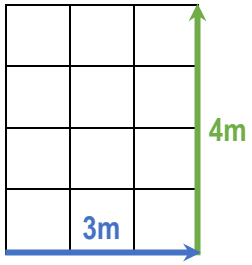
CONCEPT: ADDING VECTORS GRAPHICALLY

● Vectors are drawn as arrows and are added by _____ the arrows (tip-to-tail).

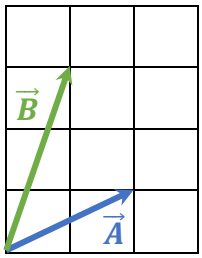
ADDING PERPENDICULAR VECTORS



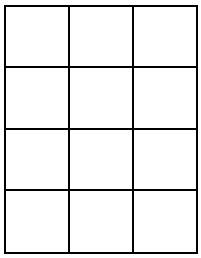
Resultant Vector:
(Total Displacement)

_____

ADDING ANY VECTORS



$\vec{A} + \vec{B}$

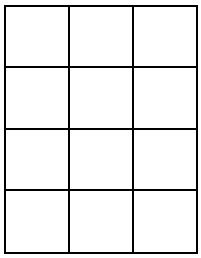


Resultant Vector:
(Total Displacement)

_____

$\Leftrightarrow$

$\vec{B} + \vec{A}$



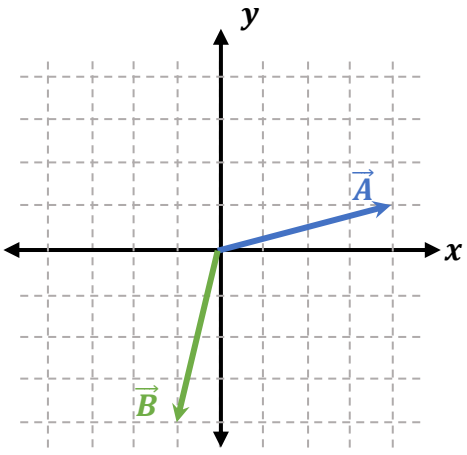
Resultant Vector:
(Total Displacement)

_____

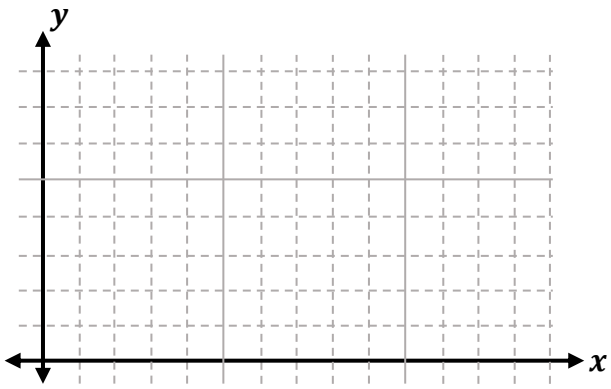
● The **RESULTANT** vector ($\vec{C}$ or $\vec{R}$) is *always* the **SHORTEST PATH** from the **start** of the first vector → **end** of the last.

- Adding vectors does **NOT** depend on the order (commutative), so $\vec{A} + \vec{B} = \vec{B} + \vec{A}$.

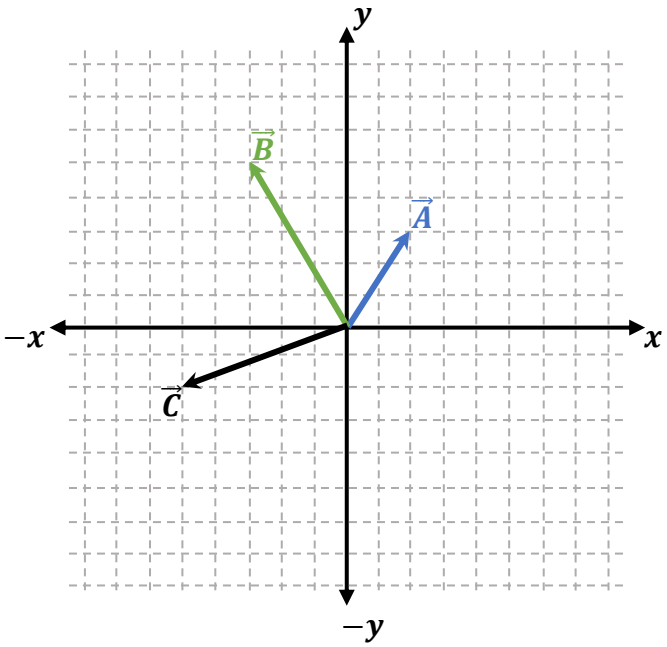
EXAMPLE: Find the magnitude of the Resultant Vector $\vec{C} = \vec{A} + \vec{B}$.



