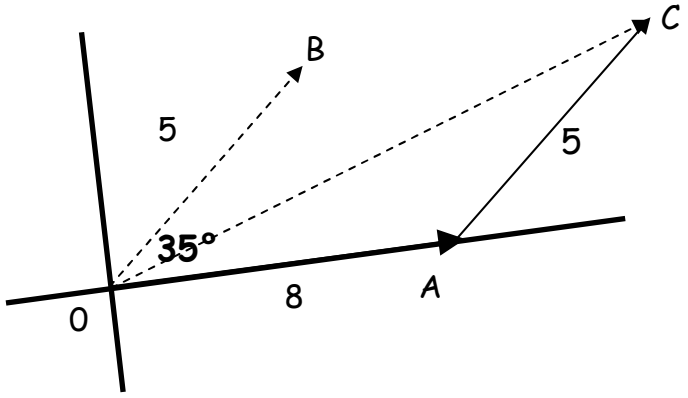
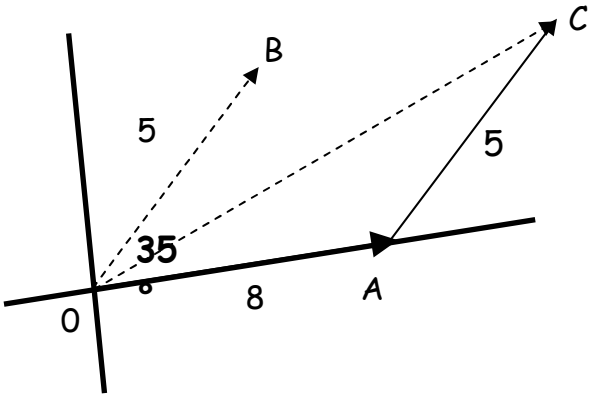
Recall the example from before, solved using geometric vectors:

Find the magnitude and direction of the resultant of two vectors whose magnitudes are 5 and 8 respectively and the angle between them is 35°.



$\therefore$ The resultant vector $\overrightarrow{OC}$ has magnitude $|\overrightarrow{OC}| \approx 12.4 units$ and is 13.4° counter clockwise from $\overrightarrow{OA}$.

Lets look at a solution involving algebraic vectors.



NOTE: No NESW reference

Lets allow one vector to run along some axis.

$$\overrightarrow{OA} = (8,0)$$

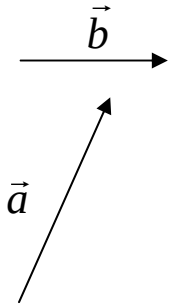
$$\overrightarrow{OB} = (5\cos 35^\circ, 5\sin 35^\circ) = (4.1, 2.9)$$

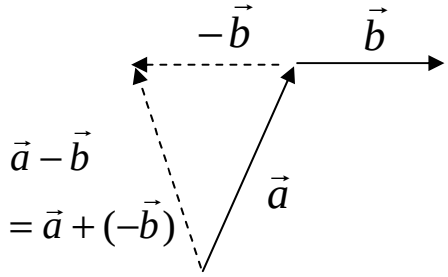
$$\begin{aligned}\overrightarrow{OC} &= \overrightarrow{OA} + \overrightarrow{OB} \\ &= (8,0) + (4.1, 2.9) \\ &= (12.1, 2.9) \\ &= 12.4\left[R13.5^\circ U\right]\end{aligned}$$

$\therefore$ The resultant vector $\overrightarrow{OC}$ has magnitude $|\overrightarrow{OC}| \approx 12.4 units$ and is 13.5° counter clockwise from $\overrightarrow{OA}$.

Vector Subtraction – adding the opposite

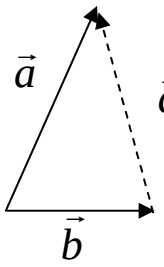
For vectors $\vec{a}$ and $\vec{b}$





OR

Arrange $\vec{a}$ and $\vec{b}$ tail to tail



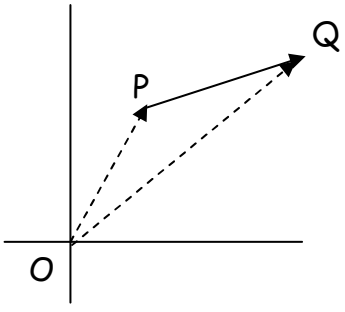
$\vec{a}-\vec{b}$ is the vector that must be added to $\vec{b}$ to get $\vec{a}$

$$\vec{b}+(\vec{a}-\vec{b})=\vec{a}$$

Algebraically, we have

(a,b,c) - (d,e,f) = (a - d, b – e, c - f)

Finding the Vector Between Two Points



$$\begin{aligned}\overrightarrow{PQ} &= \overrightarrow{PO}+\overrightarrow{OQ}\\ &= -\overrightarrow{OP}+\overrightarrow{OQ}\\ &= \overrightarrow{OQ}-\overrightarrow{OP}\\ &= \vec{Q}-\vec{P}\end{aligned}$$

Need to Know

- Commutative Property of Addition: $\vec{a} + \vec{b} = \vec{b} + \vec{a}$
- Associative Property of Addition: $(\vec{a} + \vec{b}) + \vec{c} = \vec{a} + (\vec{b} + \vec{c})$
- Distributive Property of Addition: $k(\vec{a} + \vec{b}) = k\vec{a} + k\vec{b}$, $k \in \mathbf{R}$
- Adding $\vec{0}$: $\vec{a} + \vec{0} = \vec{a}$
- Associative Law for Scalars: $m(n\vec{a}) = (mn)\vec{a} = mn\vec{a}$
- Distributive Law for Scalars: $(m + n)\vec{a} = m\vec{a} + n\vec{a}$

Example: If $G(-3, 7, 1)$ and $F(2,5, -3)$, find $\overrightarrow{GF}$.

Example: Are the points A(-3,5,-2), B(3,-3,12) and C(6,-7,19) collinear?

Example: If $3(x,-2) - 2(3,-2y) = (5,1)$, find x and y.