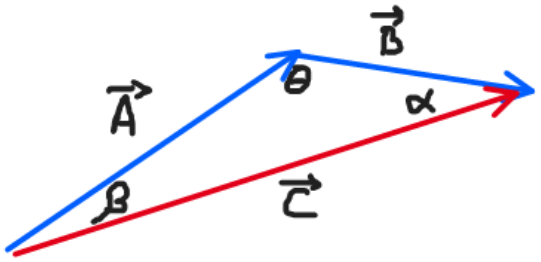
GRADE 11 ESSENTIAL
UNIT G - TRIGONOMETRY
VECTORS

Name:_____
Date: _____

1. Vectors are a fancy word for something that has a length and an angle. To add vectors we put them '*tail-to-head*' to find a **resultant** vector.

Vectors are very big part of science and especially **Physics**. Anytime you combine things with a strength and direction, like forces, or velocities, or motions you are using vectors.

2. Bob follows Vector $\vec{A}$ for some angle on the earth, then he turns some angle and moves a Vector $\vec{B}$.

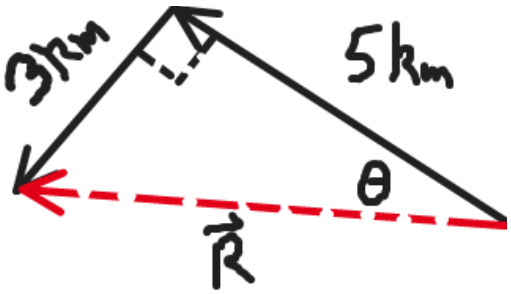


The resultant of adding them is a vector $\vec{C}$ at some other angle.

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

Example:

3. Evan walks 5 km then makes a turn 90° to his left and walks another 3 km. How far away from the start is he and what angle does it make.



What is his resultant vector, $\vec{R}$?

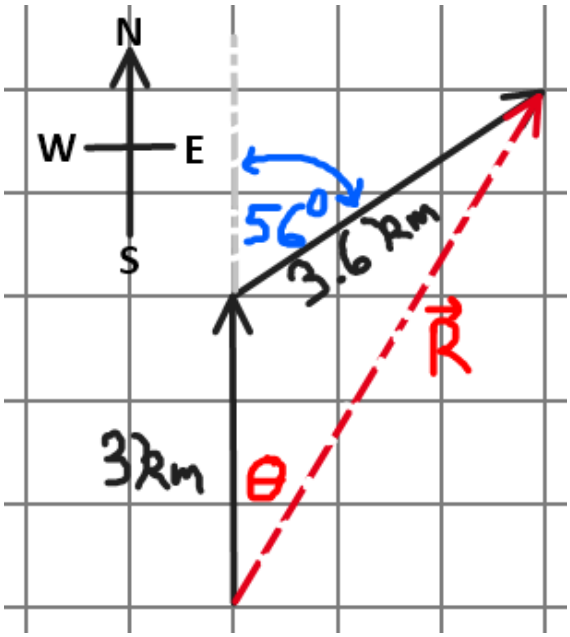
4. Just some simple SOH CAH TOA and right triangle trigonometry will suffice!

$R^2 = 3^2 + 5^2 = 34$; $R = 5.83$ km

$\theta = \tan^{-1}(3/5) \approx 31^\circ$

Evan has a resultant vector, $\vec{R}$, that is 5.83 km from the start at an angle of 31°.

5.



Cassandra drives her skidoo 3 km straight north, then she makes a 56° turn to the right and drives another 3.6 km.

She runs out of gas.

