

Key Concept: Magnitude & Direction

EXAMPLE 1
Find the magnitude and direction of $v=\langle 3,4 \rangle$.

$|v| = \sqrt{9+16} = \rule{1cm}{0.4pt}$ $\theta = \arctan(4/3) \approx \rule{1cm}{0.4pt}$

Key Concept: Vector Operations

ADD/SUBTRACT/SCALE COMPONENT-WISE

EXAMPLE 2
 $u=\langle 2,-3 \rangle$, $v=\langle -1,5 \rangle$. Find $u+v$ and $u-v$.

$u+v = \rule{1cm}{0.4pt}$ $u-v = \rule{1cm}{0.4pt}$

Key Concept: Unit Vectors

DIVIDE by the magnitude (not multiply!)

EXAMPLE 3

Find a unit vector in the direction of $v = \langle 6, 8 \rangle$.

$$|v| = \underline{\hspace{2cm}} \rightarrow \text{unit vector} = \underline{\hspace{2cm}}$$

COMMON MISTAKE

To find a unit vector, DIVIDE each component by the magnitude — don't multiply! Multiplying would make the vector LONGER, not length 1.

Key Concept: Dot Product & Angle Between Vectors**EXAMPLE 4**

Find the dot product of $u = \langle 3, 4 \rangle$ and $v = \langle -2, 5 \rangle$.

$$u \cdot v = 3(-2) + 4(5) = \underline{\hspace{2cm}}$$

EXAMPLE 5

Find the angle between $u = \langle 1, 0 \rangle$ and $v = \langle 1, 1 \rangle$.

$$\cos \theta = (u \cdot v) / (|u||v|) = \underline{\hspace{2cm}} \rightarrow \theta = \underline{\hspace{2cm}}$$

Guided Practice — Part A: Magnitude & Direction

A1 $v = \langle 5, 12 \rangle$

A2 $v = \langle -4, 3 \rangle$

Guided Practice — Part B: Vector Operations

B1 $u = \langle 4, -2 \rangle$, $v = \langle 3, 5 \rangle$. Find $u + v$ and $2u - v$.

B2 $u = \langle -1, 6 \rangle$, $v = \langle 4, -3 \rangle$. Find $u - v$ and $3v$.

Guided Practice — Part C: Unit Vectors

C1 Find a unit vector in the direction of $v = \langle 8, 15 \rangle$.

C2 Find a unit vector in the direction of $v = \langle -5, 12 \rangle$.

Guided Practice — Part D: Dot Product & Angle

D1 Find $u \cdot v$ for $u = \langle 2, 3 \rangle$, $v = \langle 4, -1 \rangle$. Are they perpendicular?

D2 Find the angle between $u = \langle 3, 0 \rangle$ and $v = \langle 3, 3 \rangle$.

BEFORE YOU MOVE ON

Check with a partner: for unit vectors, did you DIVIDE by the magnitude rather than multiply?