

Vectors Day 1

Essential Question

How do I find the magnitude & direction of a vector quantity?

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Scalar:

#

- a line segment (with a magnitude only)
- Examples: temperature, mass

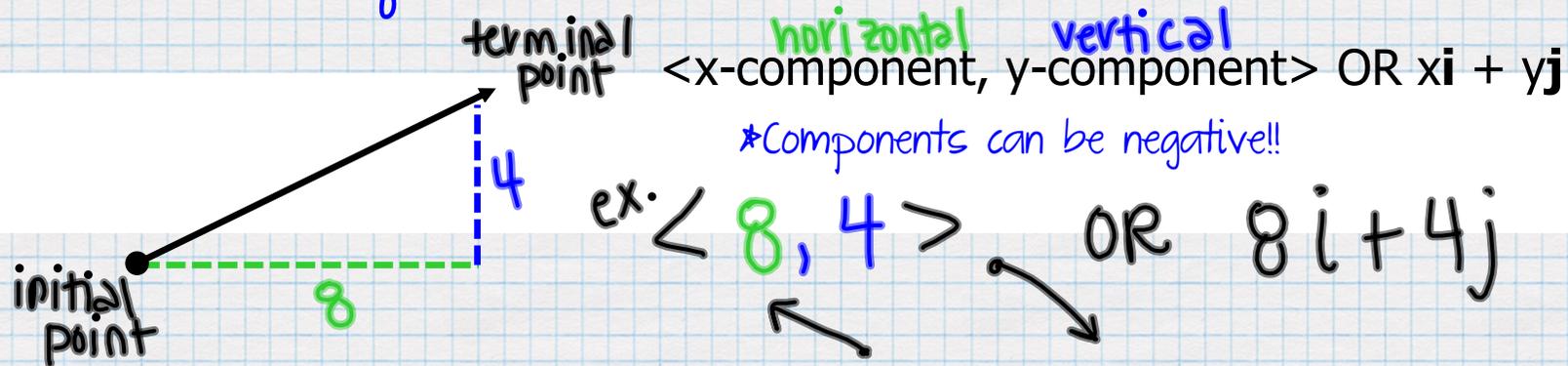
Vector:

- a ~~directed~~ line segment
- has a ~~magnitude~~ (length) and ~~direction~~ (angle made with positive x-axis)
- Example: Velocity

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Parts of a Vector

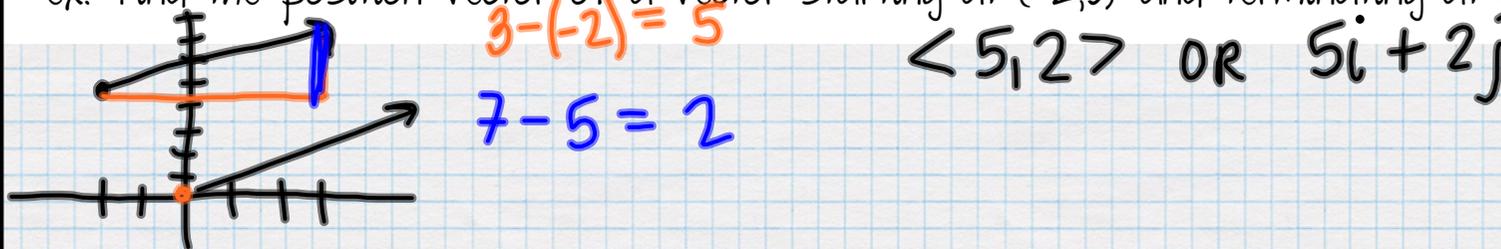


Unit Vector A vector with magnitude of one

Zero Vector A vector no direction and magnitude of zero

Position Vectors has an initial point at the origin

ex. Find the position vector of a vector starting at $(-2, 5)$ and terminating at $(3, 7)$



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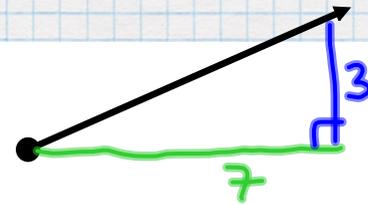
Magnitude • length of a vector

$$\|v\| = \sqrt{a^2 + b^2}$$

↑
h.c.

↑
v.c.

ex.



$$\begin{aligned} 3^2 + 7^2 &= c^2 \\ 9 + 49 &= c^2 \\ \sqrt{58} &= c \end{aligned}$$

ex. $u = 2i - 3j$
 $a=2$ $b=-3$

$$\begin{aligned} \|u\| &= \sqrt{2^2 + (-3)^2} \\ &= \sqrt{13} \end{aligned}$$

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Vector Operations Part 1

ex. $u = \langle 2, -1 \rangle$ and $v = \langle 4, 2 \rangle$. Find $2v + 3u$ and $v - u$.

Geometrically



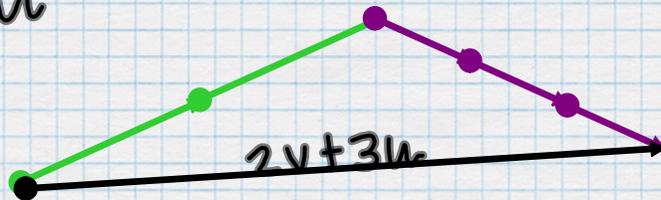
Algebraically

$$2v = \langle 4, -2 \rangle$$

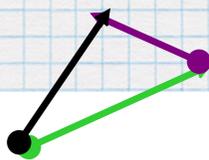
$$3u = \langle 12, 6 \rangle$$

$$2v + 3u = \boxed{\langle 16, 4 \rangle}$$

$2v + 3u$



$v - u$



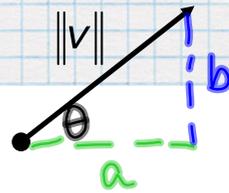
$$v - u = \langle 4, 2 \rangle - \langle 2, -1 \rangle$$

$$\langle 2, 3 \rangle$$

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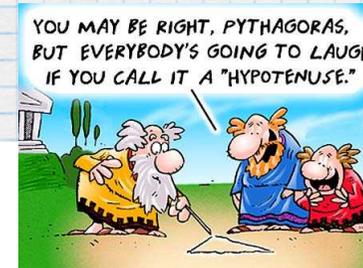
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Horizontal & Vertical Components



$$\cos \theta = \frac{a}{||v||}$$

$$a = ||v|| \cos \theta$$



ex. A vector has magnitude of 8 and direction $\frac{\pi}{3}$

Find the horizontal & vertical components in $i + j$ form.

$$a = ||v|| \cos \theta$$

$$= 8 \cos \frac{\pi}{3} = 8 \left(\frac{1}{2} \right)$$

$$= 4$$

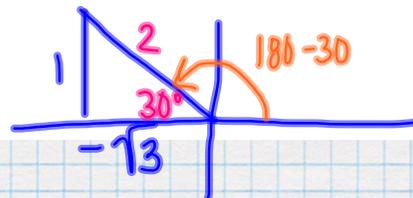
$$b = ||v|| \sin \theta$$

$$= 8 \sin \frac{\pi}{3}$$

$$= 8 \left(\frac{\sqrt{3}}{2} \right) = 4\sqrt{3}$$

$$4i + 4\sqrt{3}j$$

ex. Find the magnitude and direction of $u = -\sqrt{3}i + j$



$$x = -\sqrt{3} \quad y = 1$$

direction: 150°

$$1^2 + (-\sqrt{3})^2 = ||u||^2$$

$$2 = ||u||^2$$

$$2 = ||u||$$