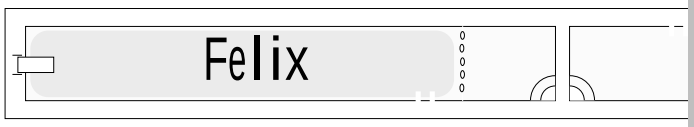
PhyzSpringboard: This Way & That Way I

POSITION & DISPLACEMENT



1. Both little people in the diagram to the right are 5m from the origin.

a. How can we distinguish the **position** of the dude from that of the dudette? For example, we cannot say each is at a place called "5m," since that would suggest they're in the same place.

Refer to Dude as being at –5m and Dudette as being at +5m.

b. What is the meaning of "positive position"?

A position to the right of the origin.

c. What is the meaning of "negative position"?

A position to the left of the origin.

d. What is the meaning of "zero position"?

A position at the origin.

e. On a number line, +5m is considered a **greater** value than –5m. Is a position of +5m nearer, farther, or equally distant from the origin compared to a position of –5m?

Equally distant.

2. Both little people in the diagram to the right moved 3m.

a. How can we distinguish the **displacement** (change in position) of the dude from that of the dudette? For example, we cannot say each had a displacement of "3m," since that would suggest they moved the same way.

Say the Dudette had a displacement of +3m and the Dude had a displacement of –3m.

b. What is the meaning of "positive displacement"?

Moved to the right.

c. What is the meaning of "negative displacement"?

Moved to the left.

d. What is the meaning of "zero displacement"?

No movement.

e. Who moved **farther:** dude or dudette? Does the sign (+/–) of a displacement indicate something about its size or its direction?

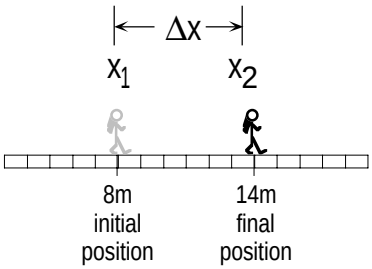
Dude and Dudette moved same distance; sign indicates direction.

f. The previous question suggests a difference between the concepts of **distance** and **displacement**. What is that difference?

Distance is "how far"; displacement is "how far and in what direction."

g. Which is **larger:** a displacement of +3m or a displacement of -4m? Justify your answer.

A –4m displacement requires moving a greater distance than does a +3m displacement.



3. a. In terms of "initial position" (x_1) and "final position," (x_2) what is the **mathematical** definition of displacement (Δx)?

$\Delta x = x_2 - x_1$

b. Label x_1, x_2, and Δx in the diagram above to the right and calculate the Dudette's displacement.

$\Delta x = 14m - 8m = 6m$

c. What are the displacements of the dude and the dudette in the diagram to the right? Write mathematical solutions.

Dude: $\Delta x = -3m - -6m = +3m$

Dudette: $\Delta x = 3m - 6m = -3m$

d. What are the displacements of the dude and the dudette in the diagram to the right? Write mathematical solutions.

Dude: $\Delta x = -3m - -6m = +3m$

Dudette: $\Delta x = 6m - 3m = +3m$

e. What is the displacement of the dudette in the diagram to the right? Write a mathematical solution. (Careful: you know it's not zero!)

Dudette: $\Delta x = -3m - 3m = -6m$

f. What relationship—if any—is there between the sign of position and the sign of displacement? Select the correct statement from the choices below.

___*The sign of position indicates the sign of displacement.*
___*The sign of position is opposite the sign of displacement.*
__√__*There is no relationship between the sign of position and the sign of displacement.*

4. A number line could be drawn vertically as well as horizontally. In the vertical case, positive and negative displacements would involve moving up and down instead of left and right. With this in mind, what is true of **all** bodies that undergo

a. positive displacement? (Hint: consider what happens to the **value** of the position.)

The value of position is increasing

b. negative displacement?

The value of position is decreasing