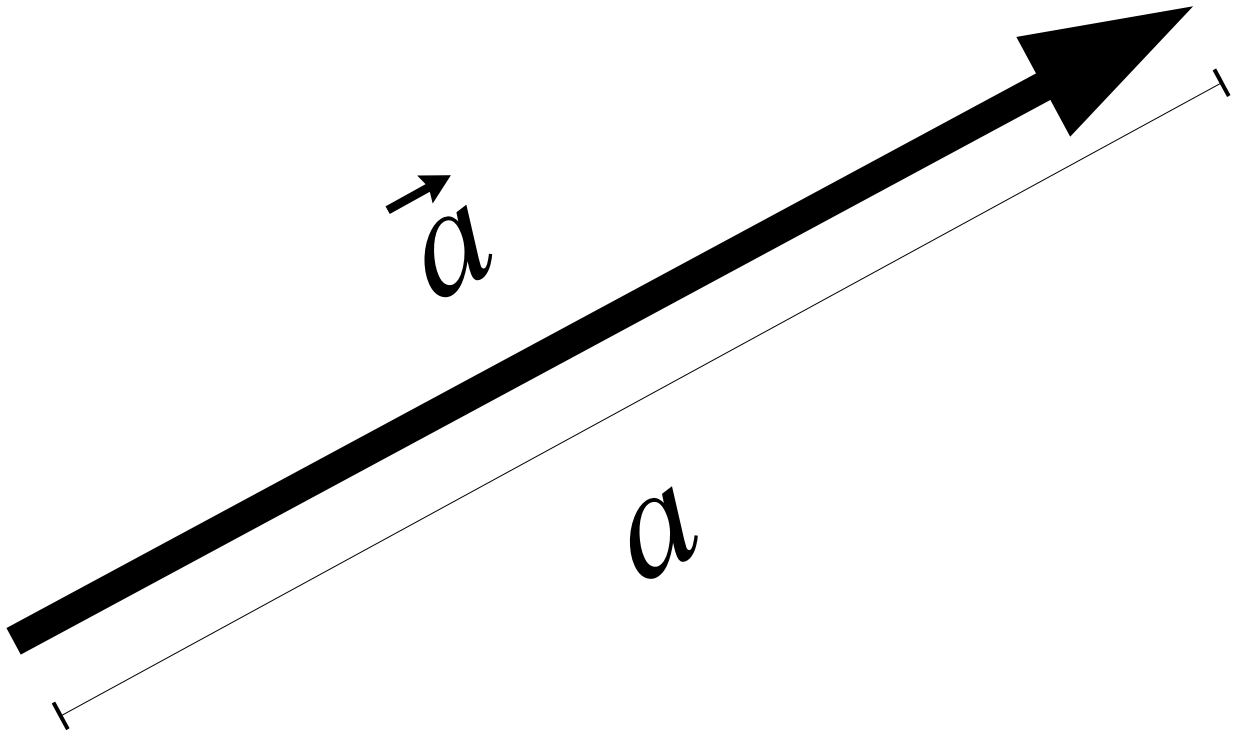
Vectors



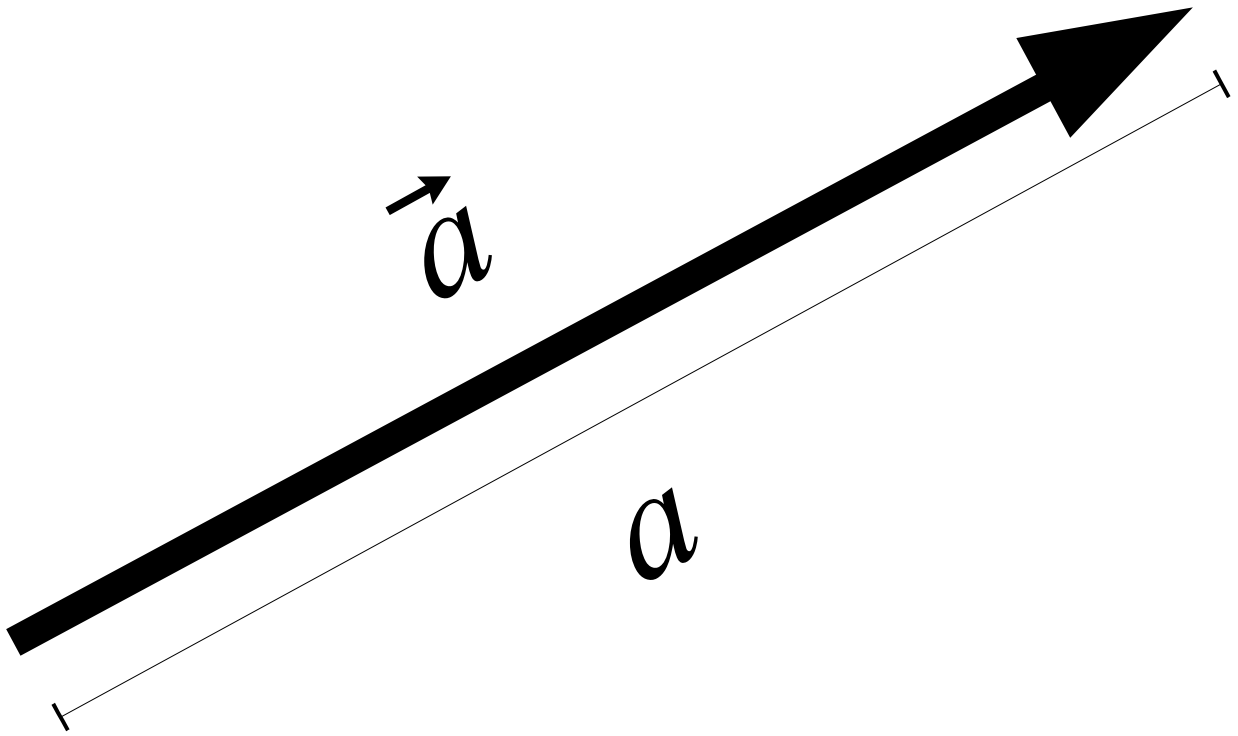
Stefan Bracher

Content

- What is a vector
- Graphical vector addition
- Components (Unit Vector Notation)
- Magnitude and direction
- Analytical vector addition
- Unit vectors

What is a vector?

Vector: A quantity with magnitude and direction



What is a vector?

