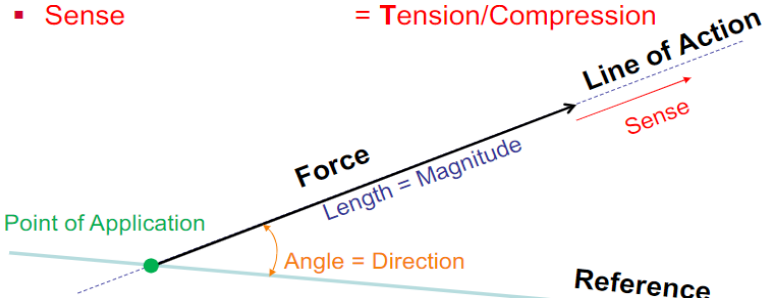
Lecture 2 Note - *Vectors I*

Textbook Chapter 2.1-2.4

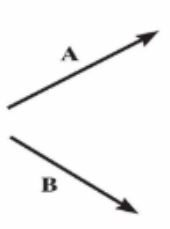
Vectors:

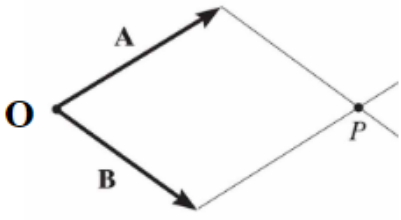
- Scalar (a reminder): A value described by its magnitude. Mass / volume /length / time.
- Vector: A value described by four traits:
  - Magnitude - Size
  - Direction - Angle
  - Sense - Tension/ Compression
  - Point of application - Location

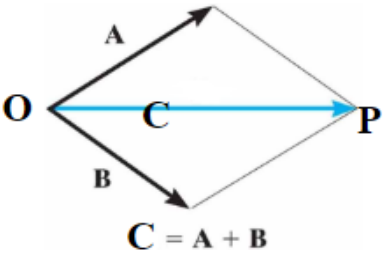


- Vectors can be represented in different ways, like ***A*** or $\underline{A}$, or *A/AB* with an arrow. In these notes all vectors (and all math) is italicized.

- **Key concept:** Vectors can be added using the parallelogram law/triangle rule:
  - When adding two vectors, A and B, they form a resultant vector C (obviously).
  - To add these vectors, join the tails of A and B at point O (where C will start)
  - From the head of B, draw a line parallel to A. Repeat from the head of A with B.
  - The point where the lines intersect is the head of P.







- Subtracting vectors works similarly—just use negative vectors and invert direction.
- Works with multiple vectors, in any order.
- Sine and Cosine Law can be used to find unknown angles, as always.
- Forces can be broken up into $\boldsymbol{F_x}$ and $\boldsymbol{F_y}$ components.
- for speed. Note: Ratio diagrams are flipped in the x-axis.

- **TIP:** Use ratios instead of trig
- Force components can be expressed on a Cartesian plane using unit vectors.
  - Recall that any force F can be written as $\boldsymbol{F} = F_x\boldsymbol{i} + F_y\boldsymbol{j}$,
  - ...Where F_x and F_y are scalar quantities (raw magnitude of ***F***'s components)
  - ...And where unit vectors ***i*** and ***j*** designate direction along the x and y axis.
- The magnitude of resultant force is $F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2}$ and direction is $\theta = \tan^{-1}\left(\frac{F_{Ry}}{F_{Rx}}\right)$