Physics Honors: Scalars and Vectors

Scalars

- **Scalars** are numbers (quantities) with magnitude but no direction
- **Magnitude** means size

  Examples of scalars:

  - temperature, distance, time

Vectors

- **Vectors** are quantities with both magnitude **and** direction
- Examples of vectors:
  - displacement, velocity, acceleration, forces


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Is this a Scalar or a Vector?

- 45 miles per hour → Magnitude
- 15 miles to the east → Magnitude, Direction

- 1 hour and 40 minutes
- 18 newtons of force in the positive direction

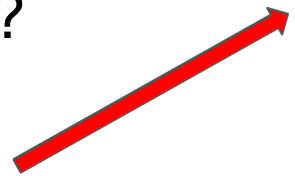
- 95 degrees fahrenheit
- 72 miles per hour to the north

Vectors Have direction

Moving 30 meters east is not the same as 30 meters north. You end up in a different spot!

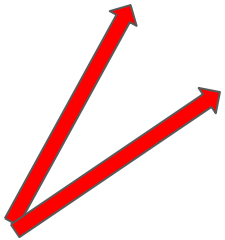
All vectors must have a specific direction associated with them

How would you give the direction for this arrow?



Vectors have direction

“Northeast” is a good answer. How could you describe the difference between these two arrows?

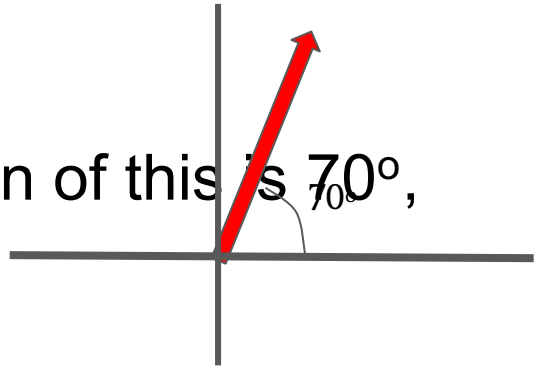


Vectors have direction

If we need something more specific, we can use angles!

We measure an angle from the x-axis, or using cardinal directions (N,S,E,W)

The direction of this is 70°,

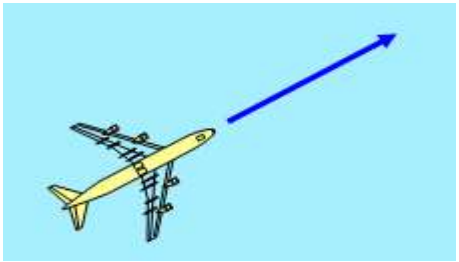


or 70° north of east

Vector Magnitude

The length of a vector represents its magnitude.

The word magnitude just means size.



Example:

An airplane is flying at 200 meters/second as shown to the right. The arrow is pointed at an angle of 30^o north of east.

For this airplane, the magnitude of its velocity is 200 meters/second, and the direction is 30^o north of east.