Understanding Motion

You know when you have moved. You know when an object around you has moved. You can tell if an object is moving faster or slower than another one. You can tell if an object is moving toward you or away from you. But, what is motion? How would you define it? How could you prove that an object has or has not moved?

Motion is the change in an object's position over time. An object's **position** is its location relative to a reference point. An object's position can be measured using a unit of distance from the reference point. The reference point is most often an object that is stationary, or not moving. Motion cannot be determined without a change in an object's position relative to a reference point.
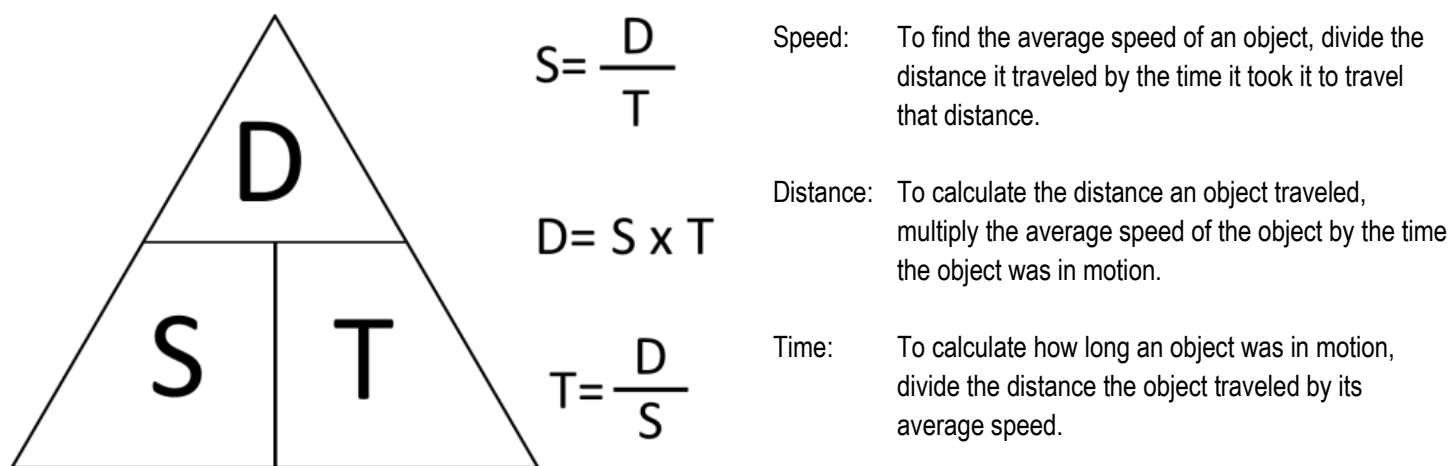
For example, imagine you are standing outside. There is a tree about ten meters in front of you. That is your *position* relative to the tree. You are ten meters away from a reference point. If you were to run to the tree you would now be in *motion*. The distance between you and the tree, or the reference point, is decreasing over time.

Calculating Motion

Motion is a quantitative variable. A quantitative variable is something that can be expressed mathematically. One way that motion can be expressed is as an object's average speed. **Speed** is a measure of distance divided by time. For instance, if an object traveled 60 miles in one hour its average speed would be 60 miles per hour. If that object were to maintain that speed, it would travel an additional 60 miles for every hour it is in motion.

Speed, distance, and time are variables that often refer to the motion of an object. If any two of these variables are known, the third can be calculated.

The following visual aid can help you remember how to calculate for each of the variables.

$$S = \frac{D}{T}$$

$$D = S \times T$$

$$T = \frac{D}{S}$$

Speed: To find the average speed of an object, divide the distance it traveled by the time it took it to travel that distance.

Distance: To calculate the distance an object traveled, multiply the average speed of the object by the time the object was in motion.

Time: To calculate how long an object was in motion, divide the distance the object traveled by its average speed.
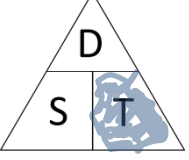
Using this triangle makes remembering these formulas very easy. When you are solving problems about motion it is a good idea to draw this triangle somewhere on your paper. However, remember that it must be labeled correctly. After you have read the problem and decided which variable you need to solve for, cover up the unknown variable with your finger. This will remind you which formula to use.
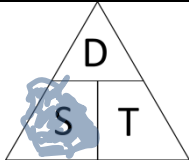
Let's look at a few examples and practice some problems on the following pages.

Study the following examples. Then, solve the problems that follow by completing each table as shown by the examples.
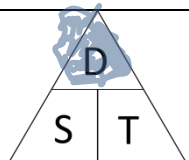
Ex. 1   An object traveled a distance of 200 miles (mi) at 50 miles per hour (mph). How long was that object in motion?

Triangle Reference	Formula	Calculation	Solution
$\triangle$ D / S T	$T = \dfrac{D}{S}$	$T = \dfrac{200 \text{ miles}}{50 \text{ miles per hour}}$	T = 4 hours

Ex. 2   A cruise ship was travelling in a straight line across the Atlantic Ocean. It traveled 60 miles every three hours. At what average speed was the cruise ship travelling?

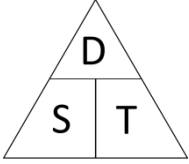| Triangle Reference	Formula	Calculation	Solution
$\triangle$ D / S T	$S = \dfrac{D}{T}$	$S = \dfrac{60 \text{ miles}}{3 \text{ hours}}$	S = 20 mph

Ex. 3   An apple falls from one of the highest branches of a tree. It travels at an average speed of two meters per second (m/s) for three seconds before hitting the ground. How far did the apple fall?

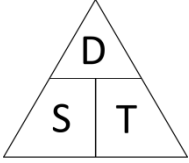| Triangle Reference	Formula	Calculation	Solution
$\triangle$ D / S T	D = S x T	D = 2 m/s x 3 seconds	D = 6 meters

Continue to the next page to try a few on your own. Remember to think about what the question is asking you to solve for and what the unknown variable is.
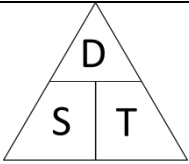
Solve/Answer the following:

1. You are going to race your friend to a tree near the back of the playground. The tree is 24 meters away from where you stand. It will take you 4 seconds to reach the tree. What will your average speed be?

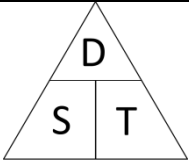| Triangle Reference	Formula	Calculation	Solution
D S | T	=		

2. A train travels down a straight track at a constant speed of 40 miles per hour. It travels at this speed for 8 hours. How far did the train travel?

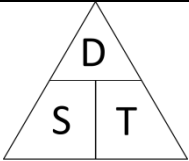| Triangle Reference	Formula	Calculation	Solution
D S | T	=		

3. The cheetah is the world's fastest land animal. An adult cheetah can reach speeds of 28 meters per second. If a cheetah was traveling at a constant speed of 28 meters per second, how many meters would the cheetah run in 5 seconds?

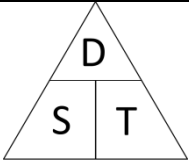| Triangle Reference	Formula	Calculation	Solution
D S | T	=		

4. How long would it take an object traveling 100 kilometers per hour to travel 800 kilometers?

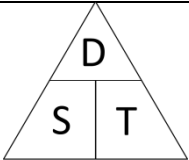| Triangle Reference	Formula	Calculation	Solution
D S | T	=		

5. An object must travel 60 meters in 4 seconds. At what average speed will the object have to travel to accomplish this task?

