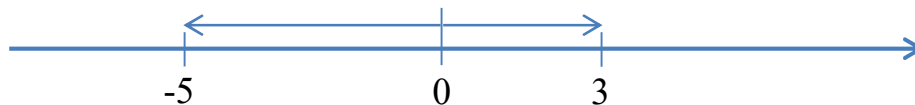**Elementary Statics**
Scalars and Vectors

Scalars

o A *scalar* is a quantity represented by a ***positive number***, ***negative number***, or ***zero***. It has magnitude (its absolute value) and sign (positive or negative).

o Scalars are sometimes called ***one-dimensional vectors***, because the sign refers to the direction along a single axis. Examples include length, area, volume, mass, pressure, and temperature.

Vectors

o A ***two-dimensional vector*** is represented by a ***magnitude*** and a ***direction*** related to ***two reference axes***. Usually, the reference axes (X and Y) are perpendicular to each other.

o In application, vectors can be categorized as ***fixed*** or ***free***. A ***fixed*** vector is defined to be ***anchored*** at a specific point or along a specific line, whereas ***free*** vectors can be ***located anywhere*** without changing their meaning.

o A vector is defined as ***fixed*** or ***free*** depending on what it represents.

o If a vector $\underset{\sim}{V}$ represents a ***force*** acting on an object, it is taken as a ***fixed vector***, because its point of application is important.

o Conversely, ***unit vectors*** are used simply to define ***directions of interest***. Since their point of origin is not important, they are ***free*** vectors.

o The ***unit vectors*** $\underset{\sim}{i}$ and $\underset{\sim}{j}$ in the diagram indicate the X and Y directions, respectively.

o The ***mathematical representation*** of a vector does not indicate whether it is fixed or free, so we must be mindful of this as we use them.