

Vectors



Vector

- A quantity with both magnitude and direction.
 - Examples – displacement, velocity, acceleration, Force



Scalars

- A quantity with ONLY magnitude
- Examples – distance, speed, mass, time, volume

Vectors

- ▶ Represented by arrows



- ▶ Add by placing arrows head to tail

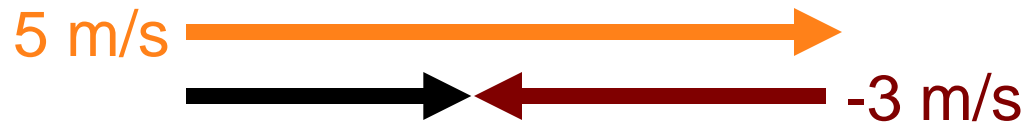
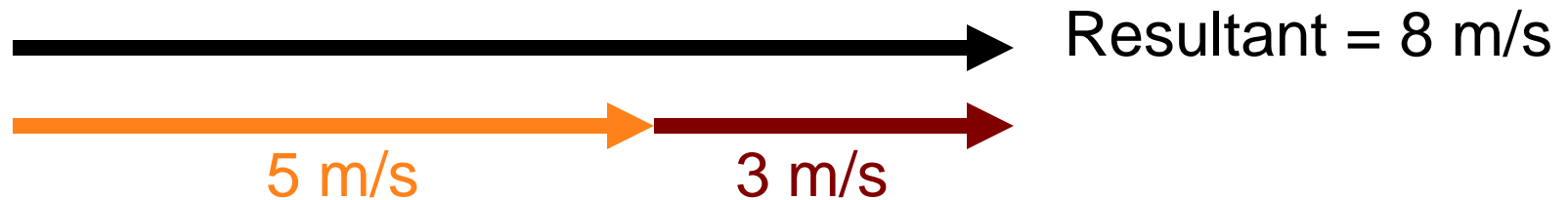


- ▶ Same with subtracting vectors



Resultant

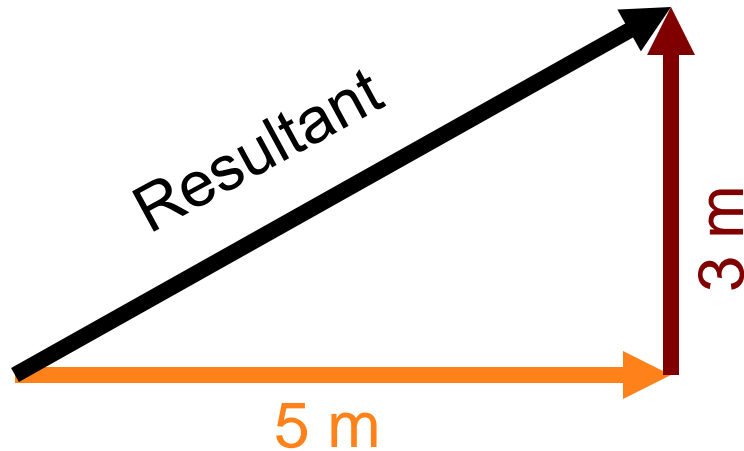
- ▶ An arrow that goes from the tail of the 1st vector to the head of the last vector



