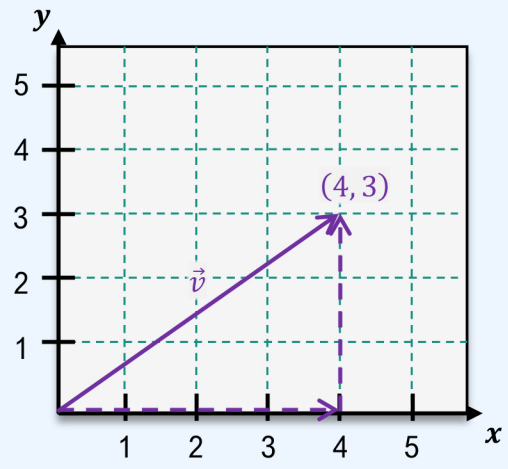
TOPIC: UNIT VECTORS AND i & j NOTATION

i & j Notation

◆ **Unit Vector**: magnitude of __ in *any* direction. Unit vectors in $+x$ & $+y$ directions: __ (*"i – hat"*) & __ (*"j – hat"*)

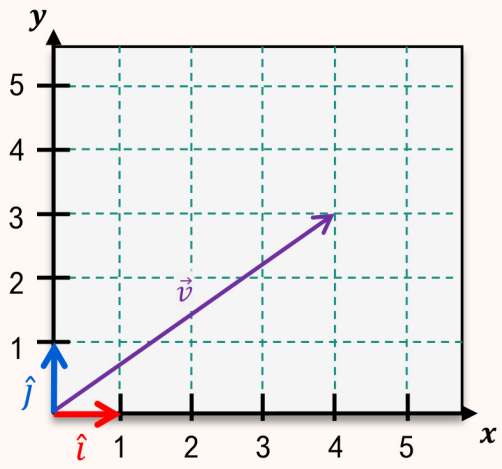
- We can use $\hat{\imath}$ & $\hat{\jmath}$ to write vectors in a new notation.

Recall — Component Form



$\vec{v} = \langle 4, 3 \rangle$

New — i & j Notation



Multiply **[x | y]** component by **[$\hat{\imath}$ | $\hat{\jmath}$]**

Multiply **[x | y]** component by **[$\hat{\imath}$ | $\hat{\jmath}$]**

$\vec{v} = 4 \cdot \_\_\_ + 3 \cdot \_\_\_$

EXAMPLE Write the vector using $\hat{\imath}$ & $\hat{\jmath}$ notation, given $\vec{u} = \langle 2, 4 \rangle$, $\vec{v} = \langle 1, 0 \rangle$

(A) $\vec{u}$

(B) $\vec{v}$

(C) $\vec{u} + \vec{v}$

(D) $\vec{u} - 2\vec{v}$

◆ Like component form, to perform operations using $\hat{\imath}$ & $\hat{\jmath}$ notation, just $+, -,$ or $\times$ by the _____.

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PRACTICE If vector $\vec{v} = 12\hat{\imath} - 2\hat{\jmath}$ and vector $\vec{u} = 5\hat{\imath} + 20\hat{\jmath}$ calculate $2\vec{v} - 2\vec{u}$ using $\hat{\imath}$ & $\hat{\jmath}$ notation.

PRACTICE If vector $\vec{v} = 11\hat{\jmath}$ and vector $\vec{u} = 10\hat{\imath} - 25\hat{\jmath}$ calculate $\vec{v} + \frac{1}{5}\vec{u}$ using $\hat{\imath}$ & $\hat{\jmath}$ notation.

PRACTICE If vector $\vec{a} = 20\hat{\imath}$ and vector $\vec{b} = 50\hat{\jmath}$ calculate $\vec{a} - \vec{b}$ using $\hat{\imath}$ & $\hat{\jmath}$ notation.

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Unit Vector in the Direction of a Given Vector

◆ Recall: **Unit Vector** has a magnitude of 1 in *any* direction.

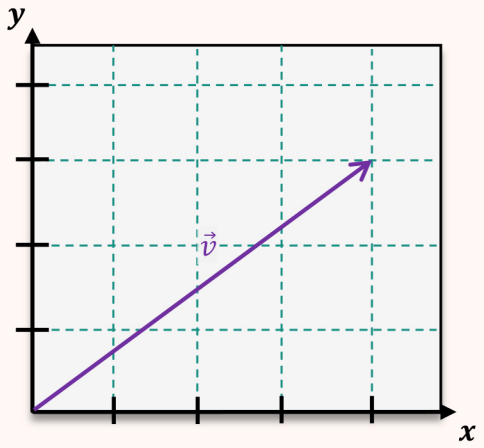
- Given $\vec{v}$, find the unit vector $(\hat{v})$ in the same *direction* by dividing each component by the _____ of $\vec{v}$.

EXAMPLE Find the unit vector $\hat{v}$ in the same direction of $\vec{v} = 4\hat{\imath} + 3\hat{\jmath}$.

New **Unit Vector in the Direction of $\vec{v}$**

$$\hat{v} = \frac{\vec{v}}{\quad}$$

$$|\vec{v}| = \sqrt{(\quad)^2 + (\quad)^2} =$$



EXAMPLE Show that $\hat{v}$ in the example above is a unit vector $(|\hat{v}| = 1)$.

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EXAMPLE Find the unit vector $\hat{u}$ in the direction of vector $u = -\hat{\imath} + 2\hat{\jmath}$.

$|\vec{u}| =$ _____

$\hat{u} =$ _____

PRACTICE Find the unit vector in the direction of $\vec{a} = 6\hat{\imath} + 3\hat{\jmath}$.

PRACTICE Find the unit vector in the direction of $\vec{v} = 12\hat{\imath} - 35\hat{\jmath}$.

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EXAMPLE If vectors $\vec{a} = \langle -1,3 \rangle$, $\vec{b} = \langle 4,7 \rangle$ and $\vec{c} = 4\vec{a} + 2\vec{b}$, find the unit vector in the direction of $\vec{c}$.