Unit P: Graphs of accelerating objects in both directions

Objective P: Graphs on Accelerating Objects in Both Directions

Objectives:
- Analyze motion maps, position-time graphs, velocity-time graphs, and acceleration-time graphs for objects that are accelerating in *both directions*.

- Be able to apply the *direction of acceleration*, both as an actual direction (like RIGHT or LEFT) or as a positive or negative sign.

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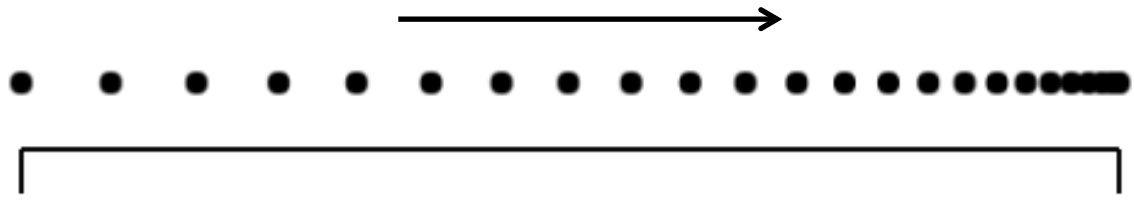
Part 1: Motion Maps
In each of these problems, the arrow shows which direction the object is moving.
The dots show the position of the object at each second.
For each motion map, determine the direction of velocity, whether the object is speeding up or slowing down, and the direction of acceleration.
For the following problems, use the terms RIGHT and LEFT, (rather than positive and negative).

Direction of Velocity The direction of velocity is always the *direction that the object is moving*. In this case, it is either RIGHT or LEFT, and is indicated by an arrow.
Speeding up or slowing down? In these motion maps, you can tell from the pattern of dots and the arrow whether an object is speeding up or slowing down.
Direction of acceleration If an object is *speeding up*, then the *direction of acceleration* is in the SAME DIRECTION as the velocity. If an object is *slowing down*, then the *direction of acceleration* is in the OPPOSITE DIRECTION from the velocity.

1.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

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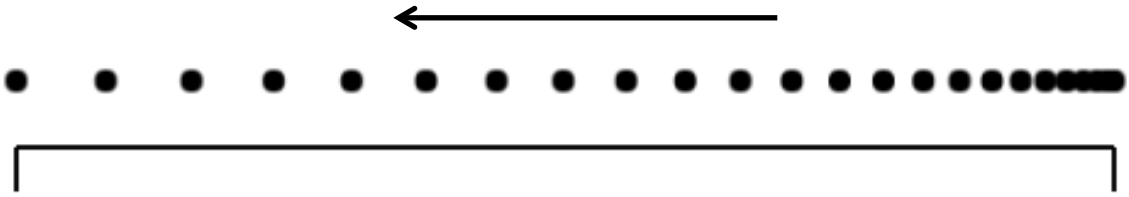
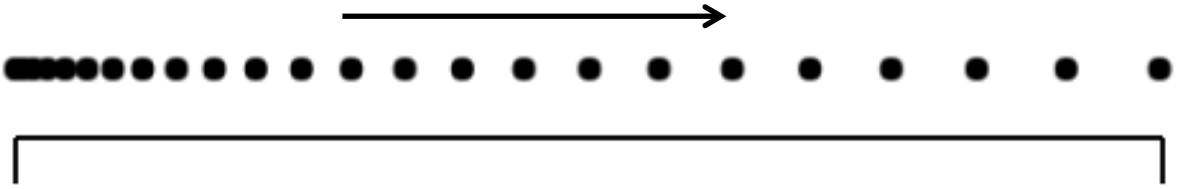
2.



