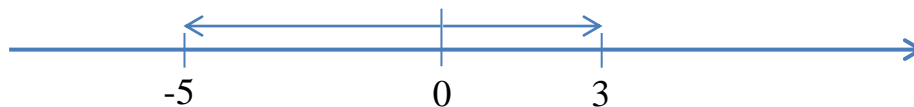


Elementary Statics

Scalars and Vectors

Scalars

- 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).
- 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

- 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.
- 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.
- A vector is defined as **fixed** or **free** depending on what it represents.
- If a vector \underline{V} represents a **force** acting on an object, it is taken as a **fixed vector**, because its point of application is important.
- Conversely, **unit vectors** are used simply to define **directions of interest**. Since their point of origin is not important, they are **free** vectors.
- The **unit vectors** \underline{i} and \underline{j} in the diagram indicate the X and Y directions, respectively.
- 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.