Determine how far and what direction she is from the start (find the resultant, $\vec{R}$). [use Cosine Law]

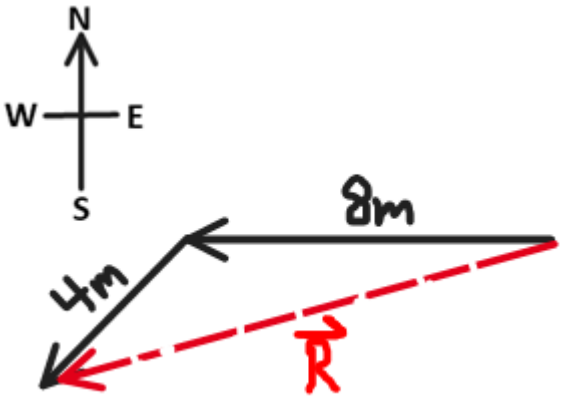
Ans: 5.83 km at angle 31° right of North.

In the example above notice it was drawn on a nice map grid, and it was drawn pretty accurately. You could have just measured distances and angles with a ruler and with a protractor. **Try it**.

Knowing how to use 'scale maps' is important, another Unit in Grade 11 Essential.

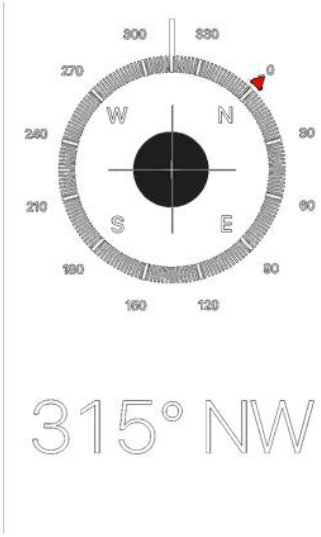
6. Debbie and Janice are having a water balloon fight. Debbie runs a vector, $\vec{A}$, of straight **west** for 8 metres, then changes her direction to a vector, $\vec{B}$, 60° to the left and runs another 4 meters.

How far does Janice need to throw a water balloon and in which direction?
i.e.: Add the vectors to get the resultant, $\vec{R} = \vec{A} + \vec{B}$

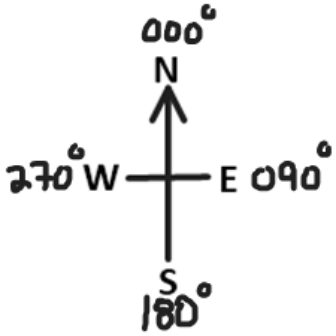


Ans: 10.58 m at angle 19° left of West

7. Do you know? How do we say 19° left of west? Pull out your compass, have a look. (it is on your phone!)



Compass on your phone



Compass 'Rose' on a map

The angle 19° to the left of west would be called [251°] (270 – 9= 251)

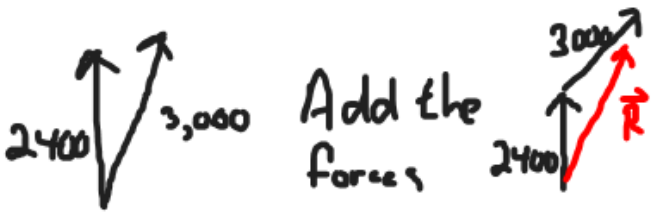
Notice *we* measure angles clockwise from North (following the sun; well at least for us Northern folks!) I *tend* to put compass directions in square brackets too.

8. Josh and Kelvin are trying to pull out a tree trump with their trucks. Josh's truck pulls North with a strength off 2,400 Newtons, and Kelvin pulls in a compass direction of [020] with a force of 3,000 Newtons.

What total force is being applied to the tree stump and in which compass direction will it come flying out? (The vectors are still added tail to head!)

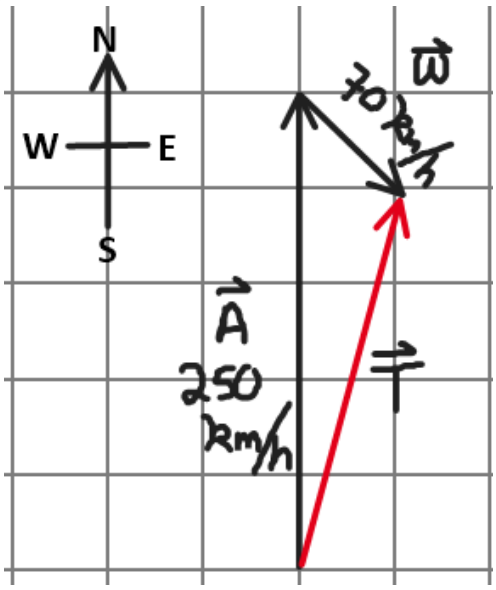
Workspace:

Here is a *sketch* of the forces



What is a Newton?? Investigate on your own!

