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Gizmos™

Professional Development

ExploreLearning
Meta-analysis of educational research identifies effective instructional techniques

In a meta-analysis (Marzano, 1998) that summarized findings from over 100 research studies involving 4,000+ experimental/control group comparisons, the following instructional techniques were all shown to have an average effect size greater than 1 (i.e., a percentile gain of more than 34% in students' achievement):

1. Representing new knowledge in graphic/nonlinguistic formats
2. Using manipulatives to explore new knowledge and practice applying it
3. Generating and testing hypotheses about new knowledge
4. Direct presentation of new knowledge, followed by application

1. Representing New Knowledge in Graphic/Nonlinguistic Formats

Research in cognitive psychology indicates that our brains store knowledge using both words and images. Instruction that targets and engages both of these systems of representation has been shown to significantly increase students' comprehension and retention. Explicitly engaging students in the creation and usage of nonlinguistic representations has even been shown to stimulate and increase activity in the brain.

Gizmos provide teachers with a ready-made path for harnessing the power of visual imagery in instruction. ExploreLearning.com contains literally hundreds of interactive visual models for topics in both math and science. For example, there are Gizmos that help students:

- visualize the flow of current in an electrical circuit they have designed themselves (The Circuits Gizmo);
- study the process of triangulation in determining an earthquake's epicenter (Earthquake - Determination of Epicenter Gizmo);
- identify the role of the Sun and Moon in the fluctuation of ocean tides (The Tides Gizmo).

2. Using Manipulatives to Explore New Knowledge and Practice Applying It

Manipulatives are concrete or symbolic artifacts that students interact with while learning new topics. They are powerful instructional aids because they enable active, hands-on exploration of abstract concepts. Research has shown that computer-based manipulatives are even more effective than ones involving physical objects, in part because they can dynamically link multiple representations together.

For example, students learning about systems of linear equations can use ExploreLearning's Gizmos to manipulate lines and instantly see the results of their actions as each of the multiple representations updates in real-time.

Summary: Based on the summarized findings of over 100 educational research studies involving 4,000+ experimental/control group comparisons, a meta-analytical study (Marzano, 1998) identified several instructional techniques that have a strong positive impact on student achievement. ExploreLearning's white paper, Why Gizmos Work: Empirical Evidence for the Instructional Effectiveness Of ExploreLearning's Interactive Content, demonstrates how math and science Gizmos bring these powerful instructional techniques to the classroom in a convenient, easy-to-use format.
3. Generating and Testing Hypotheses About New Knowledge

Although research has shown that computer-based manipulatives are powerful tools, it has also shown that students derive the greatest value from them when they are guided in their use. The full pedagogical power of the manipulative is only achieved when students mindfully reflect on the actions they perform and how the manipulative responds to them.

The Exploration Guides that accompany every Gizmo are designed to support and stimulate this type of mindful interaction. A typical Exploration Guide starts with students engaging in a set of exercises where they perform specific actions and record the results. Then, they are prompted to make predictions about new situations, after which they verify their answers using the Gizmo.

For example, in the Gizmo Translating and Scaling Functions, students first individually vary the $a$, $b$, $h$ and $k$ parameters in a function in form $y = af(b(x - h)) + k$. After observing the effects of increasing and decreasing these parameters, they are asked to predict how the graph of $y = f(x) + 3$ will differ from the graph of $y = f(x)$. The Gizmo is used to verify their prediction.

4. Direct Presentation of New Knowledge, Followed by Application

The Marzano meta-analysis notes that students learn effectively and efficiently when new concepts are first taught directly to them, after which they practice applying the concepts on their own. Ideally, then, educational software should support this instructional sequence by serving two main objectives: first, it should support teachers in presenting new knowledge to students, and second, it should support students in applying and extending what they have learned on a more individual basis.

For example, using the Gizmo Freefall Laboratory, teachers can quickly discuss and demonstrate the effect of varying parameters in an experiment, and then have students make conjectures about the results:

1. A teacher tells her students that she is going to simulate a tennis ball dropping through a 20 meter-high tube containing a vacuum. She uses the Freefall Laboratory Gizmo (projected on a screen at the front of her class) to demonstrate this scenario and show the graphs of position, velocity and acceleration that result.
2. Next, she asks the students how the graphs might change if the tube was filled with air instead of a vacuum. She directs the students to sketch their ideas.
3. Using the Gizmo, she quickly performs a trial involving a 20-meter air-filled tube, and students compare the Gizmo’s graphs to the ones they generated. The class discusses the results.

The teacher could then have her students explore the simulation on their own. They could make predictions about the effect that changing the type of object dropped or the length of the tube would have on the graphs, and then conduct experiments to test their hypotheses.

Conclusion: Meta-analysis of the research literature has identified broad scientific evidence for the effectiveness of certain instructional techniques. Why Gizmos Work: Empirical Evidence for the Instructional Effectiveness Of ExploreLearning’s Interactive Content demonstrates how ExploreLearning’s comprehensive library of mathematics and science Gizmos brings these powerful instructional techniques to the classroom in a convenient, easy-to-use format that makes them practical and efficient as well as effective.


Or, to receive a hard copy or a copy by email, contact us at sales@explorelearning.com or 1-866-882-4141.
Teacher Guide: Distance-Time Graphs

Learning Objectives
Students will...
- Observe the relationship between a running person and a graph of distance vs. time.
  - Learn what the slope and y-intercept of the graph indicate about the runner.
  - Calculate the speed of the runner based on the graph.
- Interpret a graph showing the distances and times of two runners.
- Use distance-time graphs to solve word problems involving distance and speed.

Vocabulary
speed, y-intercept

Lesson Overview
The Distance-Time Graphs Gizmo™ shows a runner on a track and a graph that represents the runner’s position over time. By manipulating the points on the graph, students can control the speed and direction of one or two runners. Students will gain graph sense as they manipulate graphs and compare the graphs to the motions of the runners.

The Student Exploration contains three activities:
- Activity A – Students see how position and time are shown on a graph.
- Activity B – Students explore how a graph shows the direction and speed of a runner.
- Activity C – Students interpret graphs of two runners and use graphs to solve problems.

Suggested Lesson Sequence
1. Pre-Gizmo activity: Make a distance-time graph (45 – 60 minutes)
   Introduce the Gizmo by graphing your students’ movements. You will need a track or field marked off in 10-meter increments, several stopwatches, and students volunteering to be timers, recorders, and runners.

   First, position a student with a stopwatch at each 10-meter marker. Position the runner at the starting line, and yell “Go!” The “timers” should all start their stopwatches at “go,” and stop their watches when the runner passes by. The recorder can then record the distance and time coordinates for that runner. Do this for fast runners, slow runners, walkers, and people who vary their pace as they go along the course.

   Graph the data, with time on the x-axis and distance from the start on the y-axis. Discuss how each graph shows the runner’s position and speed.
2. **Prior to using the Gizmo**

   *Before students are at the computers, pass out the Student Explorations and ask students to complete the Prior Knowledge Questions. Discuss student answers as a class, but do not provide correct answers at this point. Afterwards, if possible, use a projector to introduce the Gizmo and demonstrate its basic operations. Demonstrate how to take a screenshot and paste the image into a blank document.*

3. **Gizmo activities**

   *Assign students to computers. Students can work individually or in small groups. Ask students to work through the activities in the Student Exploration using the Gizmo. Alternatively, you can use a projector and do the Exploration as a teacher-led activity.*

4. **Discussion questions**

   *As students are working or just after they are done, discuss the following questions:*
   - How does the graph in the Gizmo show the direction a runner is moving?
   - What does a horizontal line on the graph indicate?
   - What would a vertical line on the graph indicate? Is this possible?
   - How does the graph show that a runner is going fast? Slow?

5. **Follow-up activity: Can you run that graph?**

   *Project the *Distance-Time Graphs* Gizmo to the front of the classroom, and ask for two volunteers: a “programmer” and a “runner.” The programmer creates a graph on the Gizmo, and the runner tries to perform the animation that will go with the graph. Once the runner has done this, play the Gizmo to see how close the runner has come to the actual animation. For a fun challenge, have the runner try to match the movements of the Gizmo runner as the Gizmo is playing. Students can also switch roles, so that the runner performs a set of movements and the programmer tries to create a graph to match. Keep going until everyone has had a turn as either a runner or programmer. Several Gizmos can be used as a follow-up to the *Distance-Time Graphs* Gizmo. The *Elevator Operator* Gizmo shows a graph of the vertical motion of an elevator. The *Distance-Time and Velocity-Time Graphs* Gizmo introduces the concept of a velocity-time graph. The *Modeling Linear Systems – Activity A* Gizmo uses a “cat chasing a mouse” scenario to graph a system of equations. See the Selected Web Resources on page 3 of this document for links to these Gizmos.*

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**Sports Connection: The “Lightning Bolt” from Jamaica**

In the 2008 Olympics in Beijing, China, the Jamaican sprinter Usain Bolt electrified the world by setting records and blowing away his competition in the 100- and 200-meter races. Bolt ran the 200-meter race in 19.30 seconds, an average speed of 10.4 m/s (37 km/h, or 23 mph).

Bolt was born and raised in the small town of Trelawny, Jamaica. Bolt loved soccer and cricket, and his talent for running was soon apparent. Although he didn’t always train seriously and loved practical jokes, Bolt steadily rose to the top in a sprinting-mad country. In Beijing, Bolt became as famous for his joyful dancing and other antics as for his stunning performances on the track. In the 100-meter race, Bolt had an untied shoelace and began celebrating victory with 20 meters to go in the race. In spite of this, he won and even set a new world record (9.69 s)!
Mathematical Background

The Distance-Time Graphs Gizmo shows a graph with time on the x-axis and distance from the starting line on the y-axis. This graph lets you describe and compare the motions of runners.

In reality, the graph in the Gizmo is probably best referred to as a position-time graph. The term distance can be misleading. In the Gizmo, we mean “distance from the starting line,” so this value can increase or decrease, depending on which direction the runner runs. This should not be confused with “distance traveled,” which can never decrease. (Think of your car’s odometer.)

Several different situations can be shown on a position-time graph. A horizontal line (figure A) indicates that, as time goes by, position does not change. In other words, the object is standing still. A straight “uphill” or “downhill” line (figure B) means that, for each increment of time, the position changes by the same amount, so this object is moving at a constant speed. A curve (figure C) shows that the position is changing by more and more (or less and less) each time increment. This means that the speed is changing—the object is accelerating.

The slope of the line indicates speed. Figure D shows a graph of a slow-moving object (blue) and a fast-moving object (red). The fast-moving object moves 40 meters in 4 seconds, a speed of $40 \div 4 = 10$ m/sec. The slow-moving object goes 10 meters in 4 seconds, a speed of $10 \div 4 = 2.5$ m/sec.

The slope of the line can also indicate the direction of motion. A line with negative slope indicates that the runner is going backwards, moving back towards the starting line.

Selected Web Resources

Distance-time graphs:  
Distance-time graphs:  
http://www.gcse.com/fm/dtg.htm  
Position time graph:  
http://www.glenbrook.k12.il.us/GBSSCI/PHYS/CLASS/1DKin/U1L3a.html  
Distance-time graph activity:  
Distance-time game:  
http://www.sycd.co.uk/dtg/  
Usain Bolt:  
http://www.usain-bolt.info/Biography.html

Related Gizmos:  
Elevator Operator:  
http://www.explorelearning.com/gizmo/id?1017  
Distance-Time and Velocity-Time Graphs:  
http://www.explorelearning.com/gizmo/id?626  
Modeling Linear Systems – Activity A:  
http://www.explorelearning.com/gizmo/id?278
Student Exploration: Distance-Time Graphs

**Vocabulary:** speed, \( y \)-intercept

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)
Max ran 50 meters in 10 seconds. Molly ran 30 meters in 5 seconds.

1. Who ran farther, Max or Molly? ________________

2. Who ran faster? ________________ Explain: ____________________________________
   __________________________________________________________________________

**Gizmo Warm-up**
The *Distance-Time Graphs* Gizmo™ shows a graph and a runner on a track. You can control the motion of the runner by manipulating the graph (drag the red dots).

Check that **Number of points** is 2, and that under **Runner 1** both **Show graph** and **Show animation** are turned on.

The graph should look like the one shown to the right – one point at (0, 0) and the other point at (4, 40).

1. Click the green **Start** button on the stopwatch.
   What happens? _______________________________
   ______________________________

2. Click the red **Reset** button on the stopwatch. The vertical green **probe** on the graph allows you to see a snapshot of the runner at any point in time. Drag it back and forth. As you do, watch the runner and the stopwatch.
   
   **A.** What was the position of the runner at 1 second? ________________
   
   **B.** What are the coordinates of the point on the graph that tells you this? __________
   
   **C.** When was the runner on the 30-meter line? ____________________________
   
   **D.** What are the coordinates of the point on the graph that tells you this? __________
Activity A: Runner position

Get the Gizmo ready:
- Click the red **Reset** button on the stopwatch.
- Be sure the Number of Points is 2.

In the Gizmo, run the “race” many times with a variety of different graphs. (The red points on the graph can be dragged vertically.) Pay attention to what the graph tells you about the runner.

1. If a distance-time graph contains the point (4, 15), what does that tell you about the runner? (Be specific, and answer in a complete sentence.)

   ________________________________________________________________________

2. Look at the graph to the right. Notice where the green probe is. If you could see the runner and the stopwatch at this moment, what would you see?

   ________________________________________________________________________
   ________________________________________________________________________
   ________________________________________________________________________

3. Look at the image below, from the Gizmo. What must be true about this runner’s graph?

   ________________________________________________________________________
   ________________________________________________________________________

4. The point on the graph that lies on the y-axis (vertical axis) is called the **y-intercept**. What does the y-intercept tell you about the runner?

   ________________________________________________________________________

5. In the Gizmo, set the Number of Points to 3. Then create a graph of a runner who starts at the 20-meter line, runs to the 40-meter line, and finishes at the 30-meter line.

   A. Sketch your graph to the right.

   B. What is the y-intercept of your graph? ______________
Run the Gizmo several times with different types of graphs. (Remember, the red points on the graph can be dragged vertically.) Pay attention to the speed and direction of the runner.

1. Create a graph of a runner that is running forward (from left to right) in the Gizmo. Sketch your graph to the right.
   
   If the runner is moving from left to right in the Gizmo, how does the graph always look?
   
   ____________________________________________________
   ____________________________________________________

2. Click the red Reset button. Create a graph of a runner that is running from right to left. Sketch it to the right.
   
   How does the graph always look if the runner is moving from right to left in the Gizmo?
   
   ____________________________________________________
   ____________________________________________________

3. Change the Number of Points to 5. Create a graph of a runner that runs left-to-right for one second, rests for two seconds, and then continues running in the same direction. Sketch the graph to the right.
   
   How does a graph show a runner at rest? ________________
   ____________________________________________________
   ____________________________________________________

4. In general, how does a distance-time graph show you which direction the runner is moving?
   
   ____________________________________________________
   ____________________________________________________
   ____________________________________________________

(Activity B continued on next page)
Activity B (continued from previous page)

5. With **Number of Points** set to 3, create the graph shown at right. Your graph should include (0, 0), (2, 10), and (4, 40).

   A. Where does the runner start? ____________________

   B. Where will he be after 2 seconds? ________________

   C. Where will he be after 4 seconds? ________________

   D. In which time interval do you think the runner will be moving most quickly? (Circle your answer below.)

      0 to 2 seconds  2 to 4 seconds

6. Click the **Start** button and watch the animation. What about the runner changed after 2 seconds of running?

   ____________________________________________________________________________

7. **Speed** is a measure of how fast something is moving. To calculate speed, divide the distance by the time. In the Gizmo, the units of speed are meters per second (m/s).

   A. In the first 2 seconds, how far did the runner go? ____________________________

   B. In this time interval, how far did the runner go each second? ___________________

   C. In this time interval, what was the runner’s speed? ___________________________

8. Now look at the last two seconds represented on the graph.

   A. In the last 2 seconds, how far did the runner go? ____________________________

   B. In this time interval, how far did the runner go each second? ___________________

   C. In this time interval, what was the runner’s speed? ___________________________

9. Click the **Reset** button. Experiment with a variety of graphs, focusing on the speed of the runner. In general, how can you estimate the speed of the runner by looking at a graph?

   ____________________________________________________________________________

   ____________________________________________________________________________

   ____________________________________________________________________________
Activity C: Two runners, two graphs

Get the Gizmo ready:
- Click Reset.
- Under Runner 2, turn on Show graph and Show animation.

1. Experiment with the Gizmo to create each of the following results. (You can use any number of points in your graphs.) Each time you find a solution, click the camera (📸) next to the graph. Then paste the image into a blank document. Label all five images.
   - Runner 1 wins the race.
   - Runner 2 wins the race.
   - Runner 2 catches up to and passes runner 1.
   - Runner 2 is going in the opposite direction as runner 1.
   - Each runner goes at a different speed, but both reach the finish line together.

2. Based on your experiments, answer the following questions.
   A. How does the graph show if a runner gets a head start? ______________________
      _____________________________________________________________________
   B. How does the graph show which runner is faster? ___________________________
      _____________________________________________________________________
   C. How does the graph show which runner wins the race? _____________________
      _____________________________________________________________________
   D. How does the graph show a runner going back and forth? ___________________
      _____________________________________________________________________
   E. What does it mean when the two runners’ graphs cross? ___________________ 
      _____________________________________________________________________

3. Challenge: For Runner 2, turn off Show graph. Click New to generate a new random graph that you can’t see for Runner 2. Click Start, and watch her run. Then try to adjust the graph for Runner 1 so that his movements match the movements of Runner 2.

   Turn on Show graph to check each answer. (For a greater challenge, increase the Number of points before selecting New.)

(Activity C continued on next page)
Activity C (continued from previous page)

4. **Challenge**: Use the Gizmo to model and solve the following word problems. Write the solutions in the spaces below. Sketch the graph you made to solve the question in the space to the right of each question.

   A. A dog is chasing a cat towards a tree. The cat has a 10-meter lead and runs at a speed of 6 meters per second. The dog runs at a speed of 8 meters per second. The tree is 30 meters away from the dog’s starting position. Which animal will reach the tree first? 

      

   B. A police officer is chasing a purse-snatcher down a street. The thief starts 9 meters ahead of the officer and can run 20 meters in 4 seconds (5 m/s). The police officer can run 32 meters in 4 seconds (8 m/s). How long will it take the officer to catch the thief?

      

   C. In a football game, one team kicks off to the other. At the moment the receiver catches the ball, he is 40 meters from the nearest tackler. The receiver runs left to right at a speed of 10 meters per second (10 m/s). The tackler runs right to left at a speed of 6 meters per second.

      How long does it take before they collide? __________

      How far does the receiver go? _____________________

   D. A tortoise challenges a hare to a four-hour race. The hare is so confident of winning that he allows the tortoise to start with a 10-km lead. The hare runs at a speed of 14 km per hour, but stops for a two-hour nap in the middle of the race. The tortoise plods along at 4 km per hour the whole race. Who gets farther in four hours?

      

5. How are distance-time graphs useful? Explain, and if possible discuss your answer with your teacher and classmates.
Vocabulary: Distance-Time Graphs

Vocabulary

- **Speed** – how fast an object is moving.
  - Average speed is calculated by dividing the total distance traveled by the elapsed time: \( \text{speed} = \frac{d}{t} \).
  - For example, the average speed of a runner who travels 56 meters in 8 seconds is 56 ÷ 8 = 7 m/s.
  - Speed is never negative.

- **Y-intercept** – the point where the graph crosses the \( y \)-axis.
  - The \( y \)-intercept can also refer to the \( y \) coordinate of that point.
Assessment Results for Distance-Time Graphs

Individual Report:

1. In which of the following graphs is the runner running the fastest?

A. Graph A  
B. Graph B  
C. Graph C  
D. Graph D  

Correct Answer: B — Graph B

Explanation: In this problem, the fastest runner will be the one that travels the greatest distance in 4 seconds. In Graph B, the runner starts at the 0 yard marker and reaches the 30 yard marker after 4 seconds. This means that the runner traveled 30 yards in 4 seconds. In the other graphs, the runners travel less than 30 yards.

2. Each of the following function rules describes a hypothetical runner. Which runner would be fastest?

A. Time = 2 • Distance  
B. Time = 3 • Distance  
C. Distance = Time  
D. Distance = 2 • Time  

Correct Answer: D — Distance = 2 • Time

Explanation: The function rule Distance = 2 • Time describes the fastest runner. This runner would cover twice as much distance in a given time period as a runner whose motion could be modeled with the rule Distance = Time. Since the function rules Time = 2 • Distance and Time = 3 • Distance could be rewritten as Distance = \frac{1}{2}Time and Distance = \frac{1}{3}Time, respectively, neither of these functions rules represents a faster runner than Distance = 2 • Time.
3. Which of the following graphs indicates that one of runners started 10 yards ahead of the other?

A. Graph A  
B. Graph B  
C. Graph C  
D. Graph D  

Correct Answer: A — Graph A

Explanation: The points on a runner's distance-time graph indicate his or her location (y-value) at a given time (x-value). Since the runners start running at time = 0 seconds, their starting positions can be found by identifying the y-values of their graphs at x = 0 (the y-intercepts). In Graph A, the difference between the two runners' y-values at x = 0 is 10, therefore one of the runners had a head start of 10 yards.

4. In which of the following graphs are both runners moving at the same speed?

A. Graph A  
B. Graph B  
C. Graph C  
D. Graph D  

Explanation: The points on a runner's distance-time graph indicate his or her location (y-value) at a given time (x-value). Since the runners start running at time = 0 seconds, their starting positions can be found by identifying the y-values of their graphs at x = 0 (the y-intercepts). In Graph A, the difference between the two runners' y-values at x = 0 is 10, therefore one of the runners had a head start of 10 yards.
A. Graph A
B. Graph B
C. Graph C
D. Graph D

Correct Answer: D — Graph D

Explanation: Speed (or, technically, velocity) is represented by the slope of a distance-time graph. So, runners running at the speed would have distance-time graphs with equal slopes. Lines with equal slopes are parallel, and graph D is the only one with two parallel lines shown.

5. Which sentence best describes the runner whose distance-time graph is shown below?

A. The runner ran forward for 2 seconds, and then he ran backward for 2 more seconds.
B. The runner ran forward for 2 seconds, and then he stood still for 2 more seconds.
C. The runner ran forward for 2 seconds, and then he ran forward more slowly for 2 more seconds.
D. The runner ran forward for 2 seconds, and then he turned right and continued forward at the same speed for 2 more seconds.

Correct Answer: C — The runner ran forward for 2 seconds, and then he ran forward more slowly for 2 more seconds.

Explanation: Both segments of this graph have a positive slope, so the runner is running forward the whole time. The first half of the graph is steeper, which indicates faster running. The second half is a little flatter, showing that the runner slowed down a bit.

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Sample Quiz: HS Physics, Newton’s Laws, Chapter 5

You have fifteen (15) minutes to complete this quiz. Calculators may be used if necessary, along with your class notes.

This sample quiz was created using several things possible with ExploreLearning Gizmos:
- Screen snapshot features.
- Data export features.
- Modification of Exploration Guides and Assessment Questions for classroom use.

Pencils ready? Begin!

**Question 1.** What is Newton’s Second Law?

**Question 2.** The cart shown has a fan attached to it, which is forcing air to the left. The acceleration of the cart is to the right.
- [ ] True
- [ ] False

**Question 3.** The velocity of the cart shown MUST be to the right.
- [ ] True
- [ ] False

In a recent experiment, the position, velocity, and acceleration of a moving cart was determined. Use this data to answer the next two questions.

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>Position (m)</th>
<th>Velocity (m/s)</th>
<th>Acceleration (m/s/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.100</td>
<td>0.004</td>
<td>0.080</td>
<td>0.800</td>
</tr>
<tr>
<td>0.200</td>
<td>0.017</td>
<td>0.160</td>
<td>0.800</td>
</tr>
<tr>
<td>0.300</td>
<td>0.037</td>
<td>0.240</td>
<td>0.800</td>
</tr>
<tr>
<td>0.400</td>
<td>0.066</td>
<td>0.320</td>
<td>0.800</td>
</tr>
<tr>
<td>0.500</td>
<td>0.102</td>
<td>0.400</td>
<td>0.800</td>
</tr>
</tbody>
</table>
Question 4. A 2 kg frictionless cart was used when recording the data in the table above. What was the force acting on the 2 kg cart?

a) 0.4 N  
b) 0.8 N  
c) 1.6 N  
d) None of the above

Question 5. Using the data in the table, make a sketch of the Velocity vs. Time for the cart.

![Velocity vs. Time Graph]

Question 6. In the graph of position vs. time shown below, indicate the region(s) where the acceleration is positive, and where the acceleration is negative. Note: this question is worth three (3) points.

![Position vs. Time Graph]
SAMPLE QUIZ — Graphs and tables using Gizmo snapshot and data export functions

Directions: Use the following graph to answer questions 1 through 3.

1. What is the slope of the line shown in the given graph?

2. What is the $y$-intercept of the line shown in the given graph?

3. What is the equation of the line shown, in slope-intercept form?

Directions: Use the data table shown to the right to answer questions 4 and 5.

4. The data table to the right shows the coordinates of eight points on a line. What is the equation of the line, in slope-intercept form?

5. Give the coordinates of three other points on this line. Write your answers as ordered pairs.

6. For which of the lines below is the product of the slope and the $y$-intercept negative? _____
Directions: Complete the following sentences to explain how you would use the Gizmo to make the changes described.

7. To make the line steeper, I would ________________________________________________
______________________________________________________________________________
______________________________________________________________________________

8. To move the line lower while keeping its steepness the same, I would ______________
______________________________________________________________________________
______________________________________________________________________________

9. To make the line horizontal, I would _____________________________________________
______________________________________________________________________________
______________________________________________________________________________
ExploreLearning Quick-Start Tutorial

This quick-start guide is meant to take you through the most important things you will need to know about the ExploreLearning site. If you have trouble or suggestions, please contact our support team at support@explorelearning.com.

In addition, check out our demo movies on the website by going to “Getting Started Videos” on your Me tab. These quick clips provide not only instructions on how to use the site, but also ideas for integrating Gizmos into your math and science classrooms.

Editing your Settings (personal info)

When you first log into www.ExploreLearning.com, you may want to update your personal information, e.g. your name, username, and password.

Instructions
1. Login to your account. You should be taken to My Homepage open to your Me tab.
2. Click on the Settings button in the upper right hand section of the screen.
3. Edit your Account Info, Public Profile Info and What I Teach as desired and click Save.

Modifying your Class/Tab Names

Across the top of My Homepage you will see your Me tab and your class tabs. You may want to name your class tabs to match the classes that you teach. You cannot rename your Me tab.

Instructions
1. Click on your class tab you wish to rename on your homepage.
2. Click on Rename Class.
3. A layover will appear and allow you to change your tab name and full name.
4. A Tab Name can be up to 8 characters in length.
5. A Full Name can be up to 50 characters in length.
6. Click Save and repeat these steps for your remaining class tabs.
7. Should you want to add more class tabs (maximum of six) click on the Add New Class link and repeat the steps above.

Adding Gizmos to your Homepage’s Class Tabs

Instructions:
1. Click on the Browse Gizmos button found towards the top of the page.
2. Browse to a desired category of Gizmos and select a Gizmo.
3. Click Add Gizmo to Class from any Gizmo listing, Lesson Info page or Gizmo page.
4. Choose the tab(s) to which you want to add the Gizmo by clicking +Add and clicking Done.

Organizing your Gizmos

Once you have a few Gizmos on a class tab, you may want to reorder, delete or categorize them by adding headings to your list.

