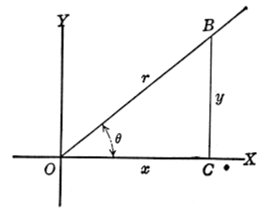
DETERMINE RESULTANT USING TRIG FUNCTIONS (QUICK REVIEW)

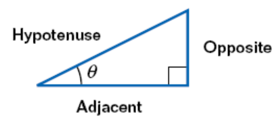


Net Force **(resultant, Hypotenuse)** acting upon an object is determined by computing the vector sum of all the individual forces acting upon that object

- Use trig functions for angles
- Pythagorean Theorem

  $A^2 + B^2 = C^2$

  - Only good for right angles



$$\text{sine of angle } \theta = \frac{\text{opposite leg}}{\text{hypotenuse}}$$

$$\text{cosine of angle } \theta = \frac{\text{adjacent leg}}{\text{hypotenuse}}$$

Tan = y/x

Sin = y/r

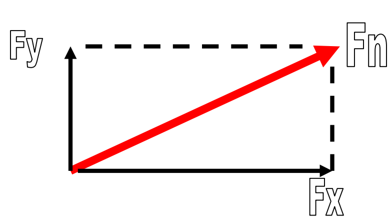
Cos = x/r

ANY VECTOR CAN BE EXPRESSED AS A SERIES OF COMPONENTS

You can often describe an object's motion more conveniently by breaking a single vector (Fn) into two **components (Fx, Fy)**, or **resolving the vector.**

The **components of a vector** are the projections of the vector along the axes of a coordinate system.

Resolving a vector allows you to analyze the motion in each direction on the X and Y axis.



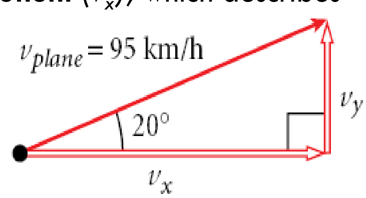
RESOLVING VECTORS INTO COMPONENTS

Consider an airplane flying at 95 km/h at 20 degrees north of east

The **hypotenuse (v_{plane})** is the **resultant vector** that describes the airplane's **total velocity.**

The **adjacent leg** represents the ***x* component** (v_x), which describes the airplane's **horizontal speed.**

The **opposite leg** represents the ***y* component** (v_y), which describes the airplane's **vertical speed.**

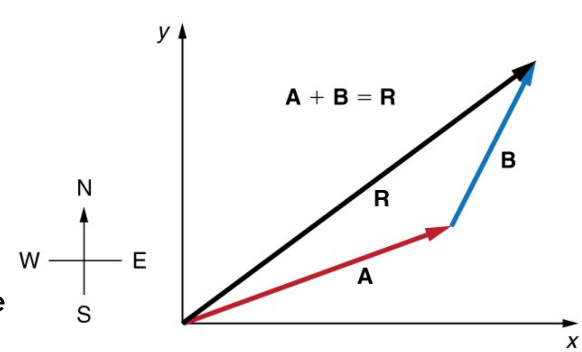


Vx = V Cos Ø   Vy = V Sin Ø

Adding Vectors That Are Not Perpendicular

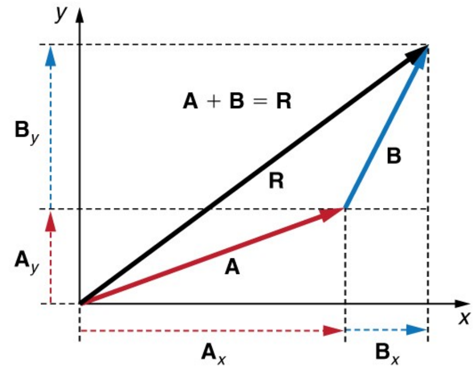
Vectors **A** and **B** are two legs of a walk, and **R** is the resultant or total displacement. You can use analytical methods to determine the magnitude and direction of **R** .

