

## Lesson 2

### Scalars and Vectors

We deal with Scalars and Vectors in Physics and Engineering all the time. **Their operations are different.**

Scalars can be operated following regular algebra rules. ( $1 + 1 = 2$ ,  $4 \times 7 = 28$ , etc)

Vector operations are tricky, but if you follow the steps, you will not make mistakes.

Vector summation (subtraction)

Graphical summation

Mathematical summation

Vector multiplication

Dot Product ( $\vec{a} \cdot \vec{b}$ )

Cross Product ( $\vec{a} \times \vec{b}$ )

Examples (Forces are good example of vector summation)

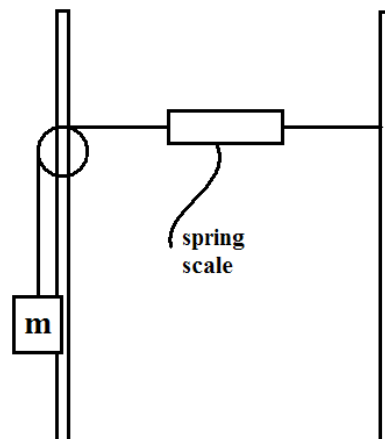
### STEPS

1. Draw a big and accurate diagram.
2. Pick a point (or points if there are multiples) as an origin.
3. Draw vectors starting at the point.
4. Establish X-Y coordinate system.
5. Break the vectors into X and Y components.
6. Operate as directed.

### Example 1

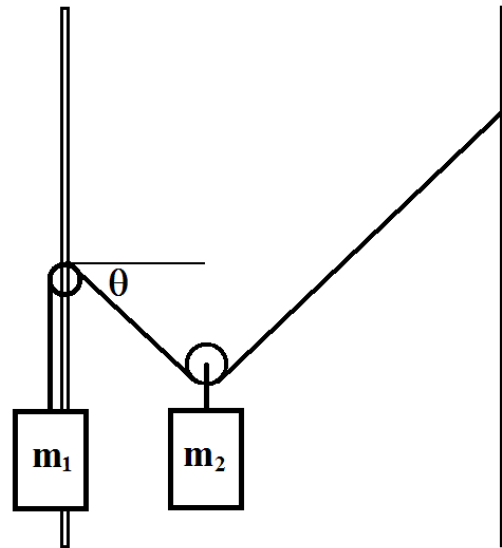
What does the spring scale read?

What if the line is not horizontal?



**Example 2**

Solve for  $m_2$  in terms of  $m_1$  and  $\theta$ .



**Example 3**

Solve for  $m_2$  in terms of  $m_1$ ,  $\theta_1$ , &  $\theta_2$ .

