Understanding Vector Addition I

Graphical Method of Vector Addition

- Vectors like displacements, velocities and forces can be added both graphically and mathematically.

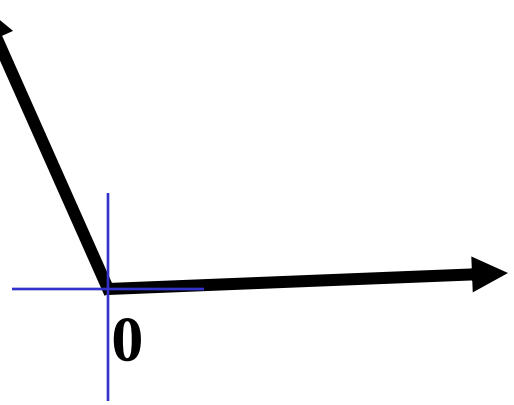
- There are two ways of adding vectors graphically: tail to tip method and the tail to tail method.

Graphical Method of Vector Addition

- The **resultant vector** is defined as the single vector that produces the same effect as several vectors added together.

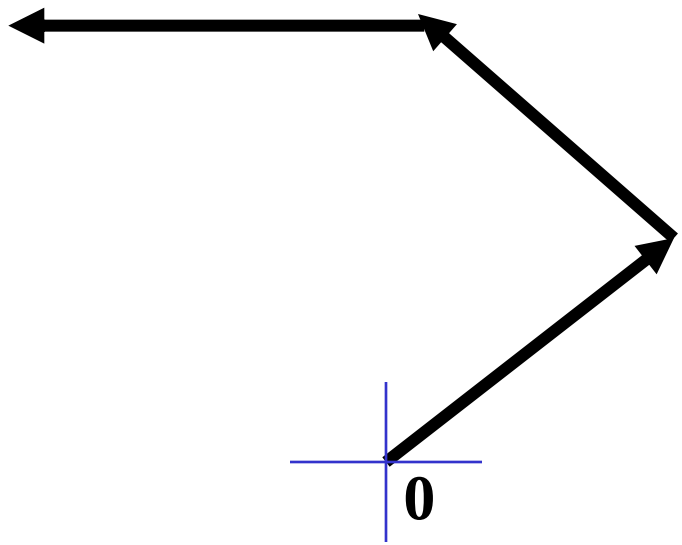
Graphical Method of Vector Addition

In the tail to tail method, the vectors are drawn from a common origin; hence the vectors are all connected at their tails.



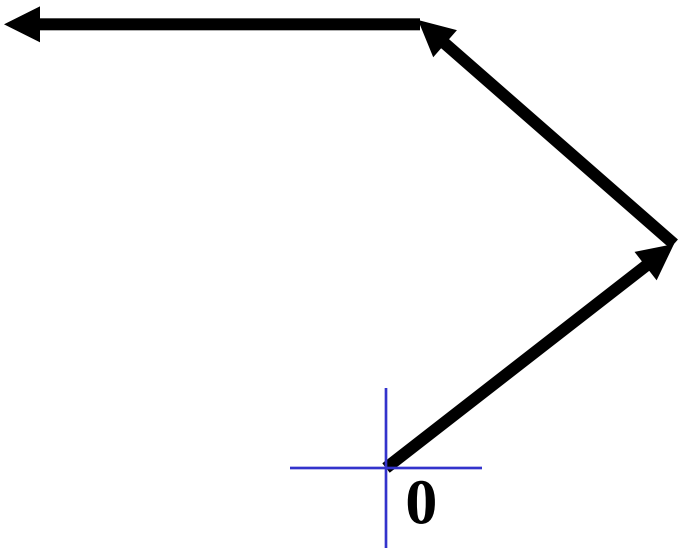
Graphical Method of Vector Addition

In the tail to tip method, the succeeding vector is attached to and drawn from the tip of the preceding vector.



Graphical Method of Vector Addition

In the tail to tip method, the resultant vector is drawn from the tail of the first vector at the origin to the tip of the last vector.