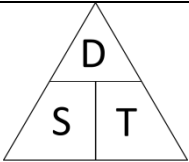| Triangle Reference	Formula	Calculation	Solution
D / S | T	=		

6. A family decided to take a trip to Europe. The plane they took flew at an average speed of 500 miles per hour during the flight. The plane covered a distance of 5,000 miles during the flight. How long was the flight?

Triangle Reference	Formula	Calculation	Solution
D / S | T	=		

7. A group of campers decided to take a canoe trip down a river. The campers traveled 25 miles in five hours. At what average speed did the group of campers travel down the river?

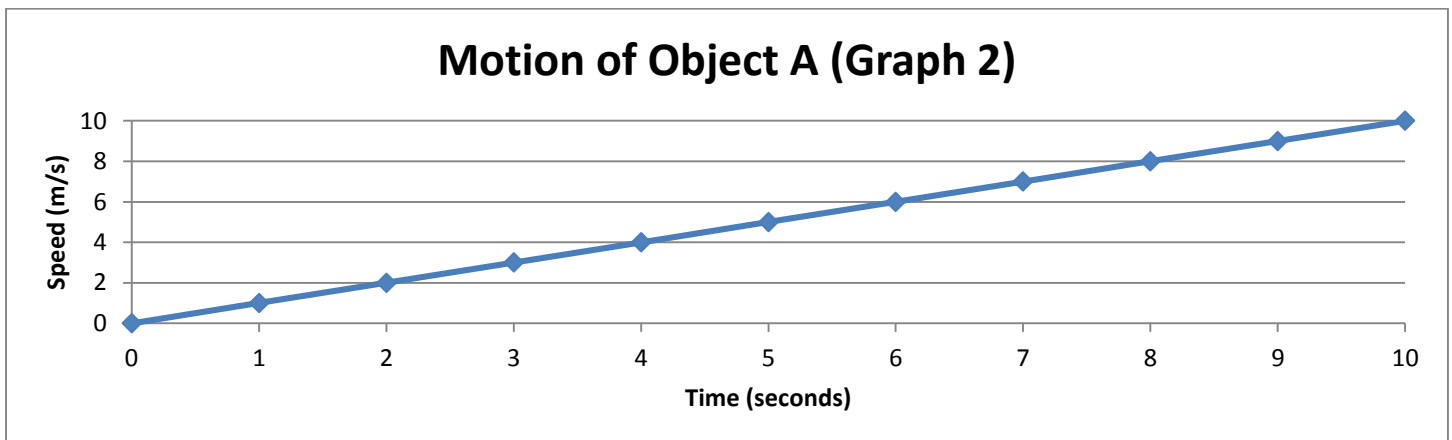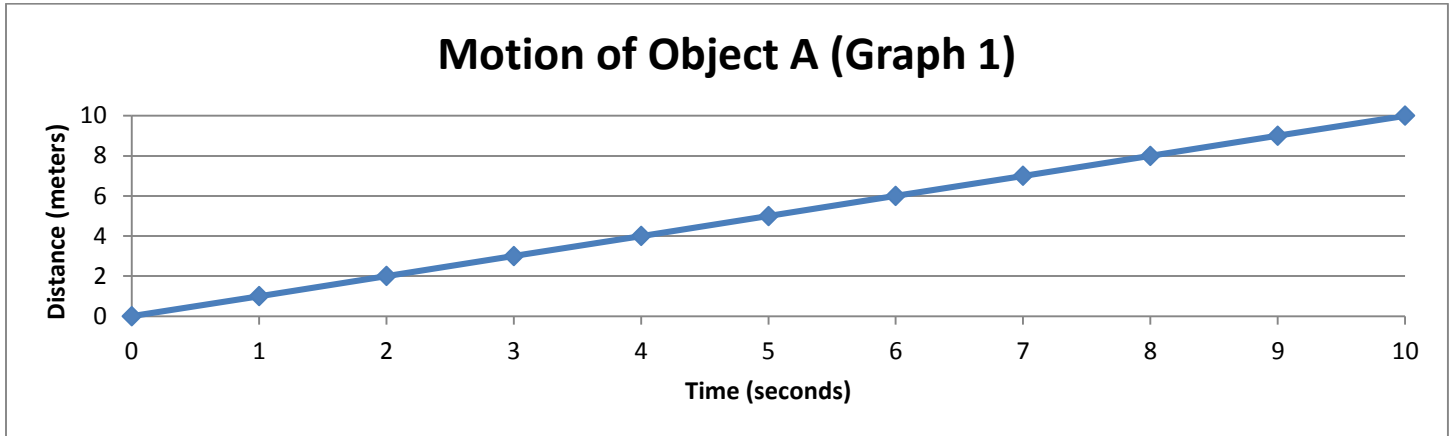| Triangle Reference	Formula	Calculation	Solution
D / S | T	=		

8. Some sharks can swim at average cruising speeds of three miles per hour. If a shark swam at that average speed for seven hours, how far would it have traveled?

Triangle Reference	Formula	Calculation	Solution
D / S | T	=		

Graphing Motion

The formulas you used earlier are very useful for calculating the overall motion of an object, but they do not account for the smaller changes in the motion of an object. For instance, a car will often speed up and slow down numerous times throughout a voyage. On Earth, the motion of objects is rarely constant because they are typically interacting with any number of forces at any given time. To show some of these changes in motion one might use a motion graph.

Motion graphs usually compare two variables at a time. Most motion graphs either compare distance/position vs time or speed vs. time. You must pay attention to what the axes represent on the graph. For instance, observe the two line graphs below:

Motion of Object A (Graph 1)

Distance (meters) vs. Time (seconds)

Motion of Object A (Graph 2)

Speed (m/s) vs. Time (seconds)

At first glance these graphs may seem identical, but they each tell a very different story about the motion of Object A. If you look closely at the y axes you will notice that they are labeled differently on each graph.
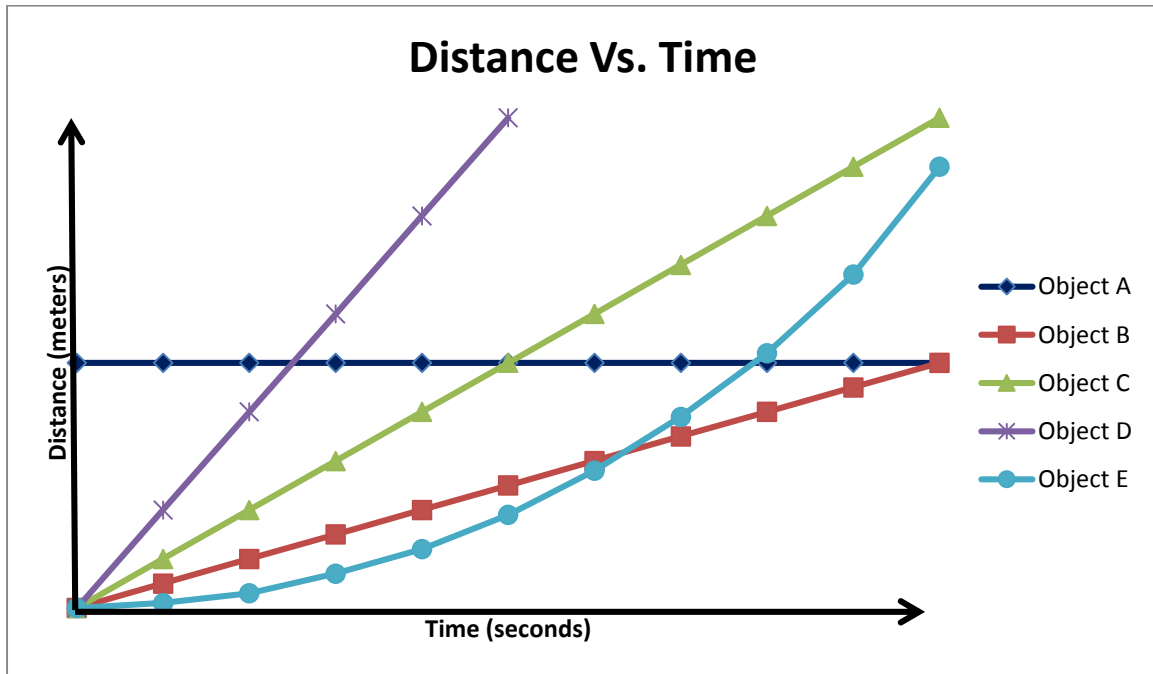
Graph 1 is a **Distance vs. Time** graph. This object was covering a distance of one meter every second. Because of this we know the object was travelling at a constant speed. This object traveled 10 meters in 10 seconds, giving it an average speed of one meter per second.

