Interpreting Graphs

Objective:
Students will interpret a graph and the vertical and horizontal translations of the graph.

Connections to Previous Learning:
Students should have knowledge of use of line graphs.

Connections to AP:
AP Calculus topic of analysis of functions

Time Frame:
30 minutes

Materials:
Worksheet

Teacher Notes:
After the students have completed the worksheet in groups of two or three students, they need to discuss the reasons for their answers.

Interpreting Graphs

1. Amy shot a toy rocket straight up into the air from the ground. The graph below represents the height in meters of the rocket at a given time in seconds. Use the graph to answer the following:

a)   When is the rocket on the ground?

b)   What is the maximum height of the rocket?

c)   When is the rocket at its highest?

d)   Approximate the height of the rocket at 1 second.

e)   Find the approximate time that the rocket is 7 meters high.

f)   How many meters did the rocket travel from 0 seconds to 1 second?

g)   Use your answer to part f to predict how many meters the rocket will travel from 0.5 seconds to 1.5 seconds.
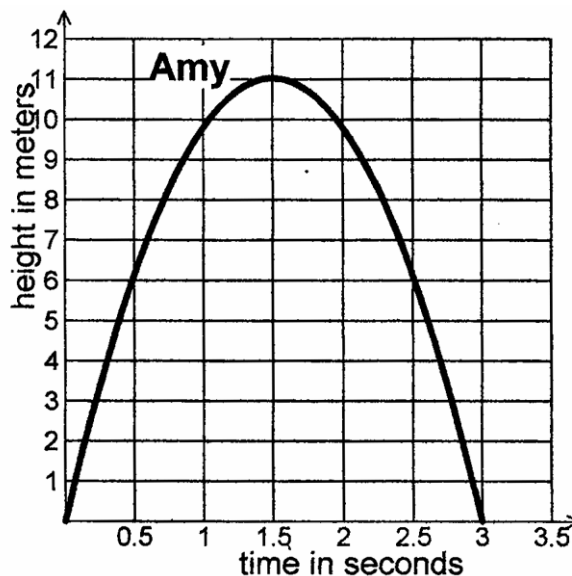
h) Use the graph to determine the number of meters the rocket traveled from 0.5 seconds to 1.5 meters. Was your prediction correct, too high, or too low?

i) Using your answers to problems f, g, and h, is the rocket traveling at a constant rate of speed in meters per second? Explain your answer.

j) What heights make sense for this problem?

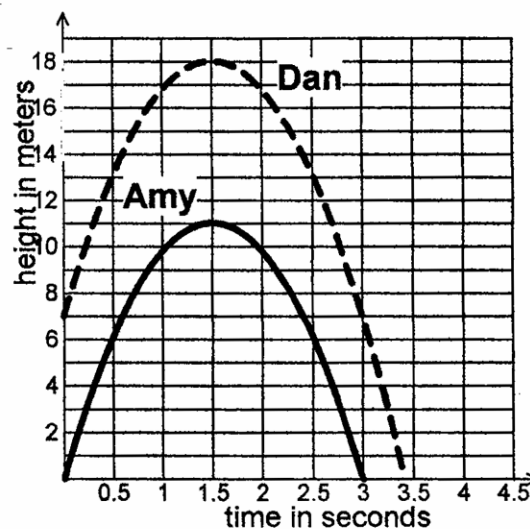k) What times make sense for this problem?

2. Amy and Matt each shot a toy rocket into the air from the ground. The graphs below represent the height in meters of the two rockets at a given time in seconds.

a) When is each rocket on the ground?

b) What is the maximum height of each rocket?

c) When is each rocket at its highest?

d) Find the approximate times that each rocket is 6 and 8 meters high.

e) What heights make sense for Matt's rocket?

f) What times make sense for Matt's rocket?
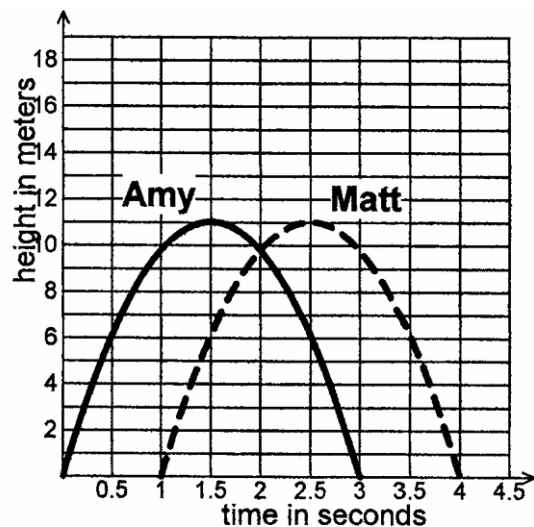
g) Trace Amy's graph on patty paper. Use this graph to compare Amy's graph to Matt's graph. How are the graphs the same? How are they different?

h) Create a story to explain the graphs. Include heights and times in the story.