Resultant = 2 m/s

- ▶ Indicates both the magnitude and direction of the vector sum

Resultant Continued



$$a^2 + b^2 = c^2$$

$$5^2 + 3^2 = c^2$$

$$25 + 9 = c^2$$

$$c = 5.83 \text{ m}$$

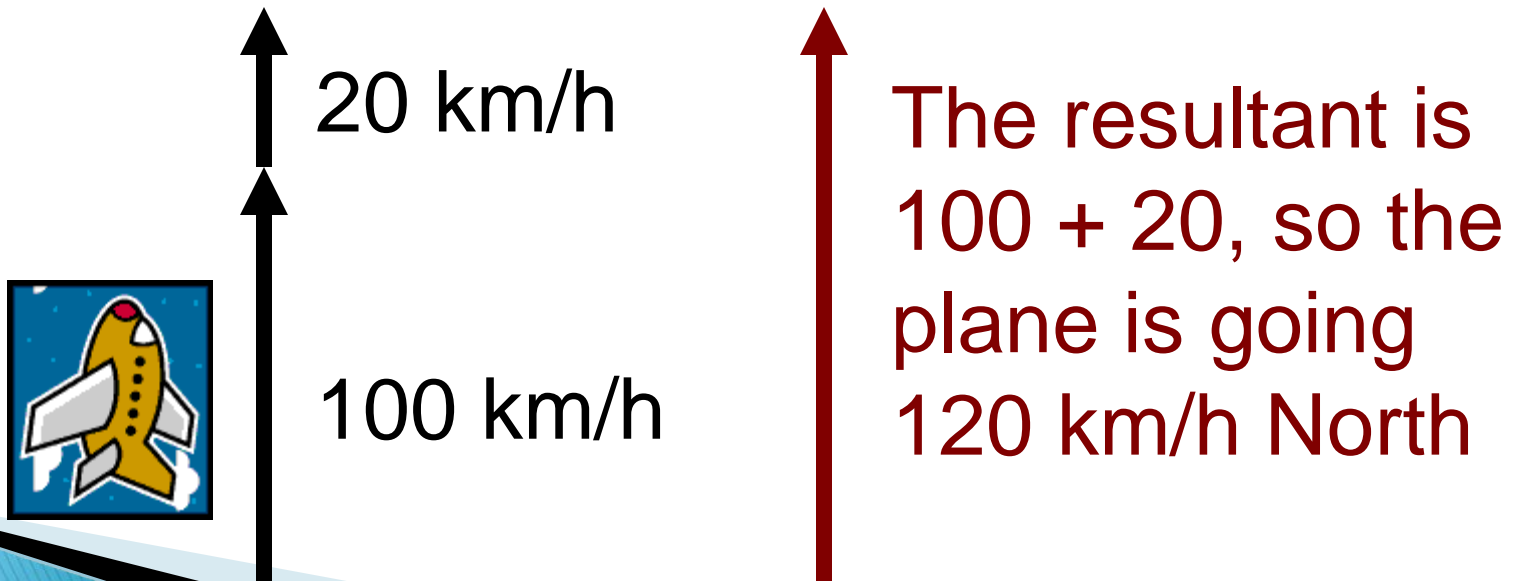
$$\tan \theta = \text{opp/adj}$$

$$\tan \theta = 3/5$$

$$\theta = 30.96 \text{ North of East}$$

Examples

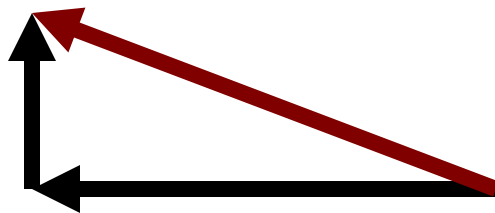
An airplane flies north with the throttle set to fly at 100 km/h and the wind is also blowing north at 20 km/h. How fast is the plane going?



Example 2

The plane now turns and aims west at 100 km/h and the wind is still blowing north at 20 km/h

