M: kinematic equation backwards

M Kinematic Equations 4 and 5:

Objectives:
As before, use the kinematic equations to solve problems.

Name	**Equation**
Definition of Acceleration	$v_f = v_i + a \cdot \Delta t$
The King of Kinematic Equations	$\Delta x = v_i \cdot \Delta t + \frac{1}{2} a (\Delta t)^2$
The Average Velocity Formula	$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t$
No-Time Equation	$v_f^2 = v_i^2 + 2a \cdot \Delta x$

However, problems now involve both *forward* and *backward* motion. Objects can move in multiple directions and can *switch directions*.

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Part 1: What Direction of Velocity and Acceleration Mean

The direction of velocity determines whether an object is moving to the RIGHT or the LEFT. The direction of acceleration determines if an object is *speeding up* or *slowing down*. But, it's a lot more complicated than

Acceleration and velocity are in the same direction	The object is *speeding up*. Speed is increasing.
Acceleration and velocity are in *different directions*.	The object is *slowing down*. Speed is decreasing.

For each situation, state what the object is doing:

Velocity	**Acceleration**	**What direction is the object moving?**	**Is the object speeding up or slowing down?**
RIGHT	RIGHT		
RIGHT	LEFT		
LEFT	RIGHT		
LEFT	LEFT		
POSITIVE	POSITIVE		
POSITIVE	NEGATIVE		
NEGATIVE	POSITIVE		
NEGATIVE	NEGAIVE		

In a typical *coordinate system*: LEFT is negative and RIGHT is positive.

If velocity is negative, an object is moving to the left.
If velocity is positive, an object is moving to the right.
[However, you as the physicist in charge of all problems, have the total power to reverse this rule if you like! Just, please don't, it makes it unnecessarily more complicated.]

Velocity	**Acceleration**	**What direction is the object moving?**	**Is the object speeding up or slowing down?**
POSITIVE	POSITIVE		

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POSITIVE	NEGATIVE		
NEGATIVE	POSITIVE		
NEGATIVE	NEGAIVE		

Does a *negative acceleration* always mean that an object is *slowing down*? When does a *negative acceleration* actually mean an object is *speeding up*?

Part 2: Two-direction problems concerning only velocity and acceleration.
In each of the following problems, velocity and acceleration are given. You can solve each of these problems with the following formula:

$$v_f = v_i + a \cdot \Delta t$$

1.
An object is moving at a speed of 4 m/s to the right.
It is accelerating at a rate of 2 m/s^2 to the right.
After three seconds….

What is the *direction of velocity*?

What is the *magnitude of velocity*?

Is the object *speeding up* or *slowing down*?

2.
An object is moving at a speed of 4 m/s to the right.
It is accelerating at a rate of 2 m/s^2 to the left.
After 3 seconds….

What is the *direction of velocity*?

What is the *magnitude of velocity*?

Is the object *speeding up* or *slowing down*?

3. An object is moving at a speed of 5 m/s to the left.

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It is accelerating at a rate of 2 m/s^2 to the right.
After 4 seconds….

What is the *direction of velocity*?

What is the *magnitude of velocity*?

Is the object *speeding up* or *slowing down*?

4. An object is moving at a speed of 6m/s to the left.
It is accelerating at a rate of 3 m/s^2 to the right.
After one second…

What is the *direction of velocity*?

What is the *magnitude of velocity*?

Is the object *speeding up* or *slowing down*?

5. An object is moving at a speed of 6m/s to the left.
It is accelerating at a rate of 3 m/s^2 to the right.
After five seconds…

What is the *direction of velocity*?

What is the *magnitude of velocity*?

Is the object *speeding up* or *slowing down*?