

DISTANCE AND DISPLACEMENT

OBJECTIVES:

1. Describe the difference between vector and scalar quantities.
2. Illustrate completely the difference between distance and displacement.
3. Calculate the magnitude and direction of displacement in one-dimensional motion.
4. Calculate the magnitude and direction of displacement in two-dimensional motion.

KNOW Me!

Create a chart differentiating initially distance from displacement using your initial knowledge of the topic.

Distance	Displacement

ACT Me!

A. Prepare the materials and act out the two scenarios.

Materials:

- Meter stick
- Any marking material

1. You're a grab rider whose work is to deliver food. One day, on your way across a customer, you traveled along a straight path of 45 meters East, then, 30 meters West.
2. You're jogging along the highway of a street in your area. Your path starts off by walking 8 meters East, then 10 meters North.

ENGAGE Me!

B. Draw a diagram for both Problem 1 and 2 using the scale aforementioned below to illustrate your movement.

Scale: 1m = 0.5 cm

ENQUIRE Me!

A. Answer briefly.

1. What is DISTANCE being referred to in the previous activity?
2. How do you calculate the DISTANCE you traveled?
3. Is DISPLACEMENT similar to the Distance you traveled?
4. What is displacement being referred to in the previous activity?
5. How do you calculate the DISPLACEMENT you traveled?
6. How is Problem 1 similar to Problem 2 in terms of distance?
7. How is Problem 1 different to problem 2 in terms of displacement?
8. How do you determine the direction of grab rider in problem 1?
9. How do you determine the direction of displacement of the beggar in problem 2?
10. In question no. 9, draw an illustration showing off and explaining the direction of displacement of the beggar.

B. Present your answers to problems 1 and 2.

ENLIGHTEN Me!

This section must emphasize the conceptual mastery of the topic. Main topic must be brief and concise, depicting only the concepts that you want to learn. Secondly, main topic must be “chunked” into its constituent significant subtopics. If the subtopics are more than two, the rest should be placed in succeeding pages. Exclusionary rule applies if the subtopics pertain to a certain classification where the learners must see the over-all difference. Subtopics are further divided and extracted into its component group topics. Related concepts are arranged in close proximity to easily identify patterns and interrelationships among them. Same-colored arrows denote relevant concepts or the same group of concepts while each diverse concept will be denoted by an arrow of different color. As much as possible, each concept must be explicitly explained using keywords only for easy retention.

Sample mind map for lecture

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- Objectives:**
1. Describe the difference between vector and scalar quantities.
 2. Illustrate completely the difference between distance and displacement.
 3. Calculate the magnitude and direction of displacement in one dimension.
 4. Calculate the magnitude and direction of displacement in two dimensions.
 5. Generate distance and displacement routes using selected reference Philippine Map.



Distance:
 $200\text{ m} + 100\text{ m} + 200\text{ m} = 500\text{ m}$

When you choose zero mark as the reference point, you have established your frame of reference.

An object can be placed in either positive or negative number or at any point in the number line.

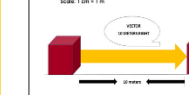
Positive sign is given in the right direction while left direction has a negative sign.

The direction is also denoted by negative (-) and positive (+) signs.

Variables such as x can be used to represent different locations on the number line.

Total distance traveled is total length of its journey or path. In this example, it would be 12 kilometers plus 4 kilometers plus 12 kilometers which would sum up to 28 kilometers.

Sample Problem:
In search of appetizing grass to eat, a cow first walks 12 kilometers to the west, and then takes a left turn and goes 4 kilometers south.



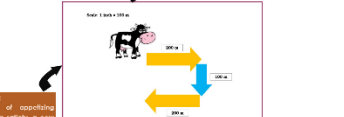
If movement is illustrated in terms of change in position and give its direction, it entails the vector version of a distance which is the displacement.

When direction is additionally given, take the reference. The bird moved 10 meters to the right. It is a vector quantity.

Displacement:
 $\Delta x = x_f - x_i$
 $\Delta x = 5\text{ m} - 0\text{ m} = 5\text{ m}$

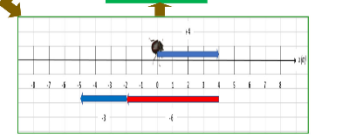
Displacement: 100 m south

What the cow did along the way or what its path was does not matter. It ended up having a movement of 4 kilometers south from where it started and the concept is known as displacement.



The bee's position started at 0 and ended up at -5 to the left as positive of its path, so substituting the equation will give you $-5\text{ m} - 0\text{ m}$ which is equal to -5 m .

Displacement: the change in position as you can recall. Mathematically, it can be expressed as:
 $\Delta x = x_f - x_i$
where Δx is the change in position, x_f is the final position and x_i is the initial position.



Distance versus Displacement

A motion that is along a straight line.

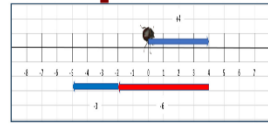
Distance-time Table

Time (s)	Distance (m)	Distance (m)
0	0	0
1	5	2
2	10	4
3	15	6
4	20	8
5	25	10
6	30	12
7	35	14
8	40	16
9	45	18
10	50	20

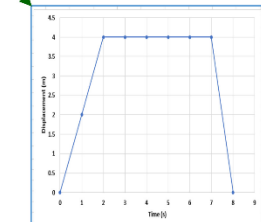
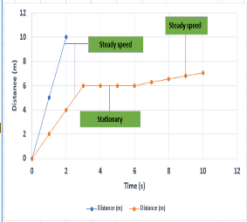
Displacement-time Table and Graph

Time (s)	Displacement (m)
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
10	20

Distance:
 $4\text{ m} + 9\text{ m} + 3\text{ m} = 16\text{ m}$



Sample Problem:
Seemingly, a beetle hovers off right over or stays on a number line. It crawled 4 units initially to the right, denoted by +4 and from there, 6 units to the left denoted by -6. If then moved 1 unit to the left denoted by -1.