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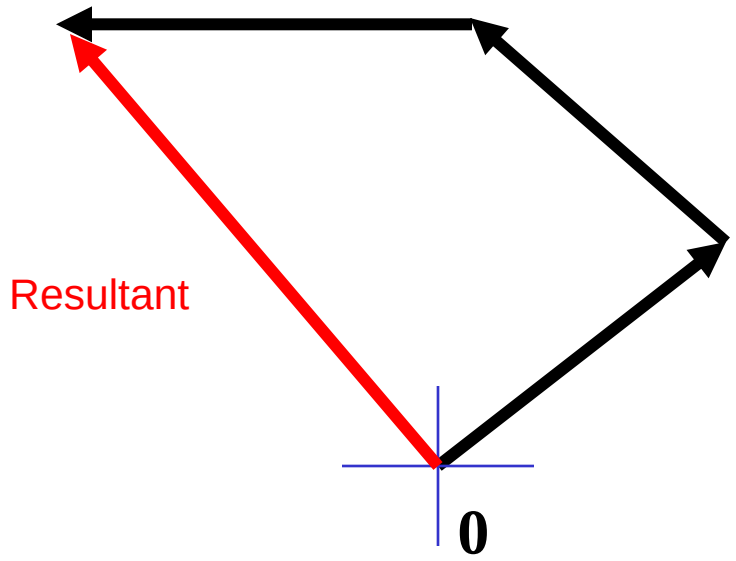


Direction of the Resultant Vector

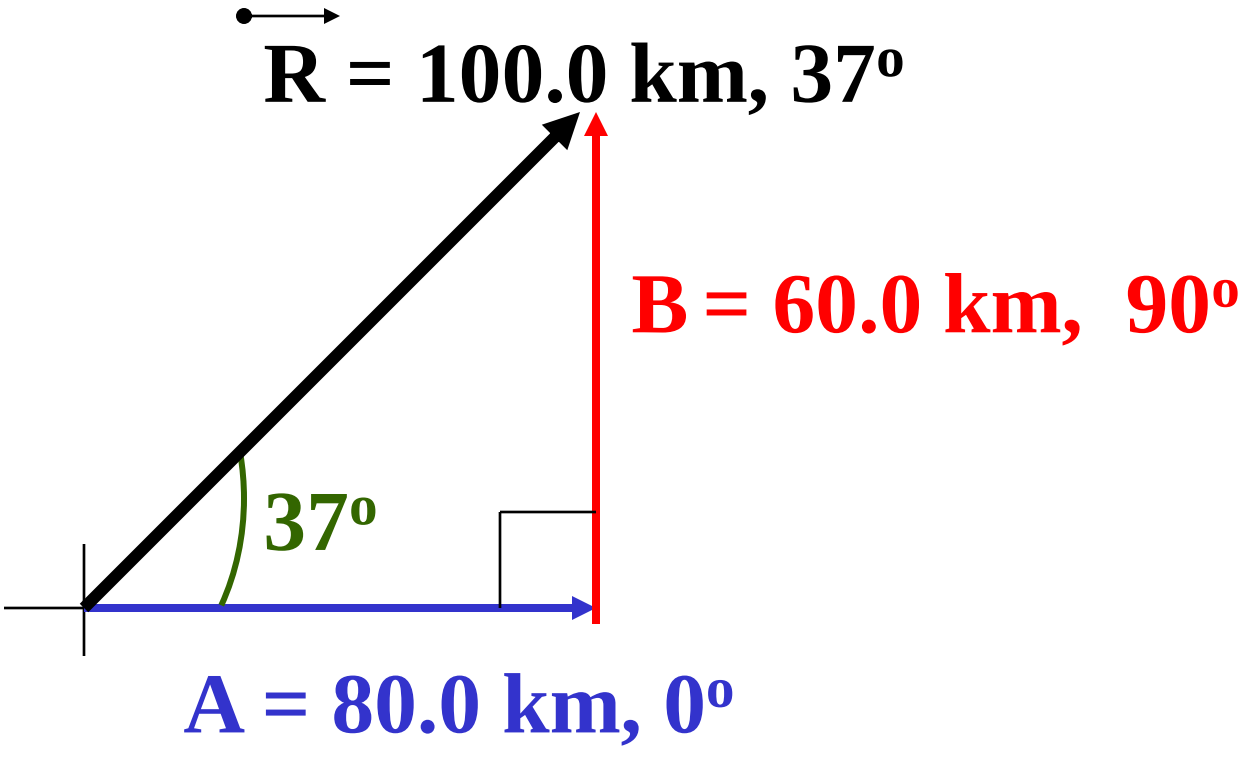
- The direction of a vector θ (Greek letter "theta") is always measured in terms of the angle in degrees from the East (0^o) or the 3 o'clock position.

- The included angle, $\angle$ of a vector is the acute angle (more than 0^o but less than 90^o) the vector makes with the horizontal axis.

Problem 1

A car travels **A = 80.0 km, 0º**, turns then travels **B = 60.0 km, 90º**.

- Where is the car now? How far and in what direction from the origin?
- This is the same as finding the magnitude and direction of the resultant displacement of the car.