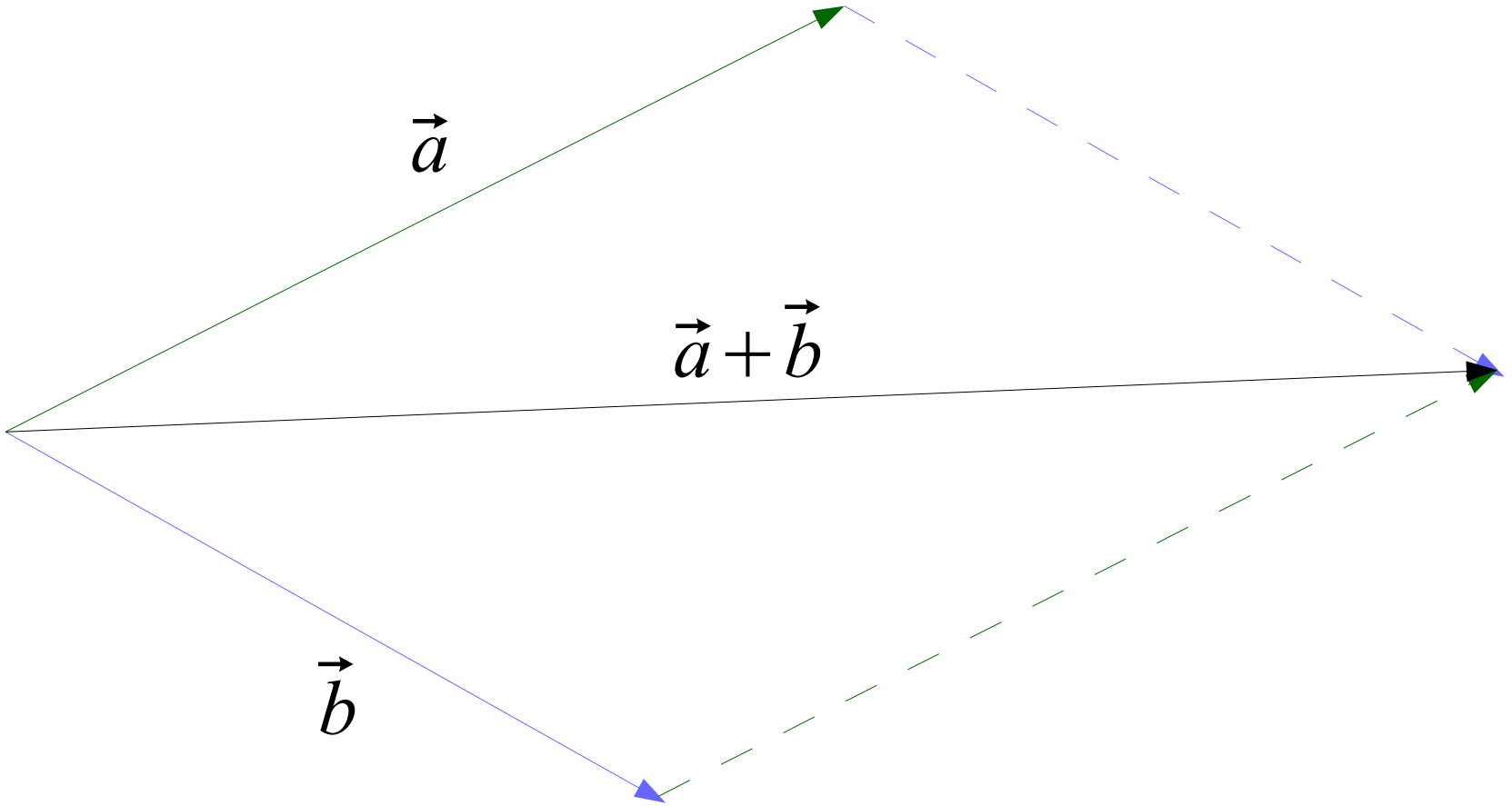
Vector: A quantity with magnitude and direction

Scalar: A quantity with magnitude only

Examples:

	Scalar	Vector
Temperature	x	
Acceleration		x
Force		
Velocity		
Speed		
Mass		
Weight		