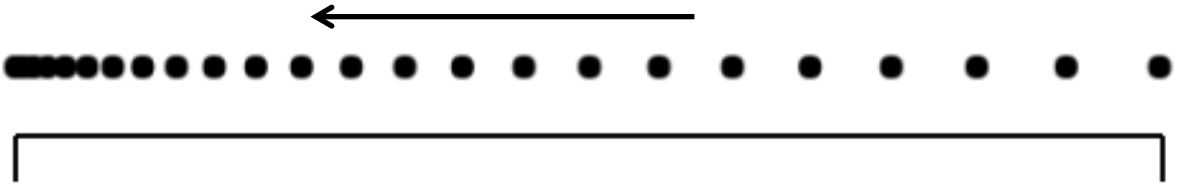
Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

3.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

4.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

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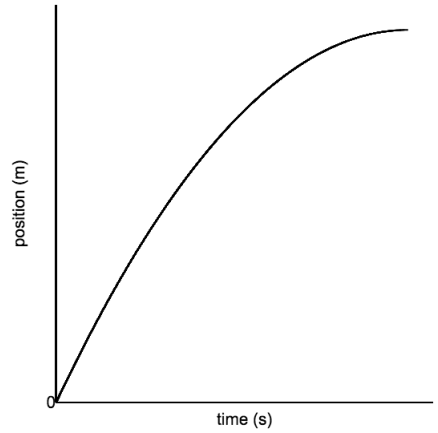
Part 2: Position-Time Graphs

For each graph, determine the direction of velocity, whether the object is speeding up or slowing down, and the direction of acceleration.
Give directions as POSITIVE or NEGATIVE.

Direction of Velocity
The direction of velocity is always the *direction that the object is moving*. If the object is moving in the positive direction, the curve will be moving upward, If the object is moving in the negative direction, the curve will be moving downward.
Speeding up or slowing down?
In the position-time graphs, you can tell from how the graph curves. If it becomes steeper, the object tis speeding up. If it becomes less step and eventually becomes flat, the object is slowing down.
Direction of acceleration
If an object is *speeding up*, then the *direction of acceleration* is in the SAME DIRECTION as the velocity. If an object is *slowing down*, then the *direction of acceleration* is in the OPPOSITE DIRECTION from the velocity.

1.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

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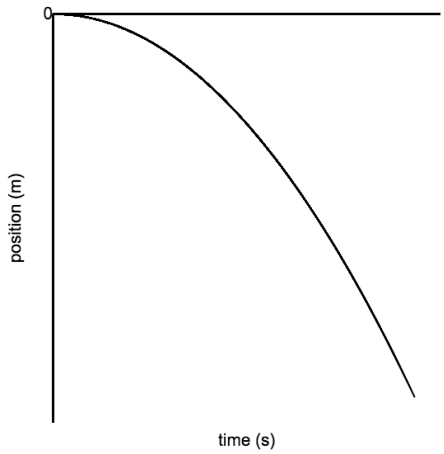
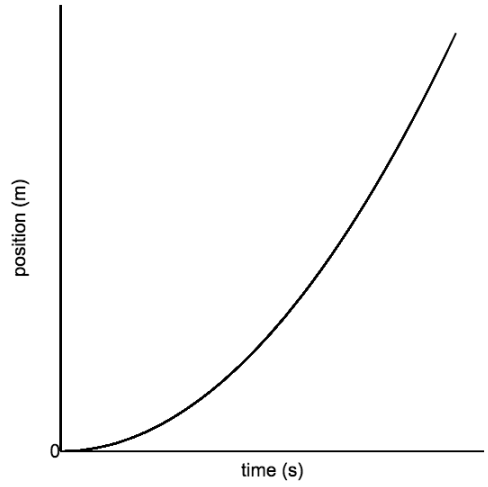
2.



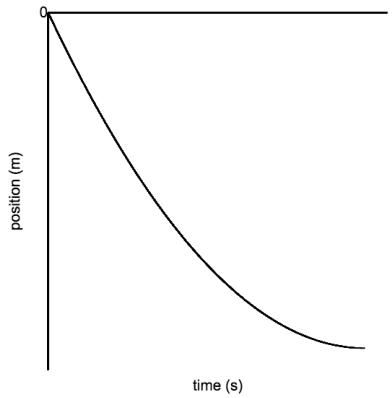
Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

3.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

4.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

Part 3: Velocity-Time Graphs
For each graph, determine the direction of velocity, whether the object is speeding up or slowing down, and the direction of acceleration.
Give directions as POSITIVE or NEGATIVE.