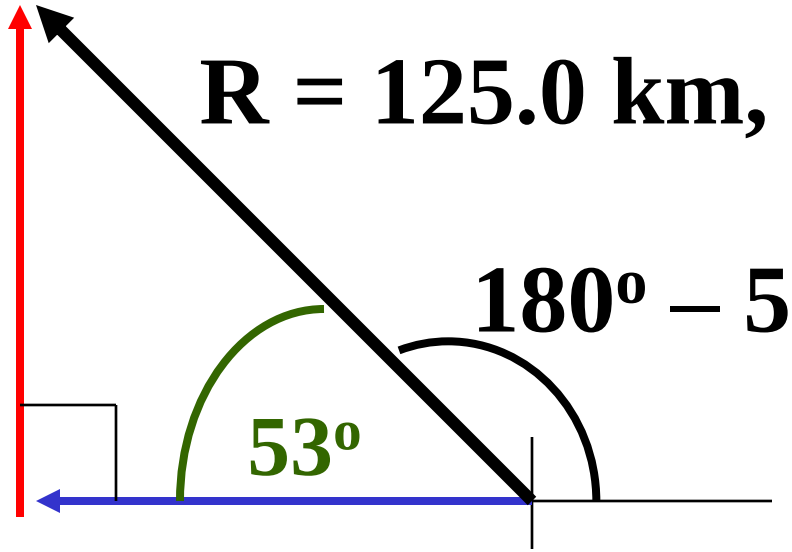

R = 100.0 km, 37°
B = 60.0 km, 90°
37°
A = 80.0 km, 0°

Problem 2

A car travels **A = 75.0 km, 180º**, turns then travels **B = 100.0 km, 90º**.

- Where is the car now? How far and in what direction from the origin?
- This is the same as finding the magnitude and direction of the resultant displacement of the car.

B= 100.0 km, 90^{o}



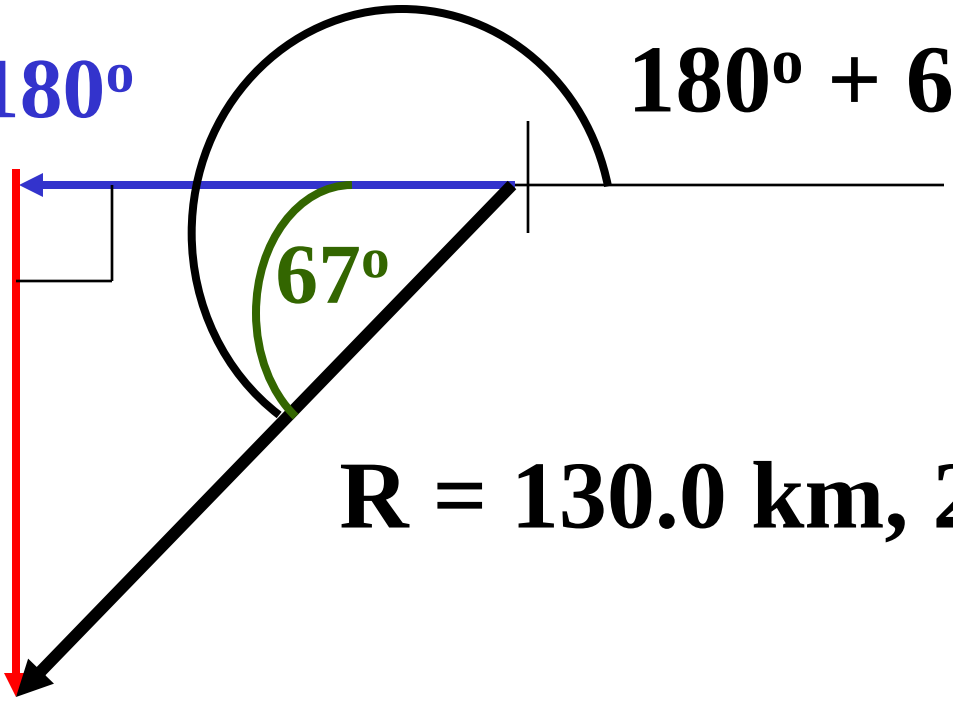
A = 75.0 km, 180^{o}

Problem 3

A car travels **A = 50.0 km, 180º**, turns then travels **B = 120.0 km, 270º**.

- Where is the car now? How far and in what direction from the origin?
- This is the same as finding the magnitude and direction of the resultant displacement of the car.

A = 50.0 km, 180°



180° + 67° = 247°

R = 130.0 km, 247°

B = 120.0 km, 270°

Limitations

- The Pythagorean theorem is used to mathematically determine the resultant vector of 2 perpendicular vectors which, together with the resultant vector (hypotenuse) form a right triangle.