3. Amy and Dan each shot a toy rocket into the air. The graph below represents the height in meters of the two rockets at a given time in seconds. Answer the following:

a) When is each rocket on the ground?

b) What is the maximum height of each rocket?

c) When is each rocket at its highest?

d) Find the approximate heights of each rocket at 0 and 0.5 seconds.

e) What heights make sense for Dan's rocket?

f) What times make sense for Dan's rocket?

g) Use the patty paper graph you made in problem 2 g) to compare Amy's graph to Dan's graph. How are the graphs the same? How are they different?

h) Create a story to explain the graphs. Include heights and times in the story.

69
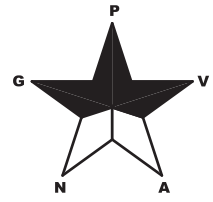
Interpreting Graphs

Answers:

1. The answers to question 1 are as follows:

   a)   The rocket is on the ground at 0 and 3 seconds.

   b)   The maximum height of the rocket is 11 meters.

   c)   The rocket is at the maximum height at 1.5 seconds.

   d)   At 1 second the rocket is approximately 9.8 meters high.

   e)   The rocket is 7 meters from the ground at approximately 0.6 and 2.4 seconds.

   f)   The rocket traveled about 9.8 meters into the air.

   g)   Answers will vary.

   h)   The rocket traveled about 5 meters into the air.

   i)   As the rocket travels into the air the rocket's speed is decreasing because of gravity.

   j)   The rocket's heights are from 0 to 11 meters.

   k)   The rocket is in the air from 0 to 3 seconds.

2. The answers to question 2 are as follows:

   a)   Amy 0 and 3 seconds   Matt 1 and 4 seconds

   b)   Amy 11 meters   Matt 11 meters

   c)   Amy 1.5 seconds   Matt 2.5 seconds

   d)   Amy 6 meters at 0.5 and 2.5 seconds   8 meters at 0.75 and 2.25 seconds
         Matt 6 meters at 1.5 and 3.5 seconds   8 meters at 1.75 and 3.25 seconds

   e)   From 0 to 11 meters

   f)   From 1 to 4 seconds

g)   The graphs are the same size and shape. Matt's graph has been translated one second to the right. Matt's rocket travels the same distance up into the air but it travels one second later Amy's rocket.

h)   Amy shot a rocket into the air.   Amy's rocket reached a maximum height of 11 meters at 1.5 seconds and returned to the ground at 3 seconds. Matt shot a rocket into the air 1 second after Amy. Matt's rocket reached a maximum height of 11 meters at 2.5 seconds and returned to the ground at 4 seconds.

3. The answers to question 3 are as follows:

a)   Amy 0 and 3 seconds   Dan 3.5 seconds

b)   Amy 11 meters   Dan 18 meters

c)   Amy 1.5 seconds   Dan 1.5 seconds

d)   Amy 0 seconds height 0 meters   0.5 seconds height 6 meters
     Dan 0 seconds height 7 meters   0.5 seconds height 13 meters

e)   From 0 to 18 meters

f)   From 0 to 3.5 seconds

g)   The graphs are the same shape. Dan's graph has been translated 7 meters up. Dan's rocket is shot up into the air at the same time but begins 7 meters above the ground so that the heights are 7 meters above Amy's rocket's heights.

h)   Amy shot a rocket into the air from the ground. Amy's rocket reached a maximum height of 11 meters at 1.5 seconds and returned to the ground at 3 seconds. Dan shot a rocket into the air at the same time Amy shot her rocket. Dan's rocket was shot from a platform that is 7 meters above the ground. Dan's rocket reached a maximum height of 18 meters at 1.5 seconds and returned to the ground at 3.5 seconds because it had farther to travel to reach the ground.