Algebraic Vectors p. 70

Component Form of a Vector Given Initial & Terminal Points	Add, Subtract & Scalar Multiplication with Vectors
Magnitude of a Vector	
Find Amplitude (Direction) of a Vector Given Components	Unit Vectors
Find Component Form Given Magnitude & Amplitude (Direction)	Orthogonal Vectors (Dot Product)

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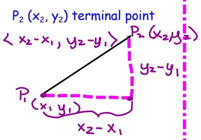
"Component" Form of a Vector Given Initial & Terminal Points

< horizontal, vertical >

P_1 (x_1, y_1) initial point

P_2 (x_2, y_2) terminal point

$\langle x_2 - x_1, y_2 - y_1 \rangle$



Write the component form of $\overrightarrow{AB}$

1. A (5, 4) & B (0, -3)

$\langle 0-5, -3-4 \rangle$

$\langle -5, -7 \rangle$

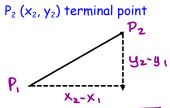
2. A (7, -3) & B (-2, -1)

$\langle -9, 2 \rangle$

Magnitude of a Vector Given Component Form

P_1 (x_1, y_1) initial point

P_2 (x_2, y_2) terminal point



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Write the magnitude of $\overrightarrow{AB}$

1. A (5, 4) & B (0, -3)

$\overrightarrow{AB} = \langle -5, -7 \rangle$

$|\overrightarrow{AB}| = \sqrt{(-5)^2 + (-7)^2}$

$= \sqrt{25+49} = \sqrt{74}$

2. A (7, -3) & B (-2, -1)

$|\overrightarrow{AB}| = \sqrt{85}$

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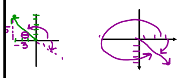
Find Amplitude (Direction) of a Vector Given Components

Sketch the vector (no protractor) on an xy axis

Create a right triangle with the reference angle



Find the direction angle of each:

1. $\langle -3, 5 \rangle$ $\tan\theta = -\frac{5}{3}$

$\theta = -59°$

$180 - 59 = 121°$

2. 3i - 4j $= 3\langle 1, 0 \rangle - 4\langle 0, 1 \rangle$

$= \langle 3, -4 \rangle$

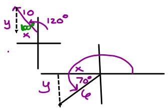
$\theta = -53°$

$* \; 360 - 53 = 307°$

Find Component Form Given Magnitude & Amplitude (Direction)

Sketch the vector (no protractor) on an xy axis

Create a right triangle with the reference angle



Find the ~~component~~ form given the magnitude & direction.

1. |v|=10 θ=120° $\langle -5, 8.7 \rangle$

$\cos 60° = \frac{x}{10}$

$x = -5$

$\sin 60° = \frac{y}{10}$ $y = 8.7$

2. |v|=6 θ=250°

$\sin 70° = \frac{y}{6}$

$\langle -2.1, -5.6 \rangle$

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Add, Subtract, & Scalar Multiplication with Vectors

If $\vec{a} = \langle x_1, y_1 \rangle$ and $\vec{b} = \langle x_2, y_2 \rangle$

Add: $\vec{a} + \vec{b} =$

$\langle x_1 + x_2, y_1 + y_2 \rangle$

Subtract: $\vec{a} - \vec{b} =$

$\langle x_1 - x_2, y_1 - y_2 \rangle$

Scalar Multiplication: $k\vec{a} =$

$k\langle x_1, y_1 \rangle = \langle kx_1, ky_1 \rangle$

Given $\vec{q} = \langle 3, 9 \rangle$ and $\vec{r} = \langle -1, 6 \rangle$, find:

1. $\vec{q} + \vec{r} =$

$\langle 3 + -1, 9 + 6 \rangle$

$\langle 2, 15 \rangle$

2. $\vec{q} - \vec{r} =$

$\langle 3 + +1, 9 - 6 \rangle =$

$\langle 4, 3 \rangle$

3. $5\vec{q} =$

$5\langle 3, 9 \rangle$

$= \langle 15, 45 \rangle$

4. $3\vec{r} - 2\vec{q} =$

$\langle -9, 0 \rangle$

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Unit Vectors

Any vector can be represented by an ordered pair or a sum of vectors.

If $\vec{a} = (a_1, a_2)$

$i = \langle 1, 0 \rangle$

$j = \langle 0, 1 \rangle$

$a_1 i + a_2 j$

Write as the sum of unit vectors:

1. $\langle 2, -5 \rangle$

$2i - 5j$

2. (-1, 2)

$-i + 2j$

3. (0, -7)

$-7j$

Orthogonal Vectors (Dot Product)

$(\perp)$

If 2 vectors have a dot product = 0, then they are orthogonal (meaning perpendicular)

$\vec{a} = \langle x_1, y_1 \rangle$ $\vec{b} = \langle x_2, y_2 \rangle$

$\vec{a} \perp \vec{b}$?

dot product

$x_1 x_2 + y_1 y_2 = 0$

Are the vectors orthogonal? Show why.

1. (2, -5) and (-2, 5)

$2(-2) + -5(5)$

$-4 + -25 = -29$ No

2. (4, -2) and (-5, -10)

$4(-5) + -2(-10)$

$-20 + 20 = 0$

yes

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