Because the original displacement vectors do not form a right triangle, you can not directly apply the tangent function or the Pythagorean theorem



ADDING VECTORS THAT ARE NOT PERPENDICULAR

- To add vectors **A** and **B**
  - First determine the horizontal and vertical components of each vector.
  - These are the dotted vectors $\mathbf{A}_x$, $\mathbf{A}_y$, $\mathbf{B}_x$ and $\mathbf{B}_y$ shown in the image.



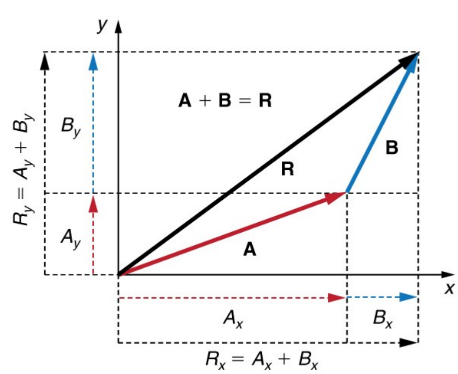
ADDING VECTORS THAT ARE NOT PERPENDICULAR

R_x X horizontal vector

- Add the magnitude of the vectors $\mathbf{A}_x$ and $\mathbf{B}_x$

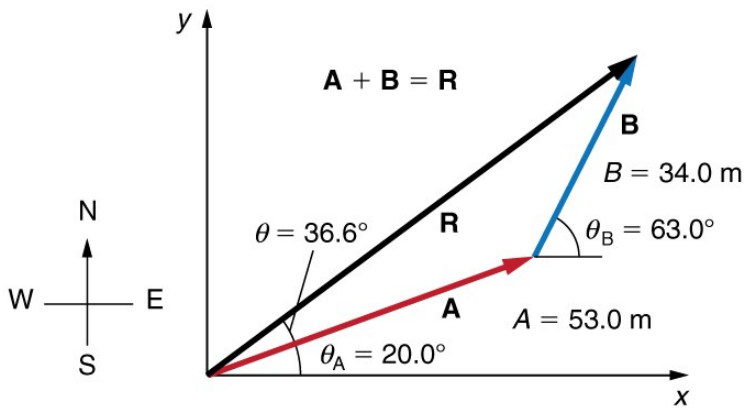
R_y Y vertical vector

- . Add the magnitudes of the vectors $\mathbf{A}_y$ and $\mathbf{B}_y$

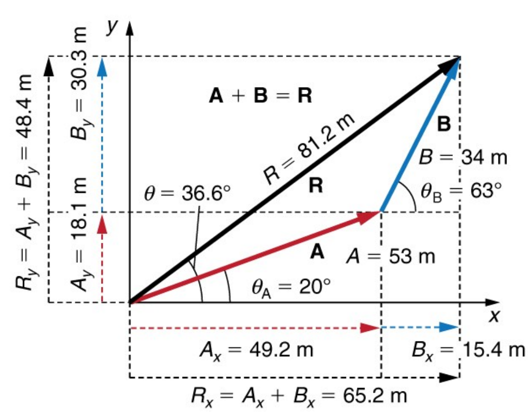


EXAMPLE PROBLEM

Given:
Vector **A** has magnitude 53.0 m, direction 20.0 ° north of east
Vector **B** has magnitude 34.0 m, direction 63.0° north of east



EXAMPLE PROBLEM



Ax = 53m Cos(20) = 49.8 m

Ay = 53m Sin (20) = 18.1 m

Bx = 34m Cos(63) = 15.4 m

By = 34m Sin (63) = 30.3 m

Xtotal = Ax + Bx = 49.8 m + 15.4 m = 65.2 m

Ytotal =Ay +By = 18.1m + 30.3m = 48.4 m

R^2 = $Xtotal^2$ + $Ytotal^2$ = 81.2m

Ø = Tan-1 = Ytotot/Xtotal = 36.6° North of east