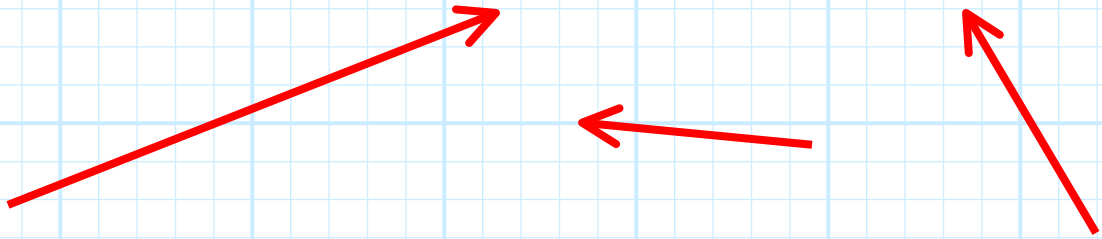
Vector Representations

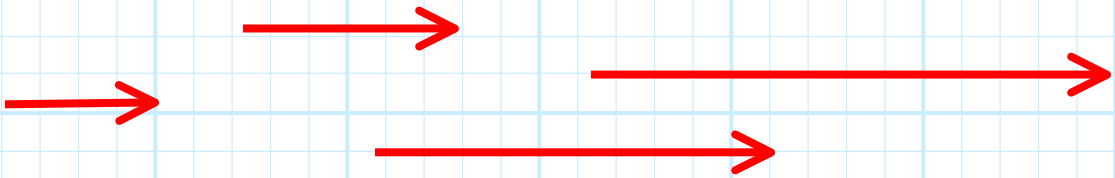
* We can **symbolically** represent a discrete vector quantity as an **arrow**:



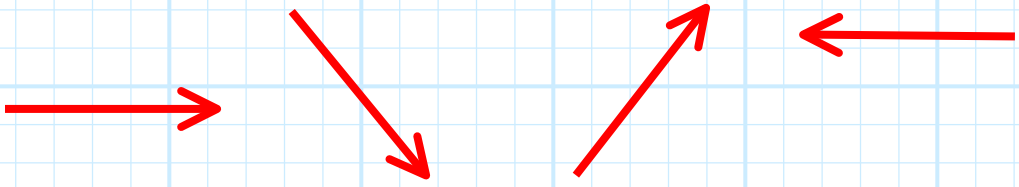
* The **length** of the arrow is proportional to the **magnitude** of the vector quantity.

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

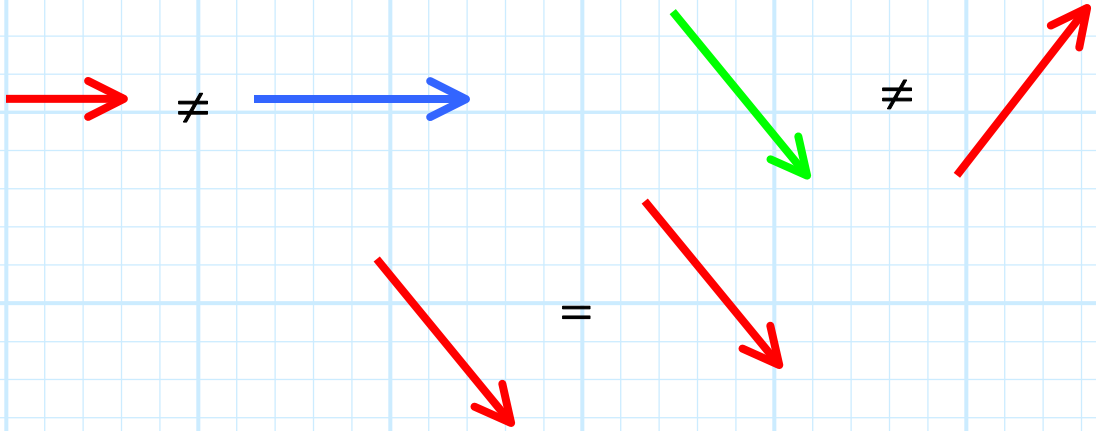
For example, these arrows **symbolize** vector quantities with **equal** direction but **different** magnitudes:



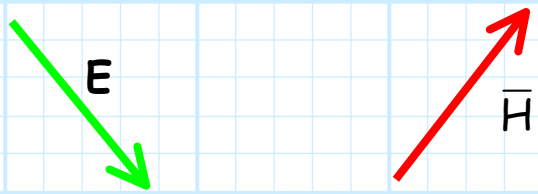
while these arrows represent vector quantities with equal **magnitudes** but different **directions**:



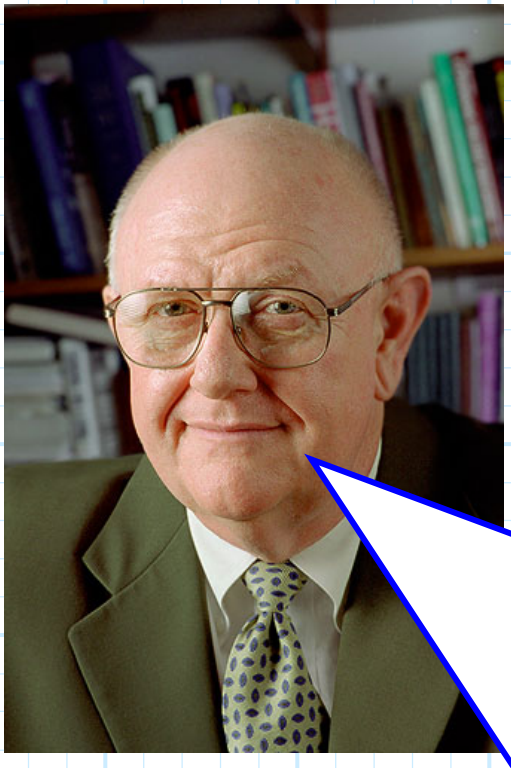
* Two vectors are **equal** only if **both** their magnitudes and directions are identical.



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



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, ρ, ϕ)



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:

$$|\boldsymbol{A}| \quad \text{or} \quad |\overline{E}|$$

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