Direction of Velocity

The direction of velocity is always the *direction that the object is moving*.
If the velocity is positive, the direction of velocity is positive.
If the velocity is negative, the direction of velocity is negative.

Speeding up or slowing down?

In the velocity-time graph, you can tell if the object is speeding up or slowing down from the velocity line.
If the *absolute value of velocity* is increasing, then the object is speeding up.
If the *absolute value of velocity* is deceasing, the object is slowing down.

Direction of acceleration

If an object is *speeding up*, then the *direction of acceleration*
is in the SAME DIRECTION as the velocity.

If an object is *slowing down*, then the *direction of acceleration*
is in the OPPOSITE DIRECTION from the velocity.

Also, you can tell if the acceleration is positive or negative from the SLOPE of the velocity-time curve.

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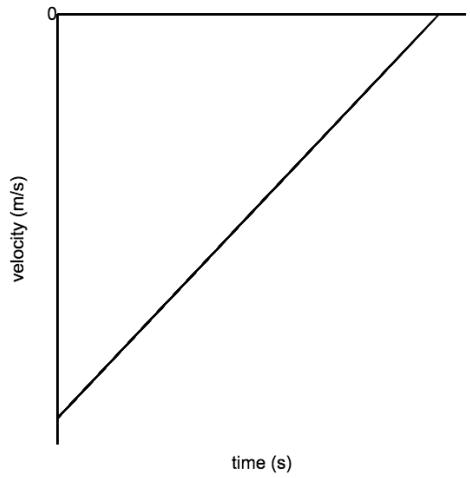
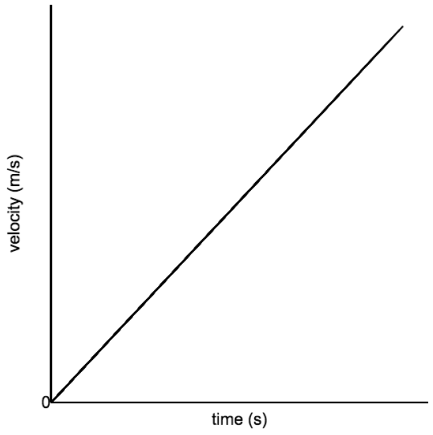
1.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

2.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

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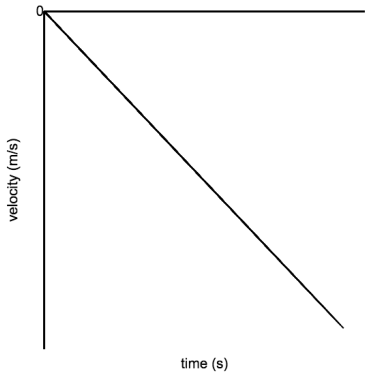
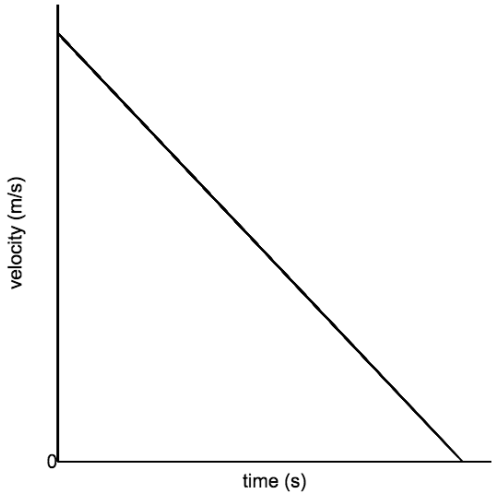
3.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

4.



Direction of Velocity	Speeding up or slowing down?	Direction of Acceleration

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Part 4: Connecting all four

For each of the following situations, select four of the graphs and motion maps that reflect the motion of that object. The two acceleration graphs will be used twice.
In these situations, RIGHT will be considered the positive direction and ELFT will be considered the negative direction.

The graphs to select from are on the next two pages.

