Topic 1B: Tracking Position

Skill 4 – Identifying scalars/vectors

Measurements can be separated into two categories VECTOR or SCALAR depending on how values are combined.

- SCALARS are values in which the sum depends only magnitude (size) of the value.
  When dealing with scalar values 2 + 2 = 4
  Scalars are numbers you have been using your entire life: time, money, distance, mass etc.
  Examples: 3kg + 2kg is always 5kg 4 seconds plus 2 second is 6 seconds.

- VECTORS are values in which the resulting sum depends on both the MAGNITUDE (size) and direction (angle) of the values. The resulting sum is known as the RESULTANT
  - When dealing with vector values 2 + 2 could equal anything between 0 and 4 depending on the angle between the values. Ie. If two forces are acting on an object the overall (sum) of the forces depends on whether the forces are going in the same direction or opposite directions or somewhere in between.
  - Vectors are represented by arrows in which the length of the vector is scaled to the magnitude (size) and the angle of the vector is given relative to reference point (for this class usually East or zero degrees)

Examples:

4 m to the right 6m to the left 2m south 3m at 45 degrees

DISTANCE VS. DISPLACEMENT

The variable used to indicate position or change in position is 'd" which stands for both DISTANCE (scalar) and DISPLACEMENT (vector).

Distance – a scalar quantity that indicates the length of the path traveled by an object <u>without</u> concern for <u>direction</u>.

(ie, The length of the path traveled)

Ex: The dog traveled 30m stopped, ran 40m and then 80m for a total **distance** of 150 m.

Displacement – a vector quantity that indicates the change in position of an object **<u>with direction</u>**.

(ie, How far you are from point of reference)

Ex: The dog ran 60 m east, 70m west and 20 east, resulting is a **displacement** of 10m east

For motion in a single direction (no turning around), distance and displacement are the same. (IF DIRECTION DOESN'T CHANGE, DISTANCE AND DISPLACEMENT ARE EQUAL or in other words, Distance is the magnitude of the displacement)

Skill 5 – Adding vectors in one dimension (A single axis)

The direction of a vector can be given as an angle (0 – 360 degrees), as a Cardinal direction (North, East, West, South) or by other description such as left, right, up, down etc. When combining one or more vectors you must describe direction in terms of a common reference point. For motion on a single axis each direction is defined as either positive or negative. (Since the direction is an important part of a vector quantity, this is a method for including direction into your calculations since we have no way to deal with east, west, right, left, etc)

In most cases:

- East or to the right is assigned positive for horizontal motion because it aligns with the positive x-axis
- North or up is assigned positive for vertical motion because it aligns with the positive y-axis.

Examples of motion on a single axis: pacing back and forth, an elevator moving up and down, an object launched straight upward that must fall back down.

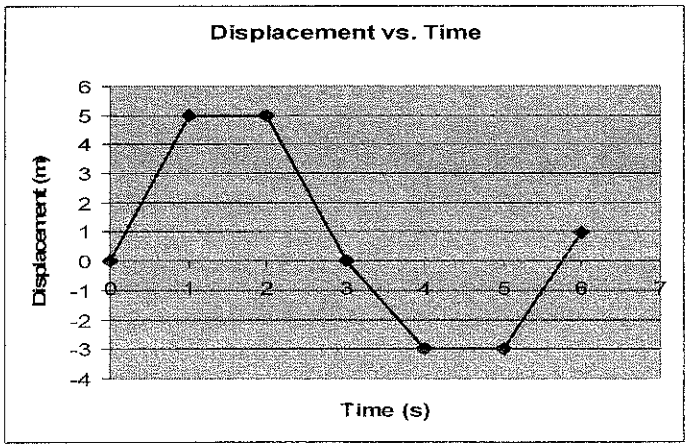
Ex: A student on a bike travels 300m west and then 500m east. Replace the directions with positive and negative signs following rules state above. (a format for direction that a calculator can interpret)

So displacement (-300m + 500m) = +200m which means 200m east [direction important]
distance = 300m + 500m = 800m [direction does not matter]

Skill 6: Graphing position on a single axis with respect to time.

One method of keeping track of position on a single axis is to plot positions of an object at different points in time.

The graph below represents the motion of a teacher in a classroom along a straight line (in reference to a stationary student at point 0).



Teacher moves
-5m to the right in a time of 1 second,
-stays still for one second,
-moves 5m left in 1 second
-3m left in 1 second
-stands still for 1 second
-moves right for 4m

Distance traveled on this graph is found by adding up all the changes in position (indicated on y-axis)

5m + 0 + 5m + 3m + 4m = 17m

Displacement traveled on this graph is found by determining the difference in position and direction between the starting-point and ending-point. Or by adding up each change in position with direction

5m + 0 + -5m + -3m + 4m = +1m (1m right)