Graphical vector addition – Head to Tail Method

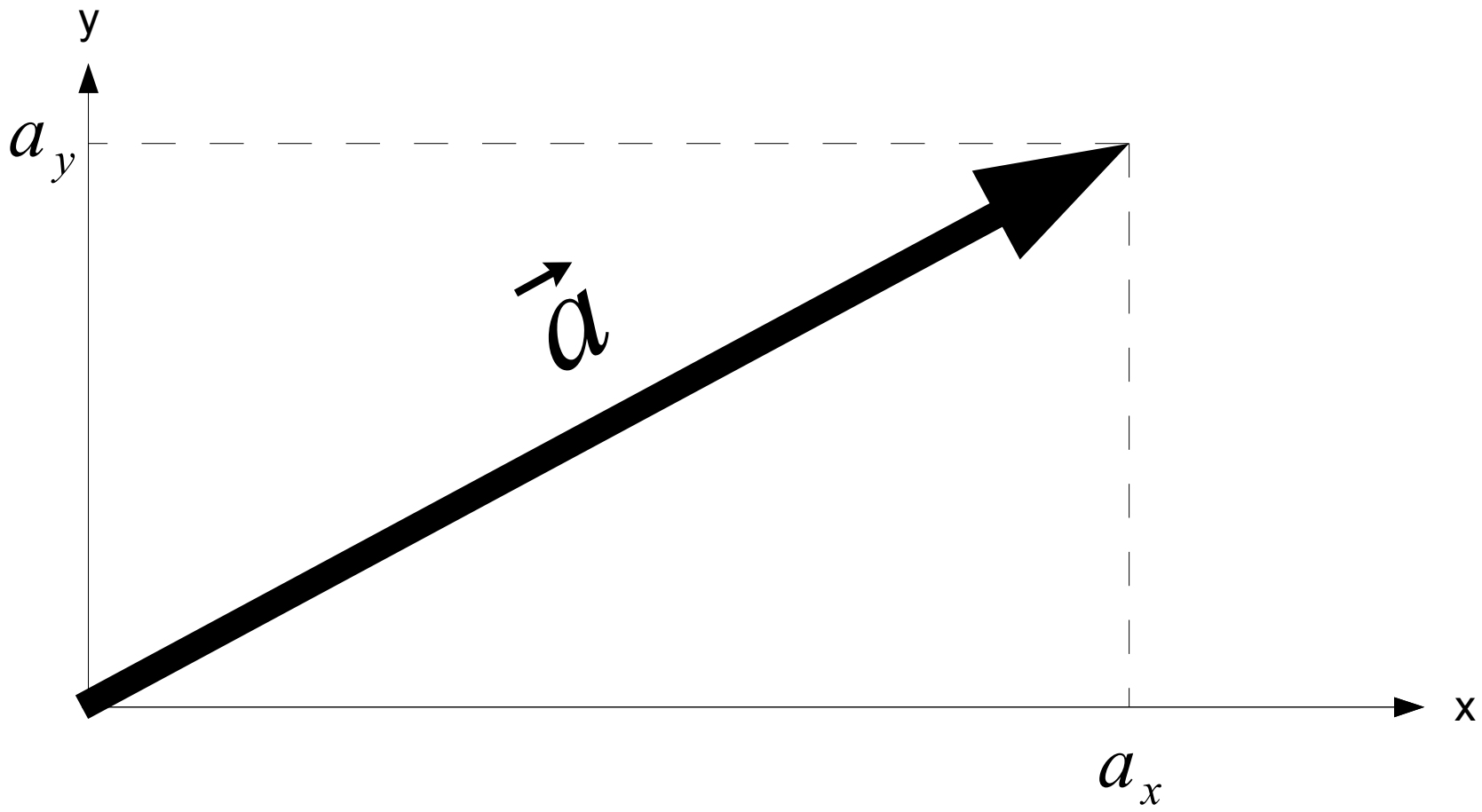


Components (Unit Vector Notation)

Vector in components (Unit Vector Notation):