Story 1: A car begins at rest at the origin and begins accelerating in the positive direction. (RIGHT)
Story 2: A car begins at the origin moving in the positive direction (RIGHT), and eventually slows down to a stop.
Story 3: A car begins at rest at the origin and begins accelerating in the negative direction (LEFT).
Story 4: A car begins at the origin moving in the negative direction (LEFT) and slows down to a stop.

The graphs to select from are on the next two pages.

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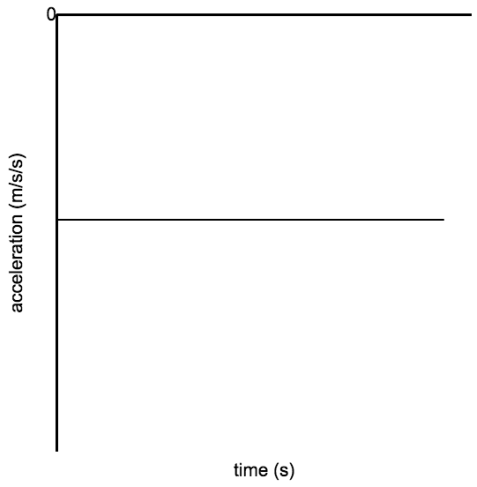
1.



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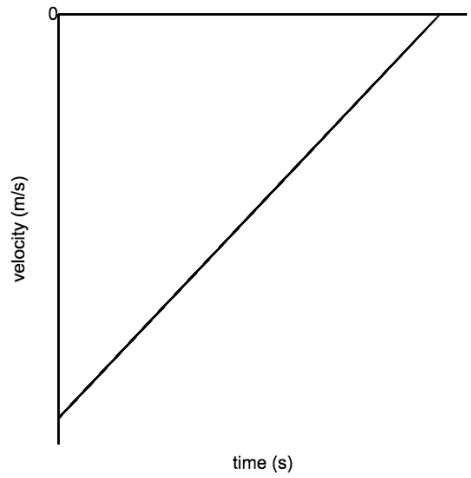

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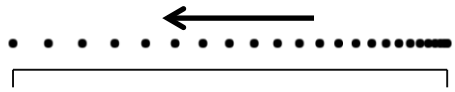

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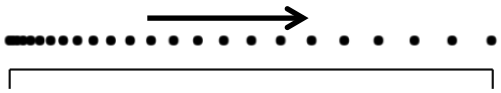

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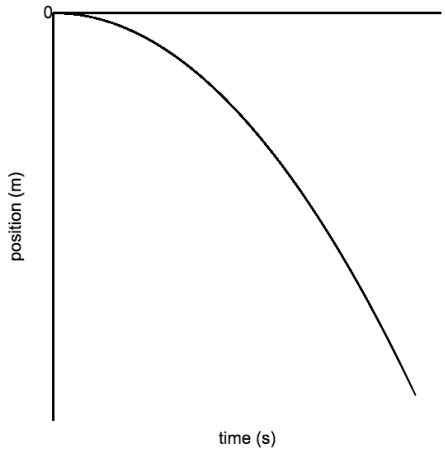

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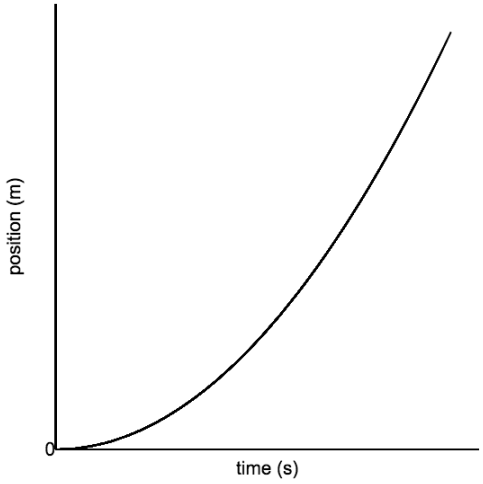

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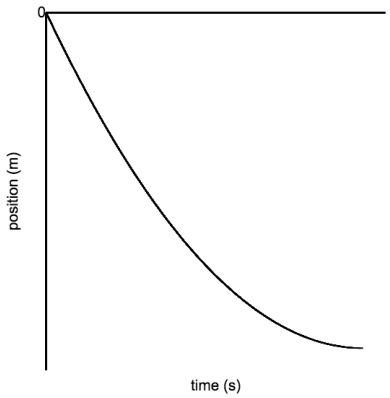
7.