PRACTICE: A delivery truck travels 8 miles in the +x-direction, 5 miles in the +y-direction, and 4 miles again in the +x-direction. What is the magnitude (in miles) of its final displacement from the origin?



EXAMPLE: Find the magnitude of the Resultant Vector $\vec{D} = \vec{A} + \vec{B} + \vec{C}$.

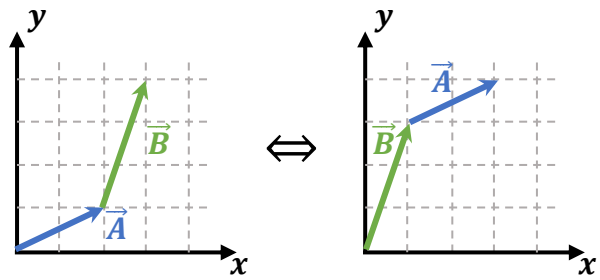


CONCEPT: SUBTRACTING VECTORS GRAPHICALLY

- Subtracting vectors is *exactly* like adding vectors tip-to-tail, but one (or more) of the vectors gets _____.

ADDING VECTORS

$\vec{A} + \vec{B}$ $\qquad$ $\vec{B} + \vec{A}$



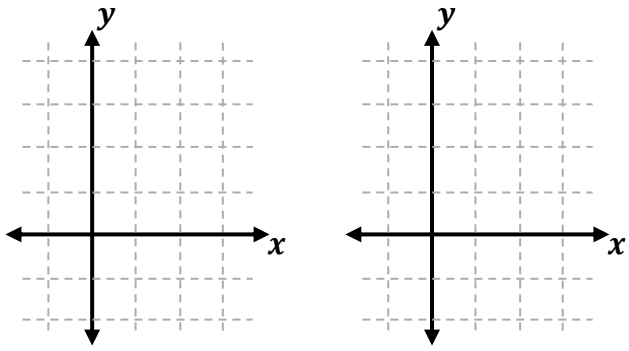
Resultant ⟶ shortest path:
(Total Displacement)

_____

- When adding, order **[DOES | DOES NOT]** matter

SUBTRACTING VECTORS

$\vec{A} - \vec{B}$ $\qquad$ $\vec{B} - \vec{A}$



Resultant ⟶ shortest path:
(Total Displacement)

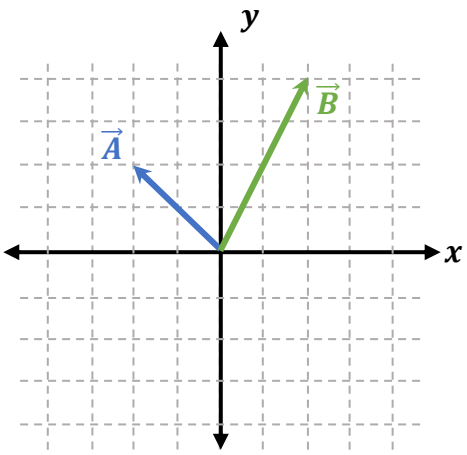
_____

Resultant ⟶ shortest path:
(Total Displacement)