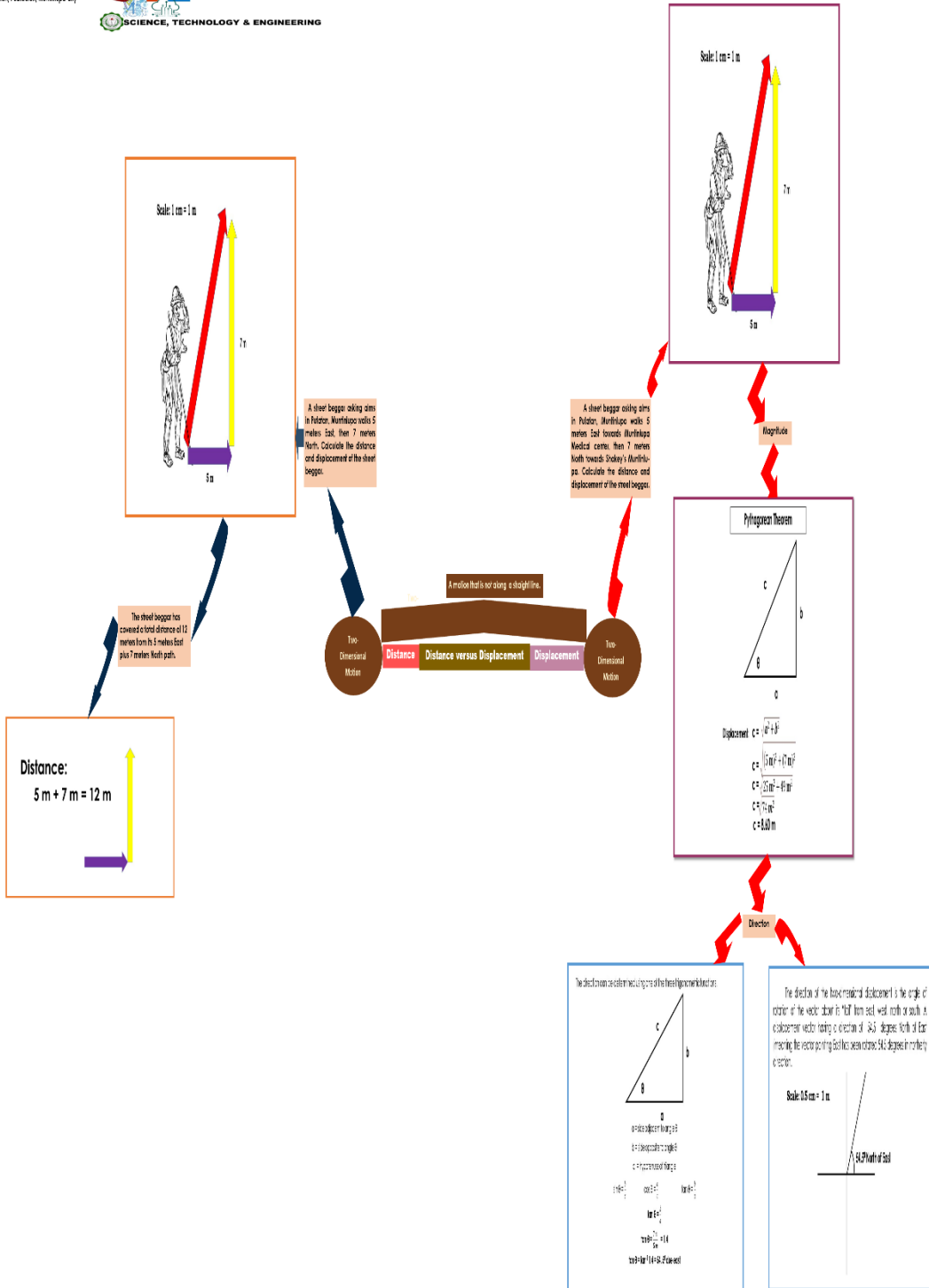
It shows how the distance moved from a starting point changes over time.

Slope of an object is represented distance-time graph.

Displacement of a moving object changes with time is being depicted in a displacement-time graph.

Stationary motion is represented by a horizontal line or not moving because the displacement does not change.

Moving object is represented by a diagonal or sloping line. Steeper line indicates faster movement.



UNRAVEL Me!

Answer briefly.

1. Does a distance have positive values only? If your answer is yes, then why? If your answer is no, then cite instances where you think distance can have negative values, too.
2. Can displacement be equal to the distance? If your answer is no, then why? If it is yes, then at what instance can displacement be equal to the distance traveled by an object?
3. Can displacement be equal to zero? If your answer is no, then why? If it is yes, then at what instance can displacement be equal to zero?
4. Can displacement be negative? If your answer is no, then why? If it is yes, then at what instance can displacement be negative?

ASSESS Me!

Take note: Draw a diagram before solving the problem. Scale 1 m = 0.5 cm

1. A biker travels around a rectangular track along a highway with a length of 45 meters and width of 10 meters. After traveling the rectangular track three times, the biker goes back to its original position. Calculate the distance traveled by the biker along with its displacement.
2. The cat in pursuit of a tasty meal run along 4 meters West, then, 3 meters South along a barren street. Calculate the distance traveled by the cat and its displacement.