Graph 2 is a **Speed vs. Time** graph. This graph tells a different story about the motion of Object A. Speed is represented on the y axis, and because of this it shows that Object A's speed was continuously increasing. This object was motionless at first, but after 10 seconds was travelling at a speed of 10 m/s.

On the next few pages you will find more detailed information about these two types of graphs and learn how they can be used to compare the motion of one of more objects.

Distance/Position vs. Time Graphs

A **distance/postion vs. time graph** illustrates the distance an object travelled over time. They can be very useful when trying to compare the motion of one or more objects, and they can also be used to find the average speed of an object over a distance. Study the graph below and then continue reading to learn how the motion of each object on this graph could be interpreted.

Distance Vs. Time

(Graph) Distance (meters) vs. Time (seconds)

Legend: Object A, Object B, Object C, Object D, Object E

Object A: This distance that Object A is travelling is neither increasing nor decreasing over time. This is what a horizontal line on a distance vs. time graph indicates. Because this object is not moving, it is said to be at rest.

Object B: Object B is traveling at a constant speed. We know this because the distance the object travels is increasing by the same increment for a given unit of time. A straight, non-horizontal line on a distance vs. time graph indicates an object travelling at a constant speed.

Object C: Object C is also traveling at a constant speed. However, it is travelling at a faster constant speed then Object B because it travels a greater distance in the same amount of time.

Object D: Object D is travelling at a faster speed than both Object B and C. Object D traveled the same distance as Object C, but it did it in half of the time. Object D would have the fastest average speed out of all of the objects shown on the graph.

Object E: This object was not at rest, but it also wasn't travelling at a constant speed. This line shows an object that was accelerating. **Acceleration** is when a change in the motion of an object is observed. Any time an object speeds up, slows down, or changes directions it has accelerated. Object E is accelerating throughout the graph because the distance the object covers is increasing by each value of time. This line shows an object that is speeding up.

The graph above did not include a scale for the x or y axis. However, you can still make several assumptions about the motion of these objects based solely on the shape and angle of the line. A perfectly horizontal line indicates that an object is at rest. A straight line indicates that an object is travelling at a constant speed. A curved line indicates that an object is accelerating. If you are comparing the motion of two objects, the steeper line represents the faster object. These graphs can be very helpful in determining the overall motion of an object.

# Describing Motion and Calculating Average Speed with a Distance vs. Time Graph

Examine the graph below:
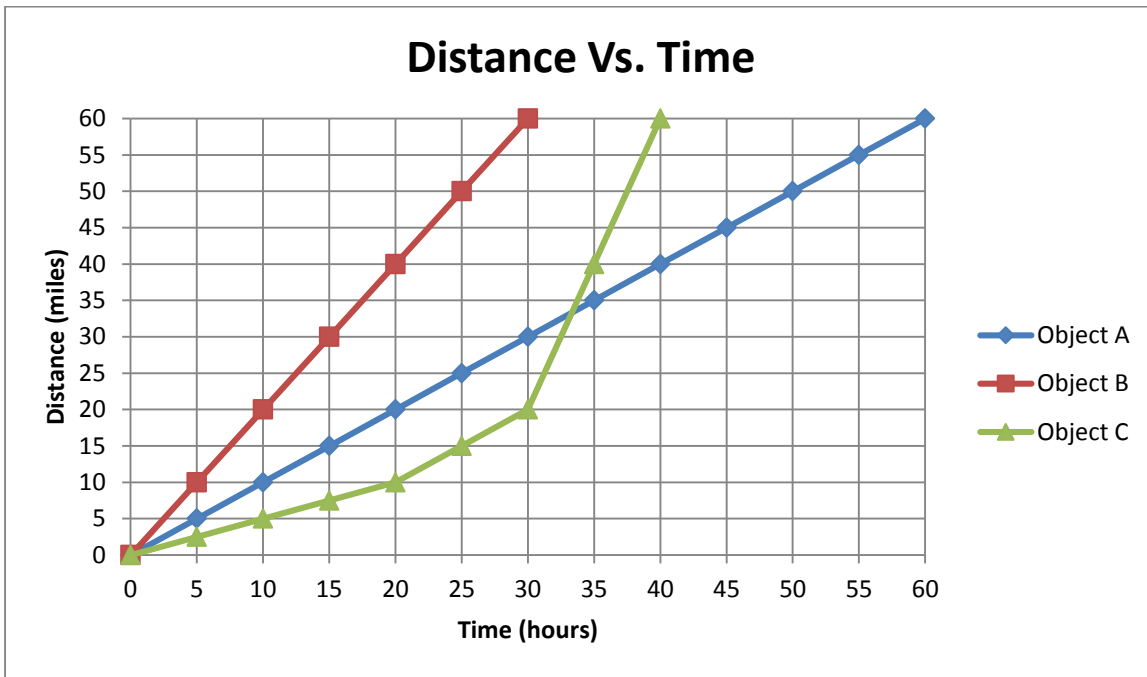
The shape of the line that represents each object should immediately tell you something about its motion compared to the motion of the other objects on the graph. You should be able to make general assumptions about which objects were faster, slower, accelerating, resting, or travelling at constant speeds. However, more precise data can also be calculated with this type of graph. The variables needed to calculate the average speed of an object are provided by a distance vs. time graph. You learned how to calculate the average speed of an object using these variables earlier in this lesson. Use the graph above to answer the following questions.

1. How far did each object travel? _____

2. Which object traveled at the greatest average speed? _____

3. Which object traveled at the slowest average speed? _____

4. What is the average speed of Object A? _____

5. What is the average speed of Object B? _____

6. What is the average speed of Object C? _____

7. Which object accelerated when it was in motion? _____

8. What is the average speed of Object C between 20 and 30 hours? _____

9. What is the average speed of Object C between 30 and 40 hours? _____

10. What is the average speed of Object C between 0 and 20 hours? _____

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Examine each of the following graphs. Then, match each graph to one of the descriptions shown at the bottom of the page.