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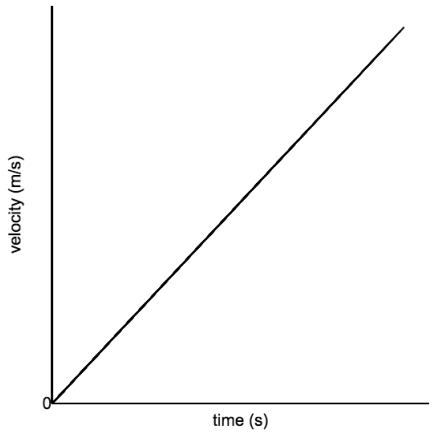

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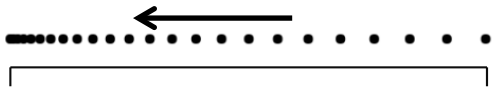

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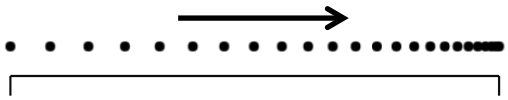

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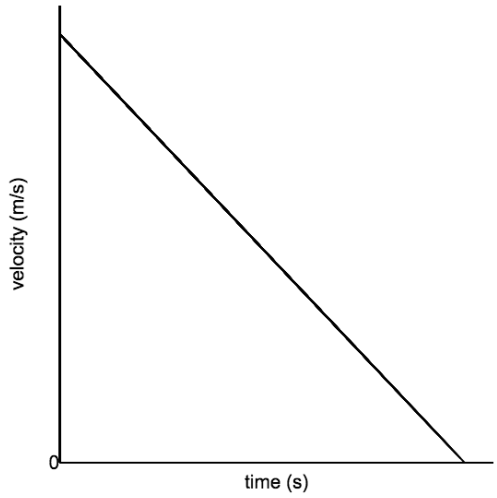

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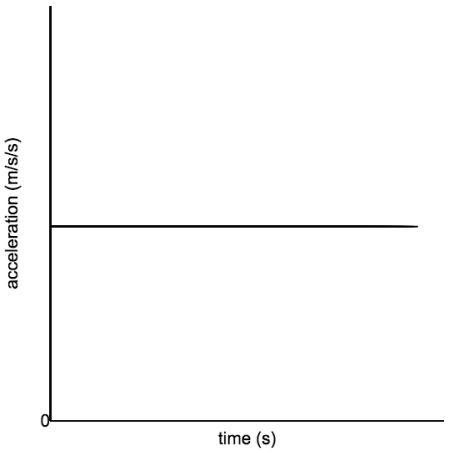

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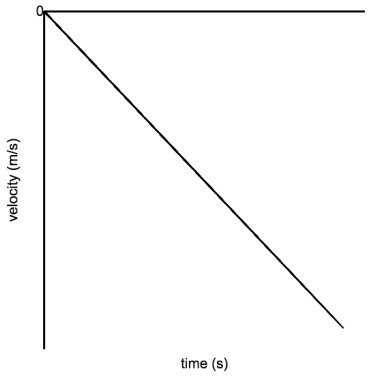

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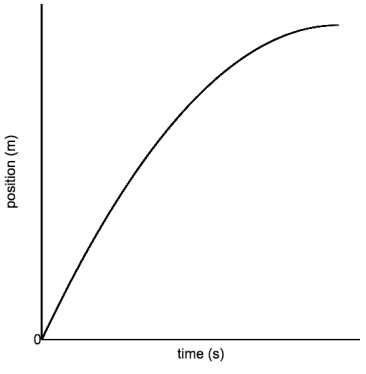

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Answers: