Linear Equations: Expressions and Diagrams

A Closer Look at the Video

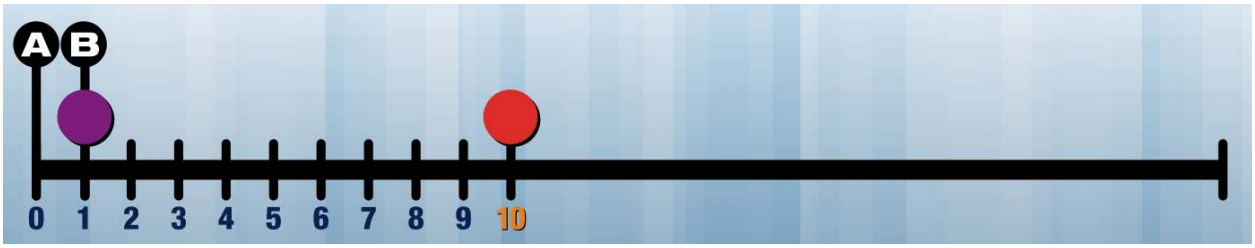
After watching the *Linear Equations: Expressions and Diagrams* video, make sense of the mathematics by reading through the problem situation and solution. Use the comments and questions in bold to help you create expressions and diagrams for the situation.

Problem: Scott and Shawn each set up camp at two different places along a trail. Scott is at checkpoint A and Shawn is one mile down the trail at checkpoint B. Scott leaves checkpoint A and runs 10 miles down the trail before Shawn starts running. Scott is running at an average rate of 4 mph, and Shawn is running at an average rate of 7 mph. How many hours will it take for Shawn to catch up with Scott, and where will they meet?

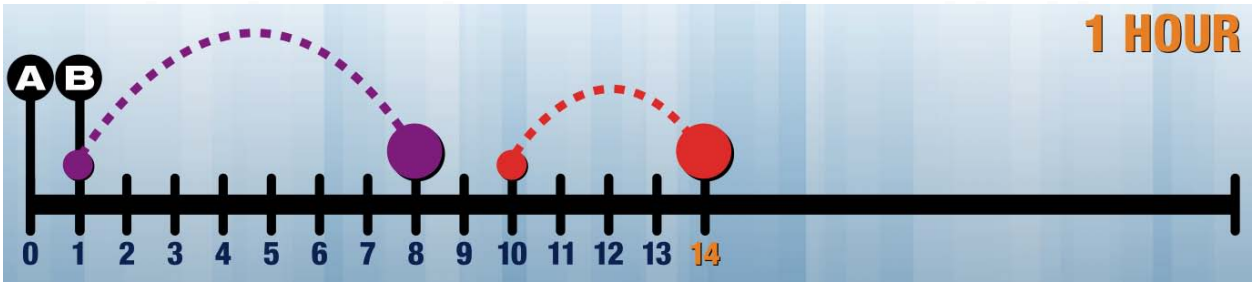
There are many ways to solve a problem. One way is to draw a picture or diagram in order to make sense of the situation. The diagram can be used to help find the answer to the question and create algebraic expressions that represent the problem. An algebraic equation can then be used to check the solution.

How can a diagram be created for the situation?
By drawing a line to represent the trail, one can see where each runner is on the trail when Shawn begins to run. At the start, Scott is at checkpoint A. Shawn is one mile down the trail at checkpoint B. This is illustrated in the following diagram.

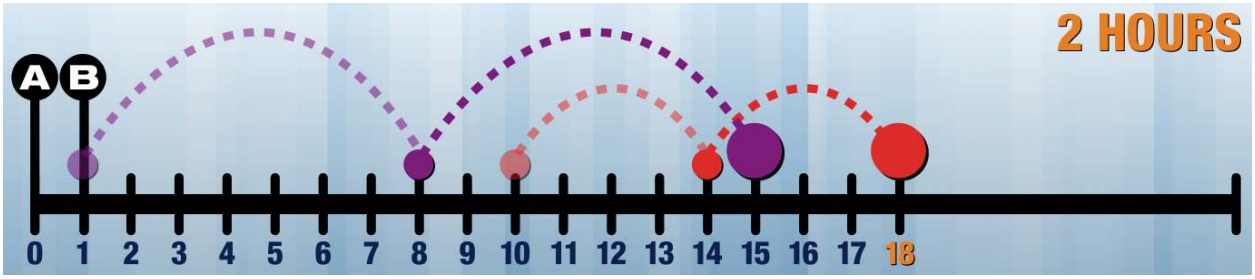
By the time Shawn begins to run, Scott is already 10 miles down the trail. In the diagram, Scott is now at mile marker 10.



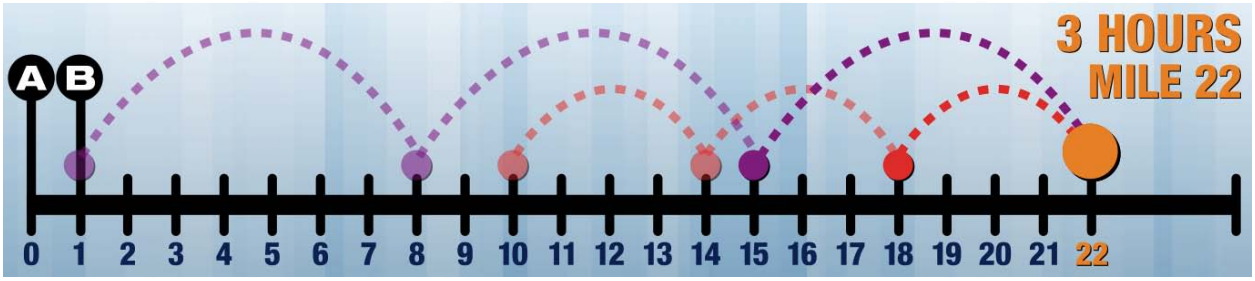
Scott is running at 4 mph, and Shawn is running at 7 mph. After one hour, Scott would be 4 more miles down the trail at mile marker 14 (because 10+4=14). Shawn would be 7 more miles down the trail at mile marker 8 (because 1+7=8).



After the second hour, Scott would be another four miles down the trail at mile marker 18 (because 14+4=18). Shawn would be another seven miles down the trail at mile marker 15 (because 8+7=15).



After three hours, Scott would be four more miles down the trail at mile marker 22 (because 18+4=22). Shawn would be seven more miles down the trail, which also places him at mile marker 22 (because 15+7=22).



Therefore, Shawn will catch up with Scott in 3 hours at mile marker 22.

How can expressions be created for the situation?
Scott travels at a rate of 4 mph. In one hour, he will travel 4 miles. In two hours, he will travel 4·2 or 8 miles. For an unknown number of hours, Scott will travel 4·h where h is the number of hours. This can be summarized in the following table:

rate (mph)	# of hours (h)	distance (d)
4	1	4·1
4	2	4·2
4	h	4·h

Since Scott was 10 miles down the trail when Shawn started, Scott's distance (d) from checkpoint A will be the distance he traveled for an unknown number of hours plus 10 miles. That is, d = 4h + 10

Shawn travels at a rate of 7 mph. In one hour, he will travel 7 miles. In two hours, he will travel 7·2 or 14 miles. For an unknown number of hours, Shawn will travel 7·h where h is the number of hours. This can also be summarized in the following table:

Rate	Hours	Distance
7	1	7·1
7	2	7·2
7	h	7·h

Shawn started out 1 mile down the trail from checkpoint A. Therefore, his distance (d) from checkpoint A will be the distance he traveled for an unknown number of hours plus 1 mile. This is, d = 7h + 1

How can these expressions help check the solution?
When Scott and Shawn meet, they will have traveled the same distance from checkpoint A.

Scott's Distance = Shawn's Distance
4h + 10 = 7h + 1

The answer we found using the diagram was 3 hours. **This answer can be checked by substituting 3 hours into the equation for h**.

Scott's distance

d = 4h+10
d = 4(3) + 10
d = 12 + 10
d = 22

Shawn's distance

d = 7h+1
d = 7(3)+1
d = 21+1
d = 22

This checks! Scott and Shawn will meet in 3 hours at mile marker 22.