Graph A

Graph B
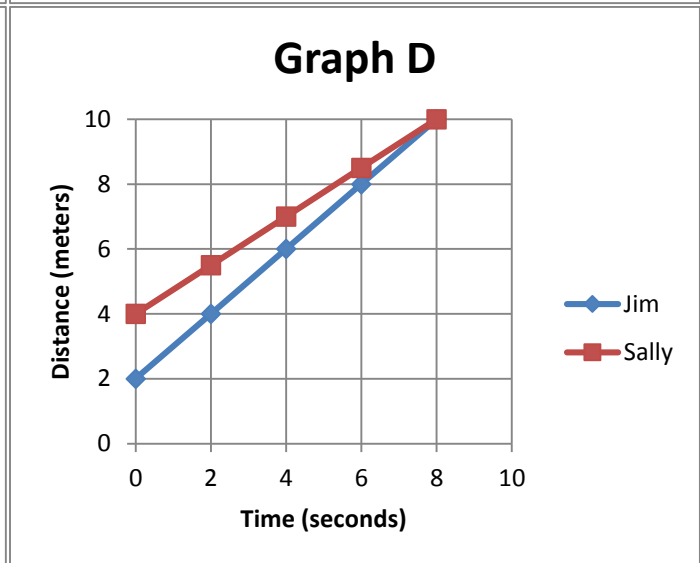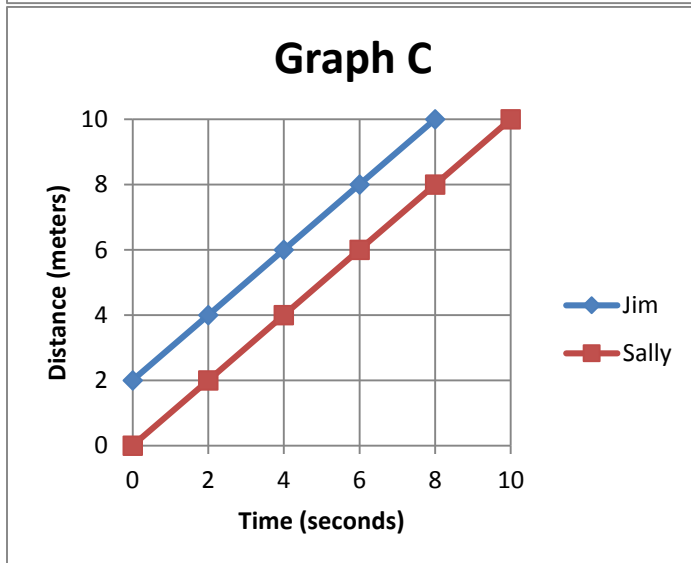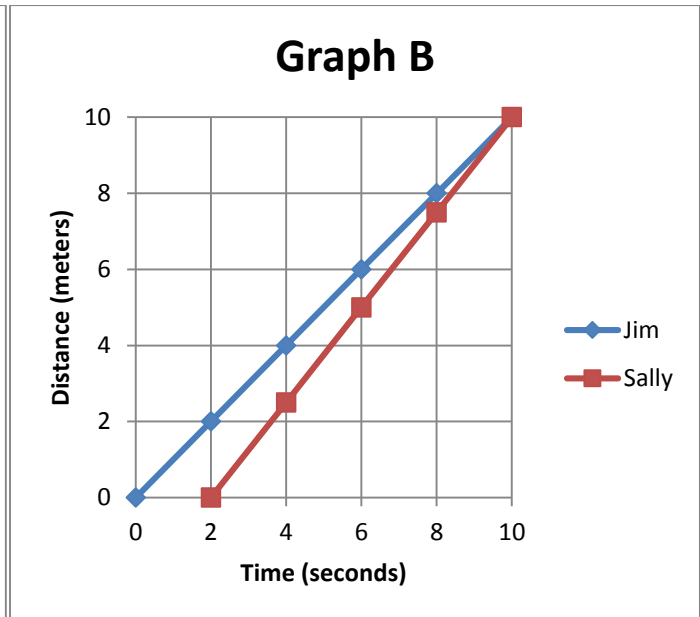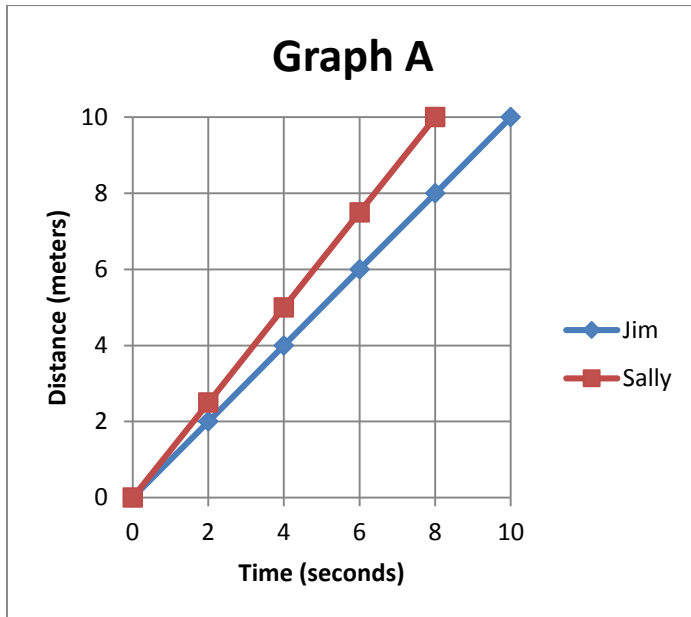
Graph C

Graph D

1. Graph _____ shows that Jim ran a distance of eight meters and Sally ran a distance of six meters.

2. Graph _____ shows that Jim and Sally started from the same place, and Sally ran at a greater average speed than Jim.

3. Graph _____ shows that Jim and Sally did not start at the same time, but they both ran the same distance.

4. Graph _____ shows that Jim and Sally started from different places, but they both travelled at the same average speed.
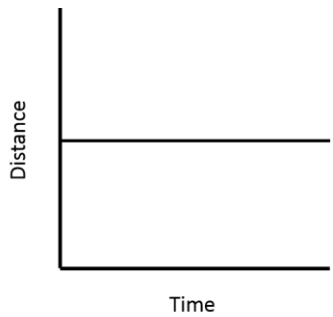
Directions: Examine each graph and then choose the statement that most accurately represents the graph by circling the letter of your choice.
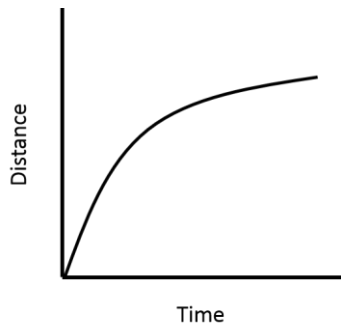
1.
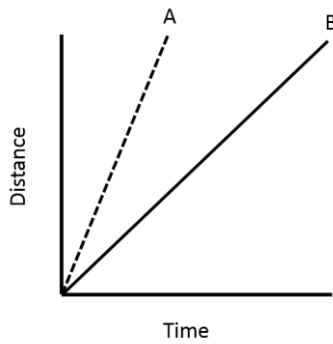
A.   Object B is travelling at a greater rate of speed than Object A.

B.   Object A is travelling at a greater rate of speed than Object B.

C.   Object B is speeding up.

D.   Object A is speeding up.

2.

A.   This object is travelling at a constant speed.

B.   This object is speeding up.

C.   This object is slowing down.

D.   This object is at rest.

3.

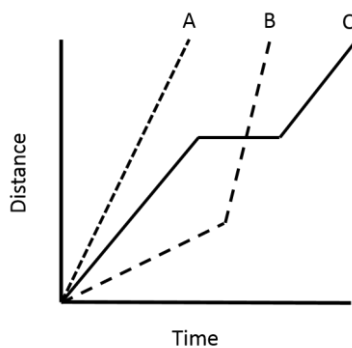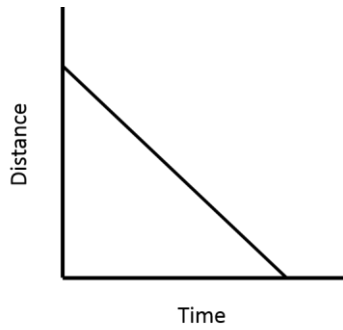A.   This object is travelling at a constant speed

B.   This object is speeding up.

C.   This object is slowing down.

D.   This object is at rest.

4.


A.   Object C traveled farther than Object B.

B.   Object B travelled at lower average speed then Object C.

C.   Object C travelled at the greatest average speed.

D.   Object A travelled at a constant speed.

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5.

A. This object is speeding up.

B. This object's distance from a reference point is decreasing over time.

C. This object's distance from a reference point is increasing over time.

D. This object is slowing down.

6.
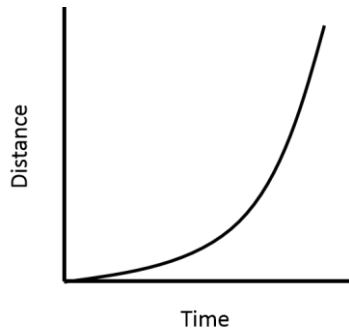
A. This object is speeding up.

B. This object is slowing down.

C. This object is going up a hill.

D. This object is travelling at a constant speed.

7.
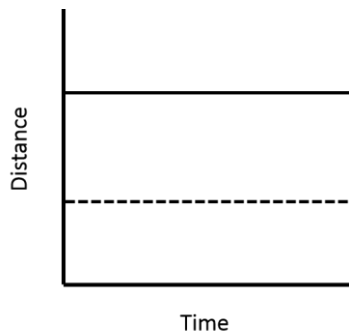
A. These objects are travelling at a constant speed.

B. These objects have stopped in the same location.

C. One of these objects is travelling faster than the other.

D. These objects are at rest in different positions.

8.
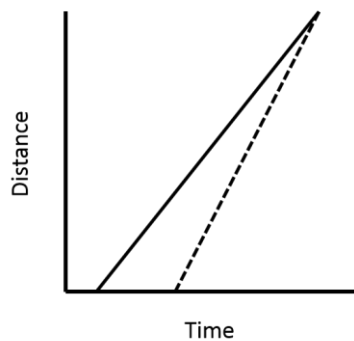
A. These objects started from different positions.

B. These objects travelled for the same amount of time.

C. These objects travelled the same distance.

D. These objects travelled at the same speed.

9.

A.	These two objects were travelling at the same speed, but began moving at different times.

B.	These two objects were travelling at the same speed, but began from different positions.

C.	These two objects are traveling at different speeds.

D.	These two objects are speeding up.

10.
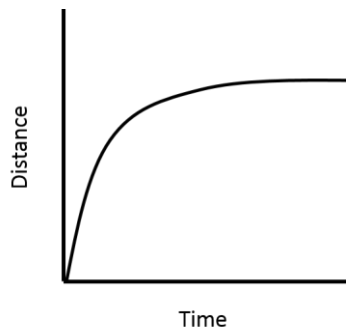
A.	This object slowed down and gradually came to a stop.

B.	This object slowed down and then maintained the same speed.

C.	This object travelled up a hill.

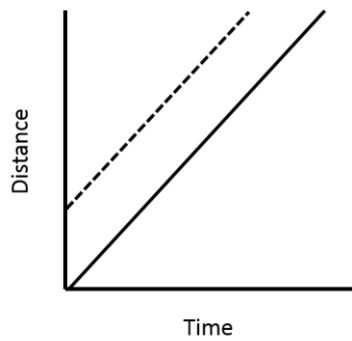D.	This object sped up throughout the entire graph.

11.
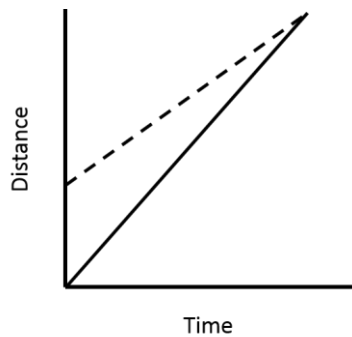
A.	These objects travelled the same distance.

B.	These objects travelled for the same amount of time.

C.	These objects travelled at the same speed.

D.	These objects began travelling at different times.

12.
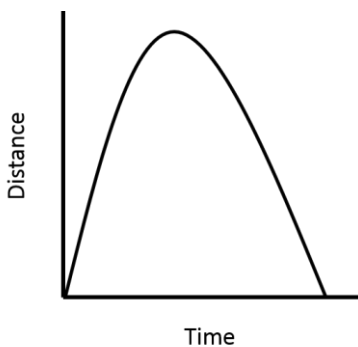
A.	This object travelled up a hill and then down the other side.

B.	This object was thrown into the air and landed several meters away.

C.	This object travelled up hill and then rolled back to the starting position.

D.	This object sped up and then slowed down.

Speed vs. Time Graph

A **speed vs. time** graph illustrates the speed in which an object travelled over time. A speed vs. time graph plots speed on the y axis and time on the x axis. This type of graph is very useful in determining the rate at which an object accelerates. Study the graph and then continue reading to learn how the motion of each of these objects could be interpreted.

Object A: This object is speeding up. Because the line is straight, this object is accelerating at a constant rate. In this graph, Object A's speed is increasing by one mile per hour every hour.

Object B: Object B began at a speed of 10mph, but it steadily decelerated over ten hours before stopping entirely. This object is decelerating at a constant rate. It is slowing down by a rate of one mile per hour every hour.

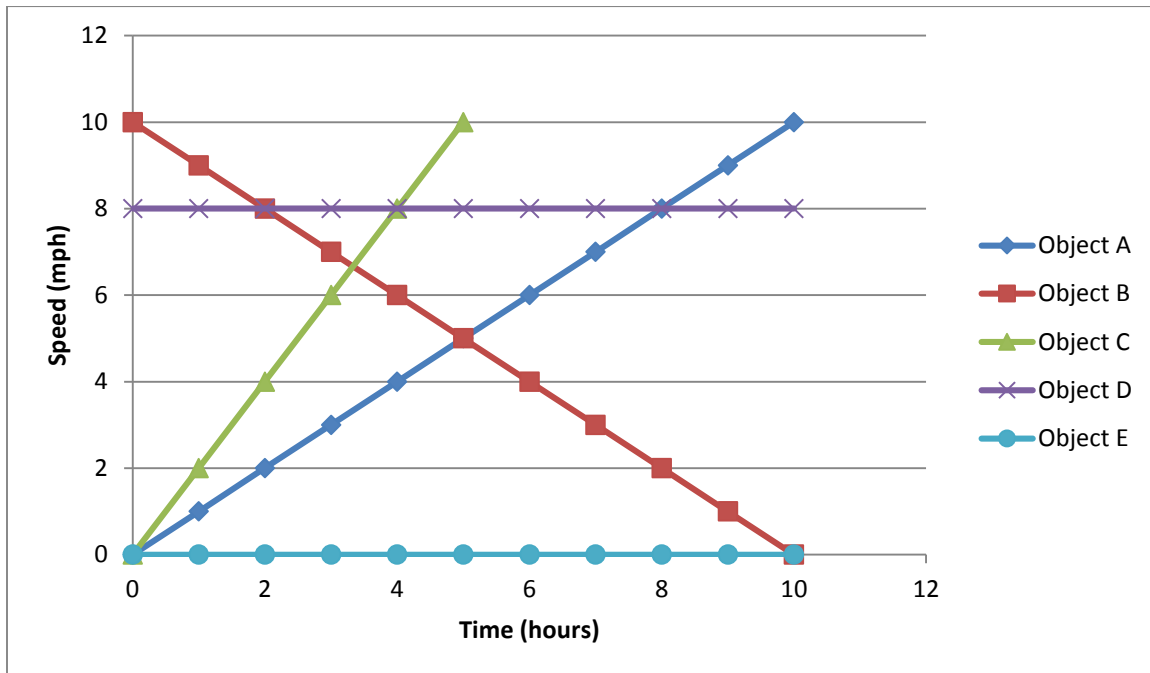Object C: This object is speeding up at a faster rate than Object A. On a speed vs. time graph a steep line, or a line that is closer to vertical, indicates a greater rate of acceleration. On this graph, Object C accelerated at a greater rate than Object A. Object C's speed increased by two miles per hour every hour.

Object D: This object traveled at a constant speed throughout the graph. A horizontal line on a speed vs. time graph indicates that the object is travelling at a constant speed. Object D travelled at a speed of 8mph for 10 hours.

Object E: This object was at rest. Its speed remained zero miles per hour for ten hours.

When reading a graph on the motion of an object, it is very important that you pay attention to the information that is on the axes. Failing to do so could cause you to misinterpret the motion of the object entirely.

On the next page you will complete an activity that may at first glance appear identical to one you have previously completed. However, if you look closely you will notice that speed is graphed on the y axis. Remember that placing speed as the variable on the y axis completely changes the interpretation of the graph.

Directions: Examine each graph and then choose the statement that most accurately represents the graph by circling the letter of your choice.

1.
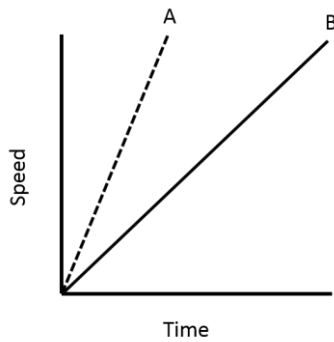
A.   Object B accelerated at a greater rate than Object A.

B.   Object A accelerated at a greater rate than Object B.

C.   Object B traveled at a constant speed.

D.   Object A traveled at a constant speed.

2.
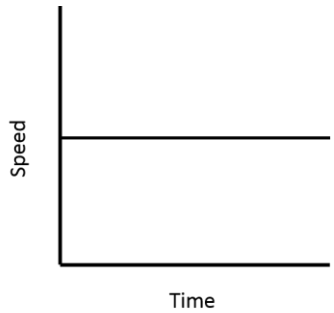
A.   This object is travelling at a constant speed.

B.   This object is speeding up.

C.   This object is slowing down.

D.   This object is at rest.

3.
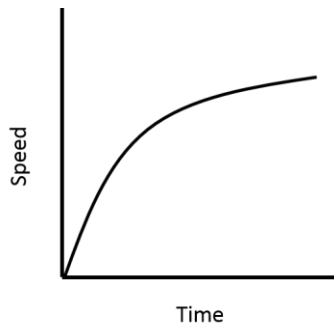
A.   This object is travelling at a constant speed

B.   This object is speeding up.

C.   This object is slowing down.

D.   This object is at rest.

4.
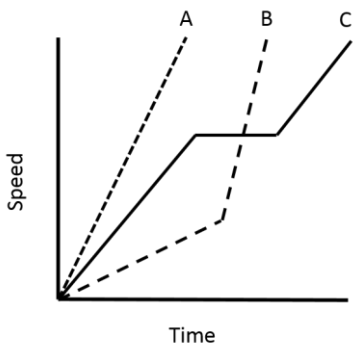
A.   Object A travelled at a constant speed.

B.   Object B travelled at a constant speed and then travelled at a greater constant speed.

C.   Object C travelled at a constant speed for a period of time.

D.   Object C was at rest for a period of time.
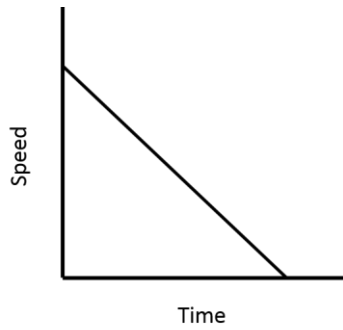
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5.

A.   This object is speeding up.

B.   This object's distance from a reference point is decreasing over time.

C.   This object's distance from a reference point is increasing over time.

D.   This object is slowing down.

6.
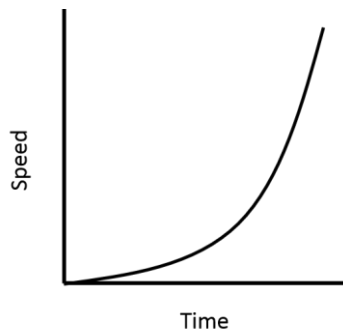
A.   This object is speeding up.

B.   This object is slowing down.

C.   This object is going up a hill.

D.   This object is travelling at a constant speed.

7.
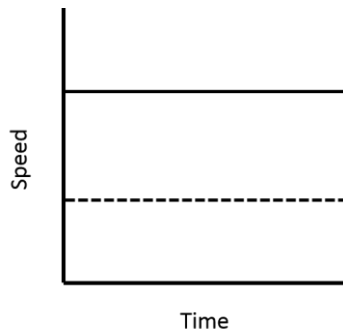
A.   These objects started moving from different positions.

B.   These objects have stopped in the same location.

C.   One of these objects is travelling faster than the other.

D.   These objects are at rest in different positions.

8.
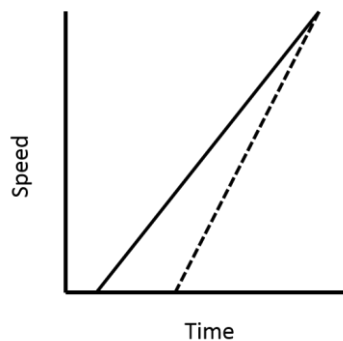
A.   These objects started from different positions.

B.   These objects travelled for the same amount of time.

C.   These objects accelerated at the same rate.

D.   These objects accelerated at different rates.

9.
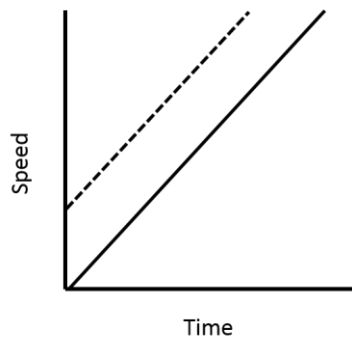
Speed / Time (graph)

A. These two objects were travelling at the same speed, but began moving at different times.

B. These two objects were travelling at the same speed, but began from different positions.

C. These two objects began moving at different speeds.

D. These two objects are travelling at a constant speed.

10.

Speed / Time (graph)

A. This object slowed down and gradually came to a stop.

B. This object slowed down and then maintained the same speed.

C. This object travelled up a hill.

D. This object sped up throughout the entire graph.

11.

Speed / Time (graph)

A. These objects travelled the same distance.

B. These objects travelled for the same amount of time.

C. These objects travelled at the same speed.

D. These objects began travelling at different times.

12.

Speed / Time (graph)

A. This object travelled up a hill and then down the other side.

B. This object was thrown into the air and landed several meters away.

C. This object travelled up hill and then rolled back to the starting position.

D. This object sped up and then slowed down to a stop.

A Story of Motion

Directions: Study the following graph. Then, create a story that matches the graph. Be sure to focus on the motion of the object. You may want to use terms such as speeding up, slowing down, at rest, constant speed, accelerating, decelerating, etc., to describe the motion of the object. Be as specific as possible.

A Story of Motion

Speed (meters per second) vs. _Time (seconds)_

Y-Values

_____

_____

_____

_____

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Distance-Time Tables

Information about an object's motion can also be displayed as a Distance-Time Table. These tables are very similar to the distance vs. time graphs you have used in the past. You can use these tables to interpret the motion of objects as well. Distance-Time Tables provide the data needed to calculate the speed of objects for periods of their motion and create distance vs. time graphs.

> Ex.   Sally likes to ride her bike when she gets home from school. The following table shows Sally's motion for a portion of her ride.

Sally's Bicycle Ride

Distance	Time	Speed
0 meters	0 seconds	0.00 m/s
20 meters	8 seconds	2.50 m/s
40 meters	15 seconds	2.85 m/s
60 meters	21 seconds	3.33 m/s
80 meters	26 seconds	4.00 m/s
100 meters	30 seconds	5.00 m/s

Which of the following statements best describe Sally's motion during this portion of her bicycle ride?
- A. Sally sped up and then slowed down during this portion of her ride.
- B. Sally slowed down and then sped up during this portion of her ride.
- C. Sally sped up throughout this entire portion of her ride.
- D. Sally slowed down throughout this entire portion of her ride.

To answer this question accurately, you will have to interpret, or understand, the data in the table. In most cases, a table will not give you the immediate indication of an object's motion that a graph will. There are several ways to understand what the data in a distance-time table is indicating about an objects motion.

The first way is to find the difference in time for each increment of distance travelled. Because time data was recorded in consistent increments of 20 meters, we can calculate the difference in time it took Sally to travel each 20 meters.

It took Sally 8 seconds to travel the first 20 meters. It took her 7 seconds to travel the next 20 meters. This was calculated by taking the time it took her to travel to the 40 meter mark, 15 seconds, and finding the difference of the time it took her to get to the 20 meter mark, 8 seconds. We can now begin to compare Sally's motion for each additional 20 meter increment of her ride.

In addition, once we have this data we can also calculate the average speed at which Sally traveled each 20 meter portion of her ride.   (*All calculations have been rounded to the nearest hundredth.*)

0 – 20 meters in 8 seconds (8 – 0 = 8)	or	S = D/T	20 meters / 8 seconds = 2.50 m/s
20 – 40 meters in 7 seconds (15 – 8 = 7)	or	S = D/T	20 meters / 7 seconds = 2.85 m/s
40 – 60 meters in 6 seconds (21 – 15 = 6)	or	S = D/T	20 meters / 6 seconds = 3.33 m/s
60 – 80 meters in 5 seconds (26 – 21 = 5)	or	S = D/T	20 meters / 5 seconds = 4.00 m/s
80 – 100 meters in 4 seconds (30 – 26 = 4)	or	S = D/T	20 meters / 4 seconds = 5.00 m/s

Because of these calculations, we can conclude that C is the best answer choice. Sally sped up throughout the entire ride based on the data provided by the table. By calculating the difference in the amount of time Sally travelled each 20 meter increment, we can determine that it took her less time to travel each additional 20 meters. We can most clearly see that she is speeding up from the speed calculations performed.

In addition, the information from the table can be used to make a distance vs. time graph. This is a less practical step if you only need to calculate an object's motion, however it is a useful tool for displaying data and making quick interpretations about an object's motion easier for others to comprehend.

Use the information from the previous table to plot Sally's motion on the distance vs. time graph below. Illustrating this data in the form of a graph should only further prove that your calculations were correct.

Sally's Bicycle Ride

(Empty distance vs. time graph: y-axis labeled "Distance" with gridlines at 0, 20, 40, 60, 80, 100; x-axis labeled "Time" with gridlines at 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30.)

Now that you have learned how to interpret data from a distance-time table, try to use those skills to correctly describe the motion of several objects by completing the following.

Directions: Calculate the speeds of each object and fill in the tables below. Choose the statements that most correctly represent each of the distance-time tables that follow. (Remember that you can calculate the speed of an object for each period of its motion to help you interpret the tables if necessary.

1. Jim's mom walks to work in the mornings. The office where she works is only 100 meters from her home. The following table shows the time it took her to travel to work this morning.

Jim's Mom's Walk to Work

Distance	Time	Speed
0 meters	0.0 seconds	
20 meters	15.7 seconds	
40 meters	24.6 seconds	
60 meters	43.0 seconds	
80 meters	55.3 seconds	
100 meters	66.7 seconds	

Which of the following statements best describe Jim's mother's motion during the 25 meter race?

A. Jim's mother was speeding up throughout her entire walk to work.
B. Jim's mother was slowing down throughout her entire walk to work.
C. Jim's mother sped up and then slowed down during her walk to work.
D. Jim's mother slowed down and then sped up during her walk to work.

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2. Jim and Sally went on vacation with their family. They took the family car and drove to the beach. The following table displays data about a portion of their drive.

Motion of Car

Distance		Time		Speed
0	meters	0.0	seconds	
50	meters	4.3	seconds	
100	meters	8.6	seconds	
150	meters	12.9	seconds	
200	meters	17.2	seconds	
250	meters	21.5	seconds	

Which of the following statements best describe the motion of the car?

    A.   The car was speeding up.
    B.   The car was travelling at a constant speed.
    C.   The car was slowing down.
    D.   The car sped up and then slowed down.

3. Jim ran a 25 meter race against his friend Sally during recess. The following table shows the time it took Jim to run that distance in five meter increments.

Jim's 25 Meter Dash

Distance		Time	Speed
0	meters	0.00 seconds	
5	meters	1.27 seconds	
10	meters	2.61 seconds	
15	meters	4.12 seconds	
20	meters	5.90 seconds	
25	meters	7.72 seconds	

Which of the following statements best describe Jim's motion during the 25 meter race?

    A.   Jim was speeding up during the race.
    B.   Jim was slowing down during the race.
    C.   Jim was running at a constant speed.
    D.   Jim sped up and then slowed down.

Information about an object's motion can also be displayed as a Distance-Time Table. These tables are very similar to the distance vs. time graphs you have used in the past. You can use these tables to interpret the motion of objects as well. Distance-Time Tables provide the data needed to calculate the speed of objects for periods of their motion and create distance vs. time graphs.

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Sally's Bicycle Ride

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80 meters	26 seconds	4.00 m/s
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C. Sally sped up throughout this entire portion of her ride.
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It took Sally 8 seconds to travel the first 20 meters. It took her 7 seconds to travel the next 20 meters. This was calculated by taking the time it took her to travel to the 40 meter mark, 15 seconds, and finding the difference of the time it took her to get to the 20 meter mark, 8 seconds. We can now begin to compare Sally's motion for each additional 20 meter increment of her ride.
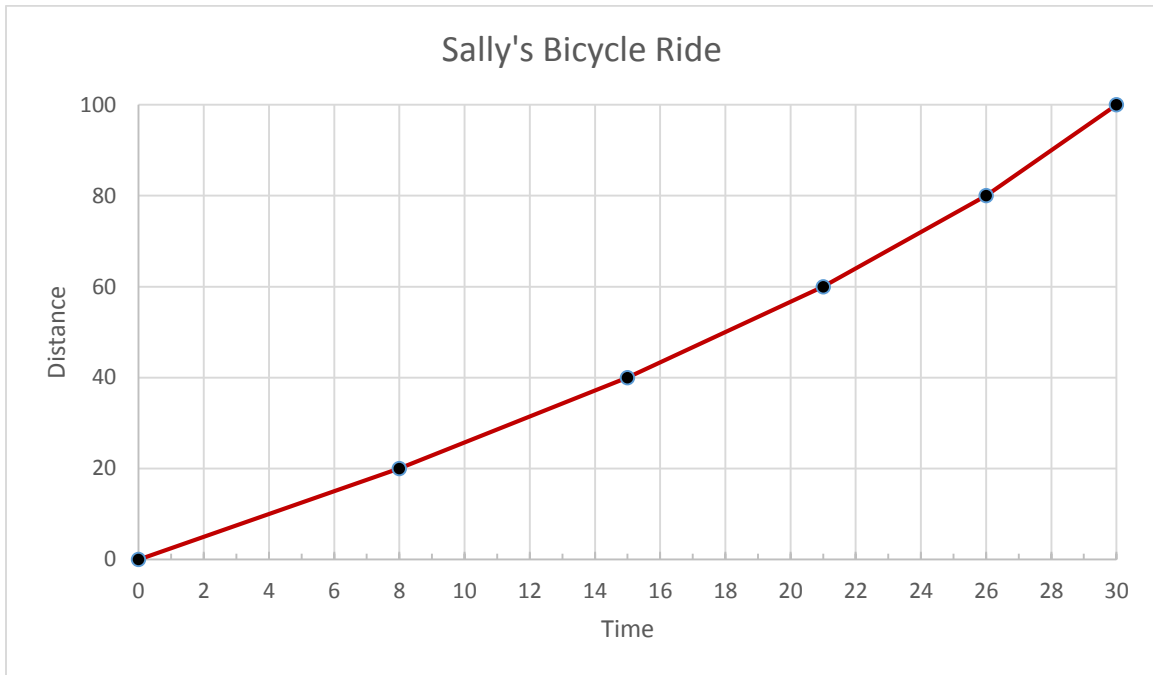
In addition, once we have this data we can also calculate the average speed at which Sally traveled each 20 meter portion of her ride.   (*All calculations have been rounded to the nearest hundredth.*)

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40 – 60 meters in 6 seconds (21 – 15 = 6)	or	S = D/T	20 meters / 6 seconds = 3.33 m/s
60 – 80 meters in 5 seconds (26 – 21 = 5)	or	S = D/T	20 meters / 5 seconds = 4.00 m/s
80 – 100 meters in 4 seconds (30 – 26 = 4)	or	S = D/T	20 meters / 4 seconds = 5.00 m/s

Because of these calculations, we can conclude that C is the best answer choice. Sally sped up throughout the entire ride based on the data provided by the table. By calculating the difference in the amount of time Sally travelled each 20 meter increment, we can determine that it took her less time to travel each additional 20 meters. We can most clearly see that she is speeding up from the speed calculations performed.

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Sally's Bicycle Ride

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Jim's Mom's Walk to Work

Distance		Time		Speed
0	meters	0.0	seconds	**0.00 m/s**
20	meters	15.7	seconds	**1.27 m/s**
40	meters	38.3	seconds	**0.88 m/s**
60	meters	66.7	seconds	**0.70 m/s**
80	meters	82.9	seconds	**1.23 m/s**
100	meters	95.8	seconds	**1.55 m/s**

Which of the following statements best describe Jim's mother's motion during the 25 meter race?

    A. Jim's mother was speeding up throughout her entire walk to work.
    B. Jim's mother was slowing down throughout her entire walk to work.
    C. Jim's mother sped up and then slowed down during her walk to work.
    D. Jim's mother slowed down and then sped up during her walk to work.

2. Jim and Sally went on vacation with their family. They took the family car and drove to the beach. The following table displays data about a portion of their drive.

Motion of Car

Distance		Time		Speed
0	meters	0.0	seconds	0.00 m/s
50	meters	4.3	seconds	11.63 m/s
100	meters	8.6	seconds	11.63 m/s
150	meters	12.9	seconds	11.63 m/s
200	meters	17.2	seconds	11.63 m/s
250	meters	21.5	seconds	11.63 m/s

Which of the following statements best describe the motion of the car?

    A.   The car was speeding up.
    B.   The car was travelling at a constant speed.
    C.   The car was slowing down.
    D.   The car sped up and then slowed down.

3. Jim ran a 25 meter race against his friend Sally during recess. The following table shows the time it took Jim to run that distance in five meter increments.

Jim's 25 Meter Dash

Distance		Time	Speed
0	meters	0.00 seconds	0.00 m/s
5	meters	1.27 seconds	3.94 m/s
10	meters	2.61 seconds	3.73 m/s
15	meters	4.12 seconds	3.31 m/s
20	meters	5.90 seconds	2.81 m/s
25	meters	7.72 seconds	2.75 m/s

Which of the following statements best describe Jim's motion during the 25 meter race?

    A.   Jim was speeding up during the race.
    B.   Jim was slowing down during the race.
    C.   Jim was running at a constant speed.
    D.   Jim sped up and then slowed down.

Answer Key

Page 3

1.	S = D/T	S = 24 m / 4s	S = 6 m/s
2.	D = S X T	D = 40 mi/hr X 8 hr	D = 320 mi
3.	D = S X T	D = 28 m/s X 5 s	D = 140 m
4.	T = D/S	T = 800 km / 100 km/hr	T = 8 hr
5.	S = D/T	S = 60 m / 4 s	S = 15 m/s
6.	T = D/S	T = 5,000 mi / 500 mi/hr	T = 10 hr
7.	S = D/T	S = 25 mi / 5 hr	S = 5 mi/hr
8.	D = S X T	D = 3 mi/hr X 7 hr	D = 21 mi

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1.	60 mi		
2.	Object B		
3.	Object A		
4.	S = D/T	S = 60 mi / 60 hr	S = 1 mi/hr
5.	S = D/T	S = 60 mi / 30 hr	S = 2 mi/hr
6.	S = D/T	S = 60 mi / 40 hr	S = 1.5 mi/hr
7.	Object C		
8.	S = D/T	S = 10 mi / 10 hr	S = 1 mi/hr
9.	S = D/T	S = 40 mi / 10 hr	S = 4 mi/hr
10.	S = D/T	S = 10 mi / 20 hr	S = 0.5 mi/hr

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1. D
2. A
3. B
4. C

Page 9

1. B
2. D
3. C
4. D

Page 10

1. B
2. A
3. D
4. C

Page 11

1. B
2. A
3. B
4. C

Page 13

1. B
2. A
3. B
4. C

Page 14

1. D
2. A
3. C
4. D

Page 15

1. C
2. B
3. B
4. D

Page 18-19

1. D
2. B
3. B