Instructions:
1. Click Manage Gizmo List from your class tab.
   A. Re-ordering Gizmos
      i. Select any Gizmo in the list.
      ii. Use the up and down arrows on the right to re-order your list.
   B. Adding a Heading
      i. Type in your heading in the field/blank on the left.
      ii. Click Insert.
      iii. Once the heading has been inserted into your list you may use the arrow keys on the right to move the heading up or down in your list.
   C. Deleting Gizmos
i. Select the Gizmo you wish to delete.
ii. Click on the X button on the right-hand side of the Gizmo List.

2. **Important:** For changes to take effect you must click on the Save button at the bottom of this page.

**Controlling Gizmo Access Directly from Your Class tabs**

You can hide, unhide and delete Gizmos from your class tabs without having to go to Manage Gizmo List.

**Instructions:**

1. To hide a Gizmo from student view on their homepages, click on the **Hide** button on the far right of the corresponding Gizmo listed on your class tabs. The Gizmo will still have full functionality on your page but will be hidden from students.
2. To unhide a Gizmo and allow students to see it again on their homepages, click the **Unhide** button.
3. To delete a Gizmo from your class tab, click on the X button.

**Giving Students Access to ExploreLearning Gizmos**

**Instructions:**

1. Select the class tab in which you wish to enroll students. Unique CLASS CODES were automatically generated when you added class tabs.
2. Your CLASS CODE is located on the right hand side of the page.
3. Click on **What's This?** to display a large overlay of the CLASS CODE and access the printable handout “Enrolling as a Student at ExploreLearning.”
4. Log out of your teacher account and follow these instructions to practice enrolling as a student in one of your own classes.

**Important:** Students can enroll in more than one class with the same login. If a student has already enrolled in a class, they should login and click **Enroll in a Class** and enter the new class code. The student is now enrolled in both classes using the same login.

**Managing Your Class Roster and Accessing Student Logins**

Use these steps to access student usernames and passwords or to remove a student from your roster. Here’s how:

**Instructions:**

1. From the appropriate class tab, click **Manage Roster**.
2. Look for the student in question. The username and password are listed under the student’s name.
3. To remove a Student from the Roster
   a. From the appropriate class tab, click **Manage Roster**.
   b. Check the box next to the student to be removed.
   c. Click **Delete Checked**.

**Checking Assessment Results**

**Instructions:**

1. Click on the class tab for which you wish to view assessment results. Scroll down to the Gizmo in which your students completed the assessment. Click on **Assessment Results**.
2. For an individual student report click on the student’s name.

**Retrieving a Username and Password for a Teacher**

Should you ever forget your username and password there is a simple link on the login page for retrieving your information.

**Instructions:**

1. Go to [www.explorelarning.com](http://www.explorelarning.com).
2. Click on the **Login** button in the top right of the screen.
3. Click on **Forgotten your Username and Password?**
4. Follow the on-screen directions.
Enrolling Students with a Class Code

Students can also self-enroll into your class if you give them a class code. See “Self Enrolling in a Class”

Getting the Class Code for a Class

1. Log into ExploreLearning.com
2. Go to your Home Page by clicking the “My Homepage” box at the top-right of any page on the site.
3. Select the tab of the class you want the Class Code listed.
4. The Class Code is listed on the right-hand side of the page under the class tabs.

Using the Class Code

1. Click on the “What’s This?” link found behind the class code
2. This will show you the Class >> Student Class Code overlay with the class code listed in large easy to read print.

3. To provide each student with an easy steps to enroll in this class click on the “Enrolling as a student at ExploreLearning.com” link.

4. Print the Enrolling at ExploreLearning.com handout and make copies to hand out to students who need to enroll in the respective class.
Enrolling at ExploreLearning.com

Follow these simple steps to enroll in your teacher's class:

**Step 1:** Go to http://www.explorel earning.com.

**Step 2:** Click on the “Enroll in a Class” button in the upper right hand corner of the web page.

**Step 3:** Type in your teacher’s class code: ______________
Click “Continue” and follow the directions on the site to complete your enrollment. *Each class will have a unique Class Code.*

**Step 4:** Write down your username and password and put this sheet in your class notebook.

username: ________________________
password: ________________________

**Congratulations!** Now that you’re enrolled, you can login anytime using just your username and password (no class code required)