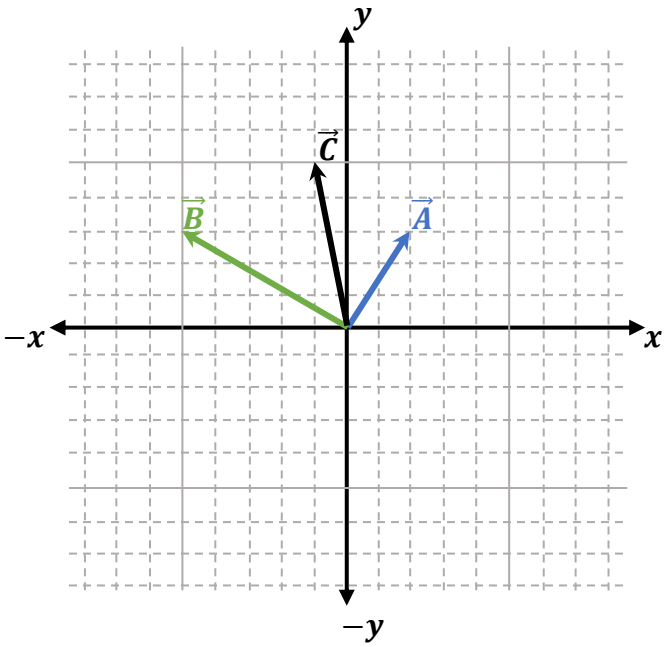
_____

- "Negative" vector: SAME magnitude, _____ direction
- When subtracting, order **[DOES | DOES NOT]** matter

EXAMPLE: Find the magnitude of the Resultant Vector $\vec{C} = \vec{A} - \vec{B}$.



PRACTICE: Find the magnitude of the Resultant Vector $\vec{D} = \vec{C} - \vec{B} - \vec{A}$.

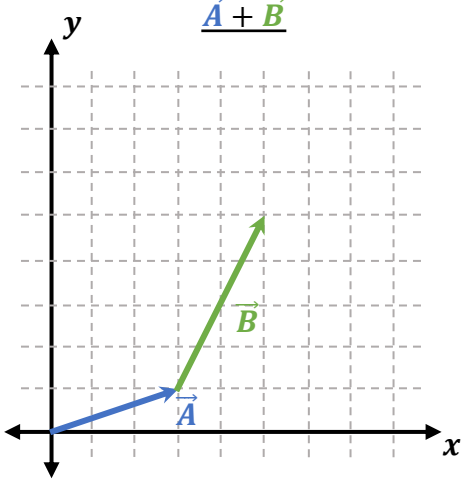


CONCEPT: ADDING MULTIPLES OF VECTORS

- When you multiply a vector by a number ($\vec{A} \rightarrow 2\vec{A}$), the **magnitude** (length) changes but NOT the direction.

ADDING VECTORS

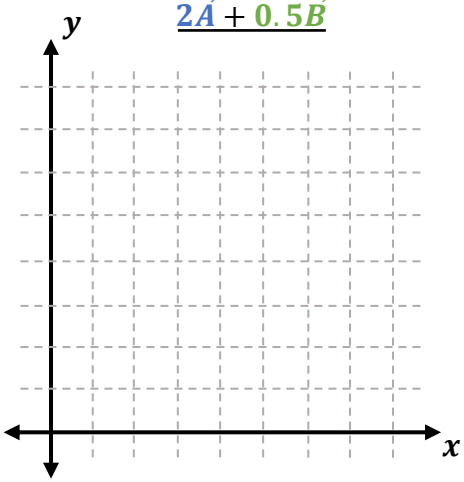
$\vec{A} + \vec{B}$



Resultant Vector → Shortest Path:
(Total Displacement)

ADDING MULTIPLES OF VECTORS

$2\vec{A} + 0.5\vec{B}$



Resultant Vector → Shortest Path:
(Total Displacement)

- Multiplying by > 1 **[increases | decreases]** magnitude/length
- Multiplying by < 1 **[increases | decreases]** magnitude/length

EXAMPLE: Find the magnitude of the Resultant Vector $\vec{C} = 3\vec{A} - 2\vec{B}$.