Vector Representations

* We can symbolically represent a discrete vector quantity as an arrow:

* The length of the arrow is proportional to the magnitude of the vector quantity.

* The orientation of the arrow indicates the direction of the vector quantity.

For example, these arrows symbolize vector quantities with equal direction but different magnitudes:

while these arrows represent vector quantities with equal magnitudes but different directions:
* Two vectors are equal only if both their magnitudes and directions are identical.

\[ \neq \neq \neq = \]

* The variable names of a vector quantity will always be either boldface (e.g., \( A, E, H \)) or have an overbar (e.g., \( \overline{A}, \overline{B}, \overline{C} \)).

\[ E \overrightarrow{H} \]

We will learn that vector quantities have their own special algebra and calculus! This is why we must clearly identify vectors quantities in our mathematics (with boldface or overbars). By contrast, variables of scalar quantities will not be in bold face or have an overbar (e.g. \( I, V, X, \rho, \phi \))
Vector algebra and vector calculus include special operations that cannot be performed on scalar quantities (and vice versa).

Thus, you absolutely must denote (with an overbar) all vector quantities in the vector math you produce in homework and on exams!!!

Vectors not properly denoted will be assumed scalar, and thus the mathematical result will be incorrect—and will be graded appropriately (this is bad)!

* The magnitude of a vector quantity is denoted as:

\[ |A| \text{ or } |\mathbf{E}| \]

Note that the magnitude of a vector quantity is a scalar quantity (e.g., \( |\mathbf{F}| = 6 \) Newtons or \( |\mathbf{v}| = 45 \) mph).