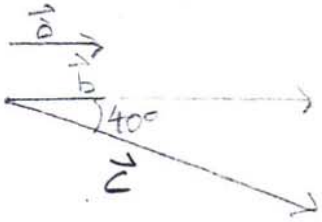
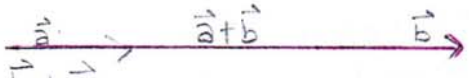
6.2 Addition and Subtraction of Vectors

Resultant - when two vectors are added/subtracted

Consider the following:



1) $\vec{a}+\vec{b}$ $\quad \vec{a}+\vec{b} = \vec{b}+\vec{a}$ (commutative property)

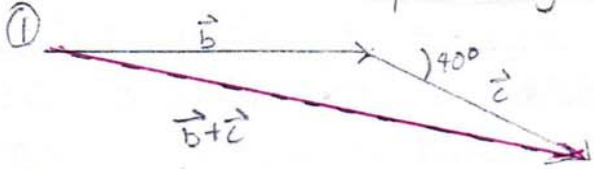


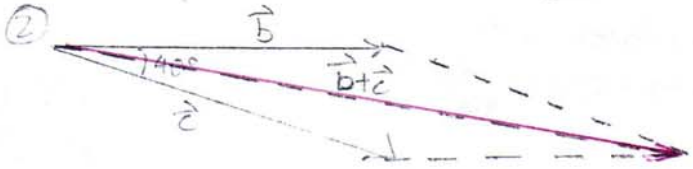
2) $\vec{b}+\vec{c}$

2 methods for adding vectors:

① head to tail (triangle method)

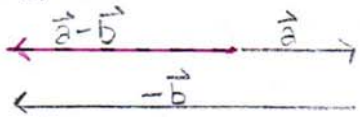
② tail to tail (parallelogram method)





Subtraction

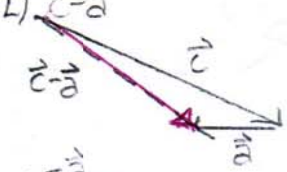
1) $\vec{a}-\vec{b}$

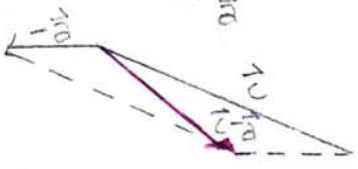


"$\vec{a}$" head is attached to opposite "$\vec{b}$" tail

2) $\vec{c}-\vec{a}$

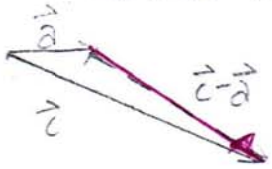
Method 1 - triangle method (head to tail)

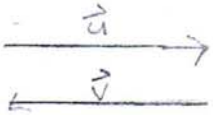




Method 2: parallelogram method

New method (subtraction ONLY), tail to tail





$\vec{u}+\vec{v}=\vec{0}$ (zero vector) – same magnitude but opposite direction

Properties of vectors

$\vec{u}+\vec{v}=\vec{v}+\vec{u}$ (commutative)

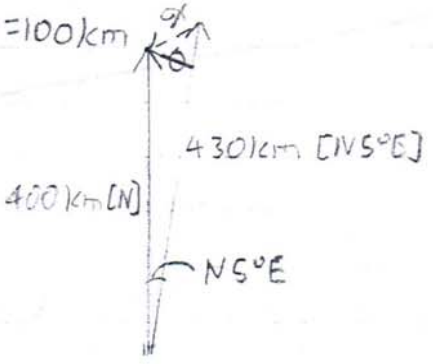
$(\vec{u}+\vec{v})+\vec{w}=\vec{u}+(\vec{v}+\vec{w})$ (associative)

$\vec{v}+\vec{0}=\vec{v}=\vec{0}+\vec{v}$ (identity)

Application Example

A pilot wishes to fly 400km [N]. Due to a wind, the pilot actually flies 430km in the direction N5°E. How far, and what direction must the pilot now fly in order to achieve the proper displacement?

1cm = 100km



SAS is given → cos LAW

$a^2=b^2+c^2-2bc\cos A$

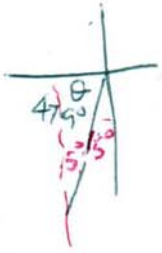
$x^2=400^2+430^2-2(400)(430)\cos 5°$

$x=47$

$\sin\theta/400=\sin 5°/47$

$\sin\theta=400\sin 5/47$

$\theta=47.9°$



∴ the pilot must fly 47km at (S52.9W)

47.9° + 5°

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