9. Bernice is flying home. The airplane has a **speed** and **heading** vector of 250 km / h straight north. But there is a 70 km / h wind! The wind is **from** the **North-West**. The wind causes the airplane's path to **drift** a bit to the right, even though it is pointing on a **heading** of straight north.



The wind also is pushing the airplane backwards a bit. ('head wind')

Determine vector $\vec{T}$ by answering the following:

a. Ground Speed across the ground:

b. Drift Angle of the airplane:

c. What angle is the aircraft tracking on the map?

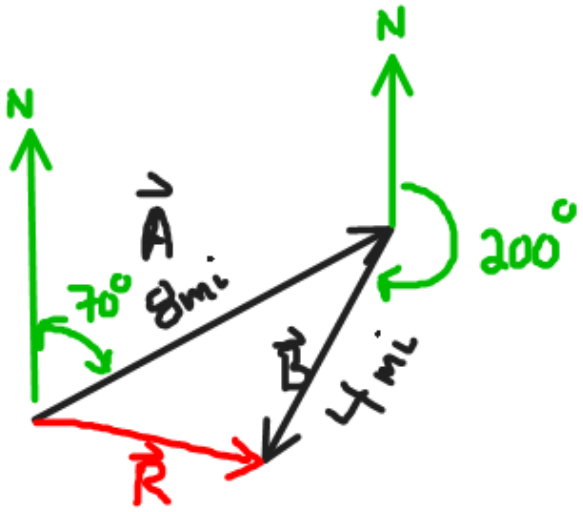
Notice you could actually measure this too with a ruler and protractor since it is on a map grid.

Compass Work!

10. Gerry goes 8 miles on a compass direction of 070°, then heads back on a compass direction of 200° for 4 miles.

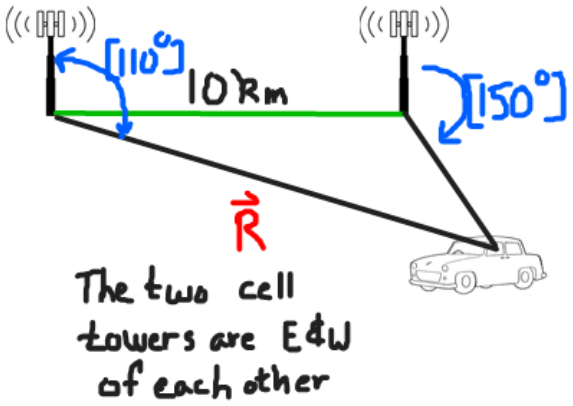
His phone battery is about to quit! He calls his friends, says he is lost and states the vectors he has moved!

Calculate the map direction and distance his friends have to follow to find Gerry.



Notice: Not drawn accurately to scale! Not a very accurate drawing! Do not check with a protractor. Just use trig!

10. Carla is expecting her mom for dinner. There is a snow storm. Her mom's car is stuck in a ditch in the countryside. They are talking on a cell phones. Mom does not know where she is. It is freezing!



The police call Rogers and get direction **bearings** off each of the two indicated cell phone towers.

Find mom! (Determine vector $\vec{R}$ based on a compass direction from the west most cell tower)

We '*triangulated*' mom!

Hint: need sine law

(A bearing off of north is usually put in square brackets, so [150] means 150° off of north).

Ans: Mom is 13.5 km on a [110°] bearing from the west tower.

If you like this stuff then **Physics** is a great science course for you!

Or **surveying, geomatics**! They measure lots of angles too! Check out that career!