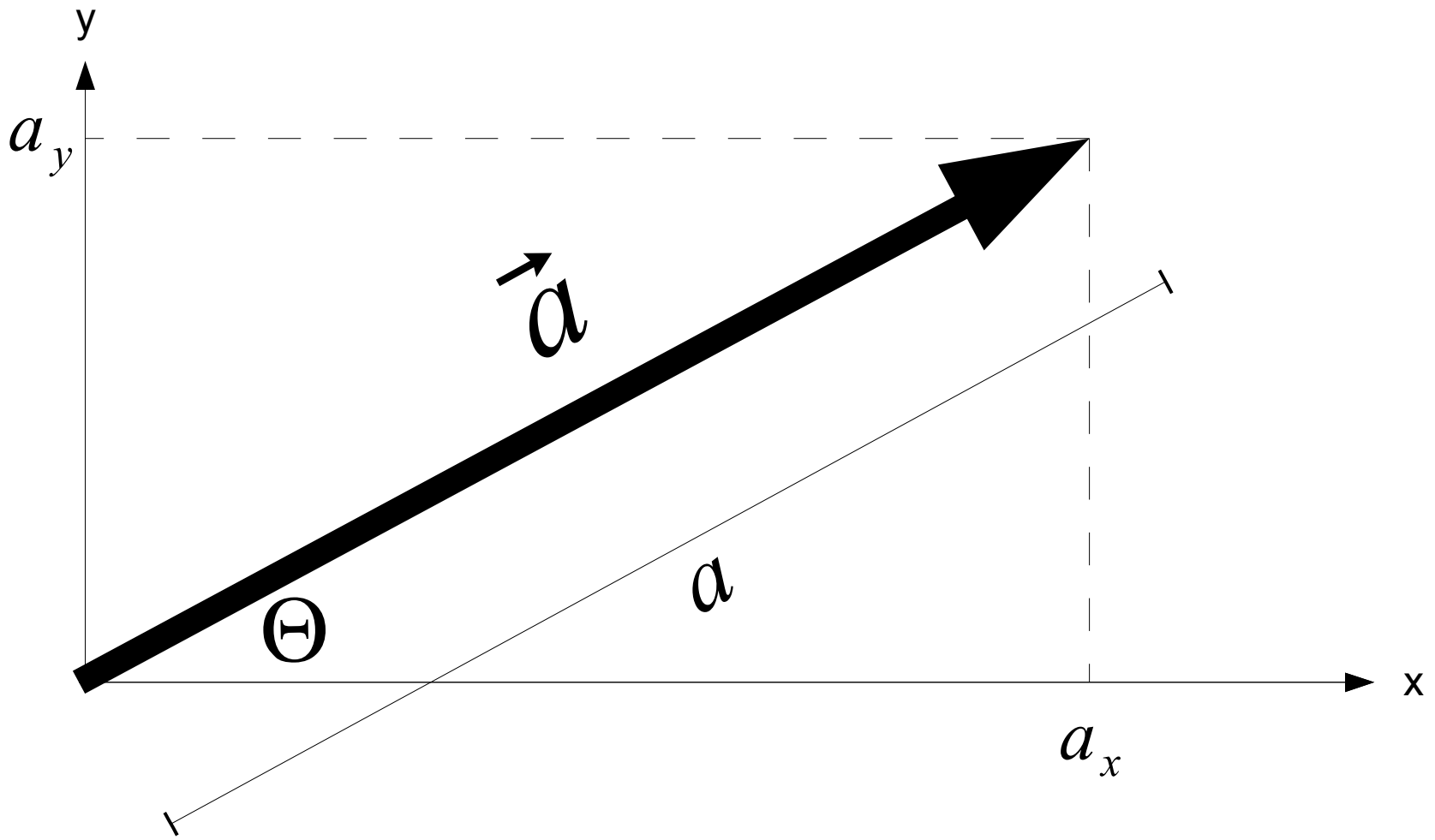
$$\vec{a} = (a_x, a_y)$$

$$\vec{a} = a_x \hat{i} + a_y \hat{j}$$

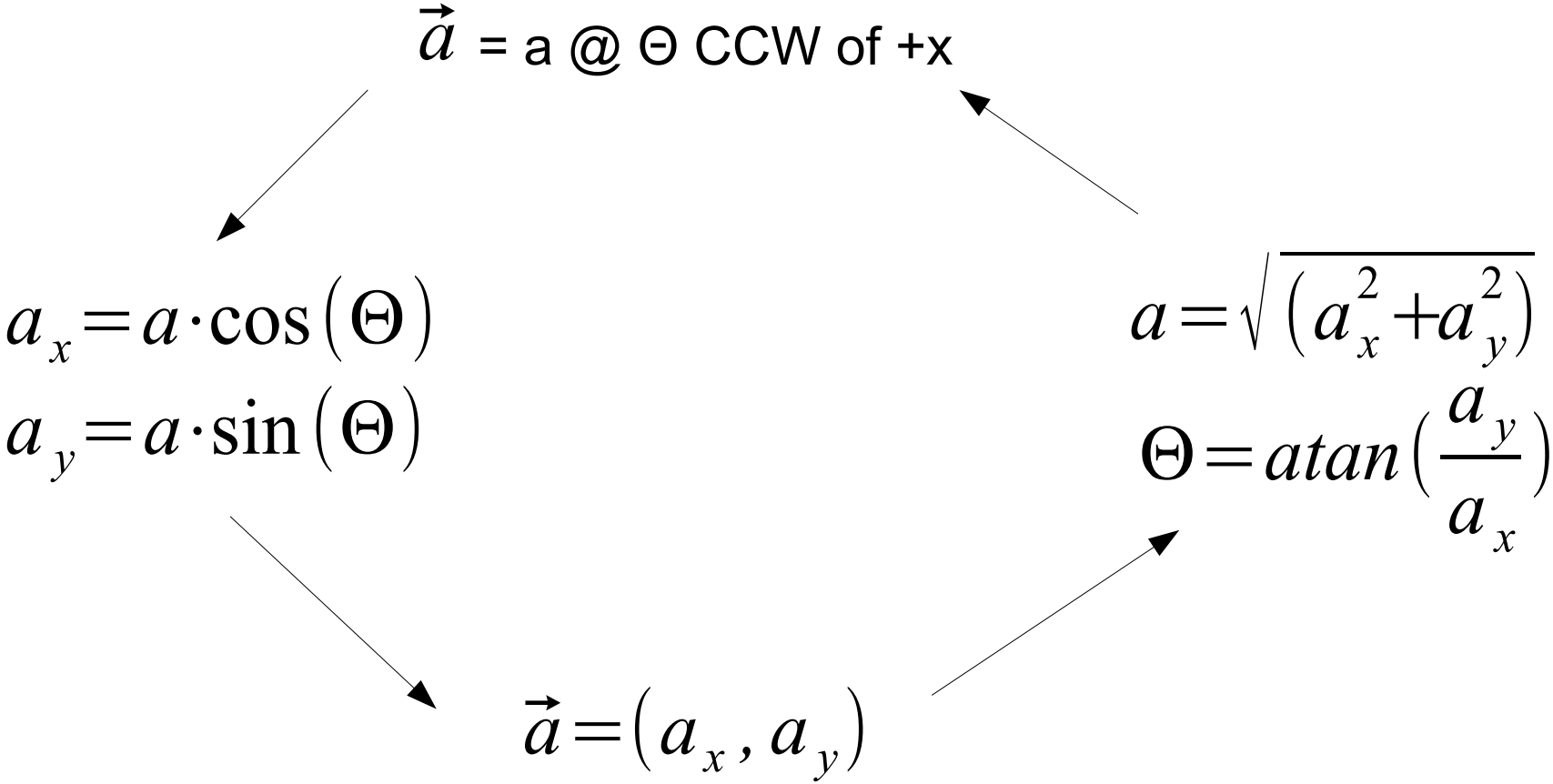


Magnitude and Direction

Vector in magnitude and direction: $\vec{a}$ = a @ Θ CCW of +x



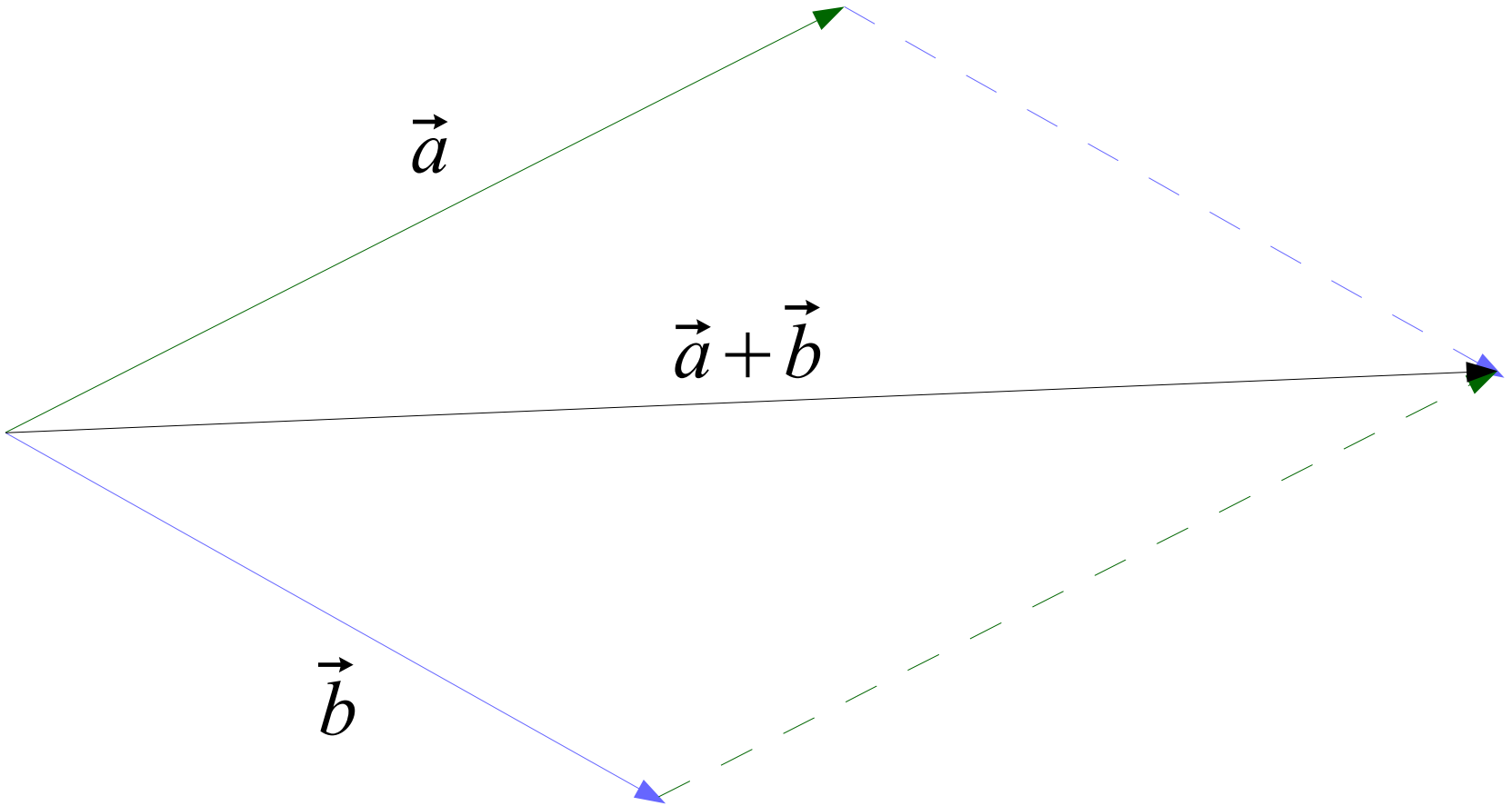
Convert



* **Warning:** The given trigonometric functions are for angles CCW of +x, if your angles are measured differently, you will need different trigonometric functions (or you have to convert first) !

Analytical vector addition – Adding the components

$$\vec{a}+\vec{b}=(a_x+b_x, a_y+b_y)$$



Unit vectors

Unit vector: A vector of length 1 in a given direction

Creating an unit vector $\hat{a}$ from a given vector $\vec{a}$

$$\hat{a} = \frac{\vec{a}}{|(a)|}$$

Additional Resources

Online Textbook

- Vector Addition and Subtraction: Graphical Methods, OpenStax „College Physics“
  http://cnx.org/contents/Ax2o07UI@9.93:S9i77L2i@7/Vector-Addition-and-Subtractio

- Vector Addition and Subtraction: Analytical Methods, OpenStax „College Physics“
  http://cnx.org/contents/Ax2o07UI@9.93:uXOb_dyd@11/Vector-Addition-and-Subtractio

Videos

- Adding Vectors Graphically : Head to Tail Method
  https://www.youtube.com/watch?v=OrryaQqcvk8

- Find the direction and the components of a vector
  https://www.youtube.com/watch?v=v2Cd4C7JXPY

- Drawing Vectors
  https://www.youtube.com/watch?v=pDPOcpsdOXs