20 km/h



100 km/h

$$a^2 + b^2 = c^2$$

$$20^2 + 100^2 = c^2$$

$$400 + 10,000 = c^2$$

$$c = 101.98 \text{ km/h}$$

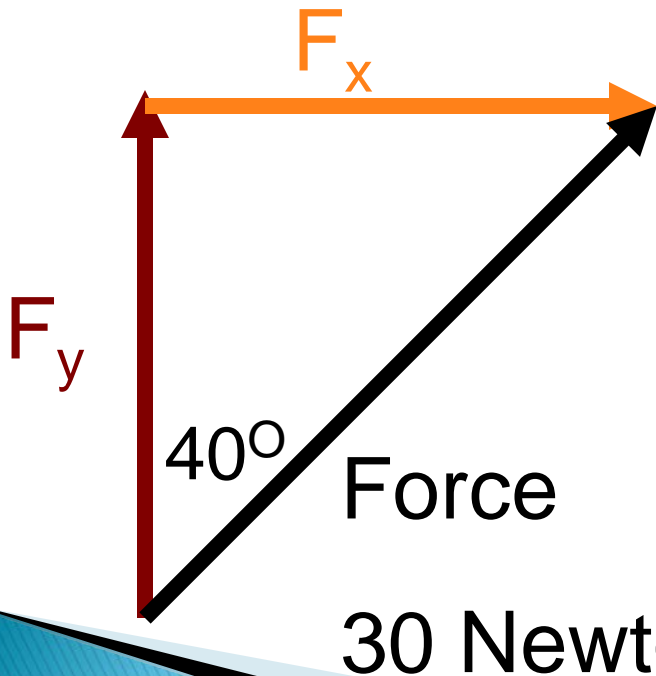
$$\text{Tan } \theta = \text{opp/adj}$$

$$\text{Tan } \theta = 20/100$$

11.30 degrees North of West

Vector Components

- ▶ Because a vector has both magnitude and direction, you can separate it into horizontal (x) and vertical (y) components.

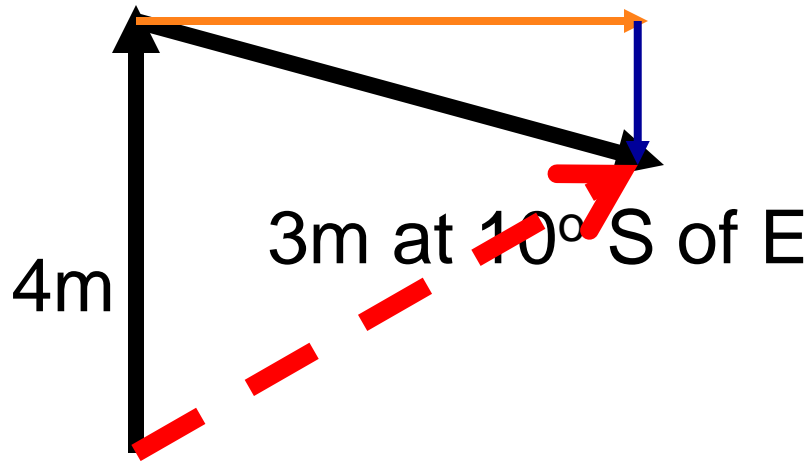


$$\cos 40 = \text{adj/hyp}$$

$$\cos 40 = F_y/30 \quad F_y = 22.98\text{N}$$

$$\sin 40 = \text{opp/hyp}$$

$$\sin 40 = F_x/30 \quad F_x = 19.28\text{N}$$

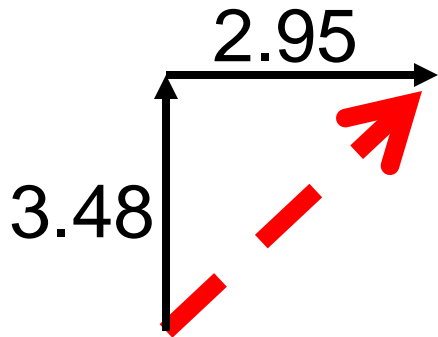


Disp	X	Y
4m	0	+4
3m	$\text{Cos } 10 = X/3$ $X = + 2.95$	$\text{Sin } 10 = Y/3$ $Y = - .52$
7m	+2.95	+3.48

X

Y

Total :



	X	Y
Total :	+2.95	+3.48

$$a^2 + b^2 = c^2$$

$$2.95^2 + 3.48^2 = c^2$$

$$20.8129 = c^2$$

$$c = 4.56 \text{ m}$$

$$\text{Tan } \theta = \text{opp/adj}$$

$$\text{Tan } \theta = 2.95/3.48$$

$$\theta = 40.29^\circ \text{ E of N}$$