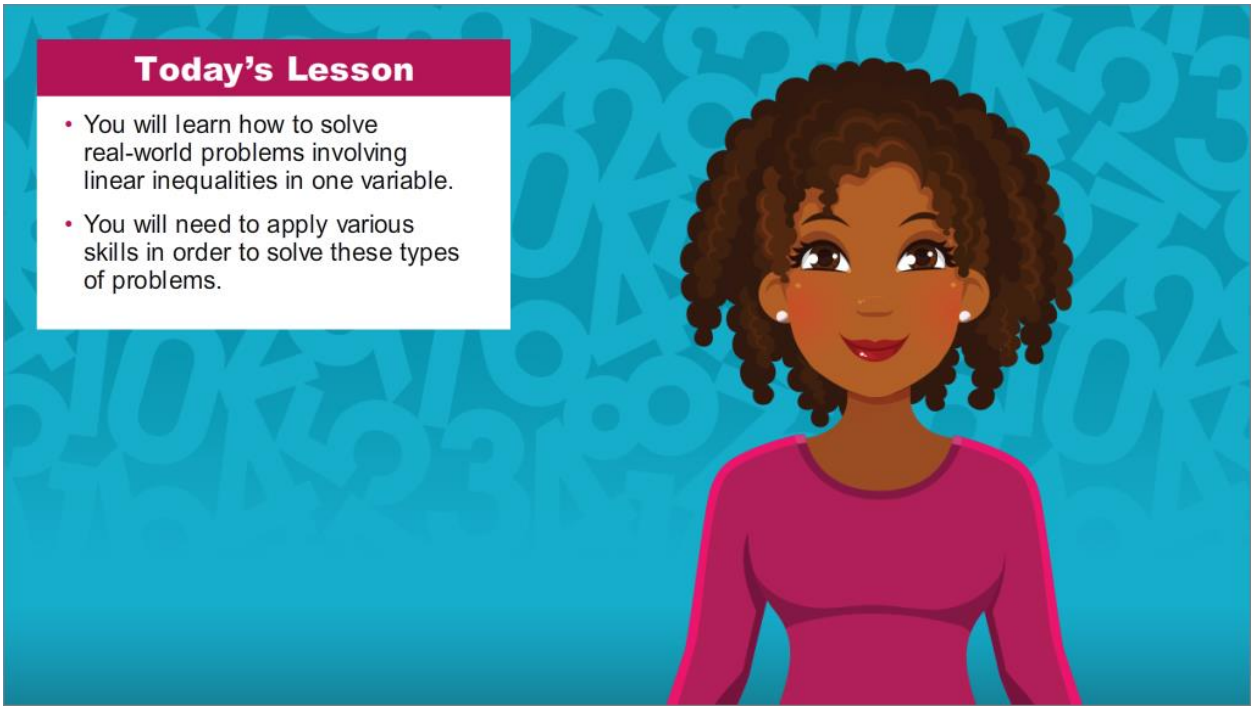
Module 7: Solving Linear Inequalities
Topic 4: Real-World Linear Inequalities in One Variable

Introduction



I'm glad to have you here for this lesson in Algebra I, where you will learn how to solve real-world problems involving linear inequalities in one variable. Get ready to apply various skills in order to solve these types of problems. Let's dive in!

Inequalities in Real-World Scenarios

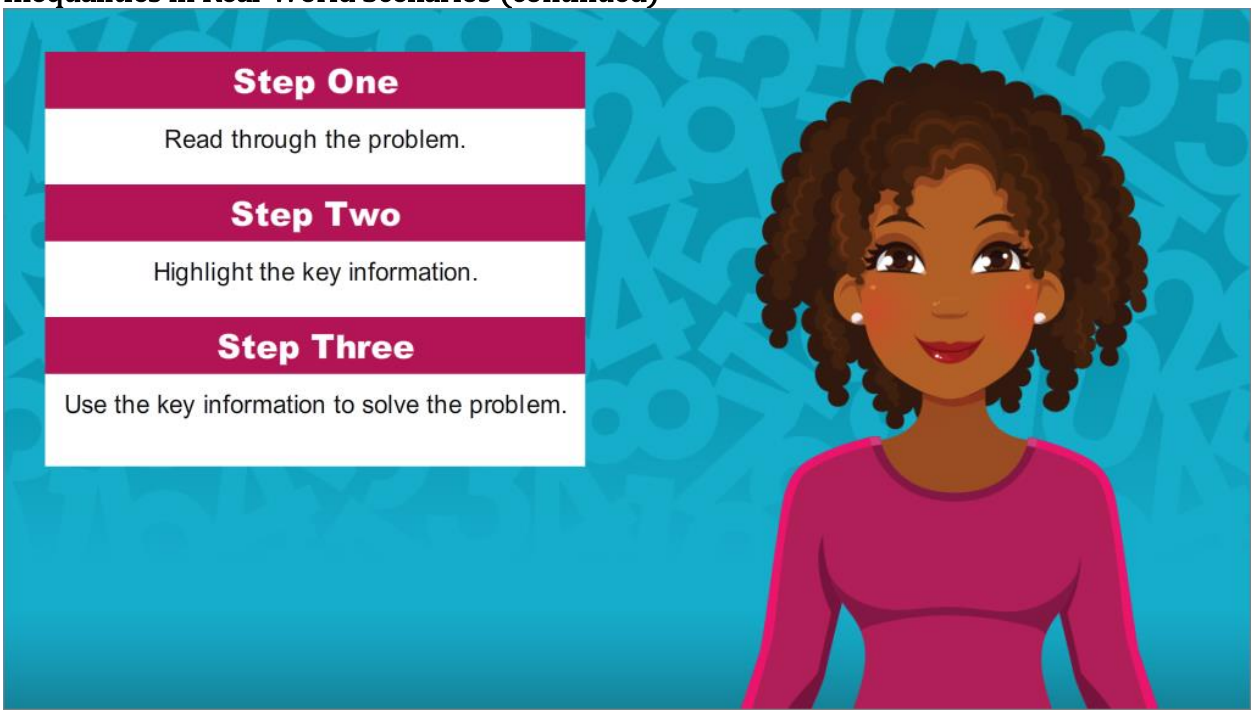
Inequalities can often be used to model real-world scenarios. For example, you must be at least four feet tall to ride a roller coaster at the local amusement park. One way to interpret this example is that you must be four feet or taller in order to ride a roller coaster.

The inequality, $x \geq 4$, can be used to represent this situation.

Inequalities in Real-World Scenarios (continued)

There are countless real-world scenarios than can be represented by linear inequalities. Sometimes, the scenario includes a small amount of information and can be modeled by a simple inequality. At other times, however, the real-world scenario includes multiple pieces of information and it will take some effort to interpret the facts you are given.

Inequalities in Real-World Scenarios (continued)

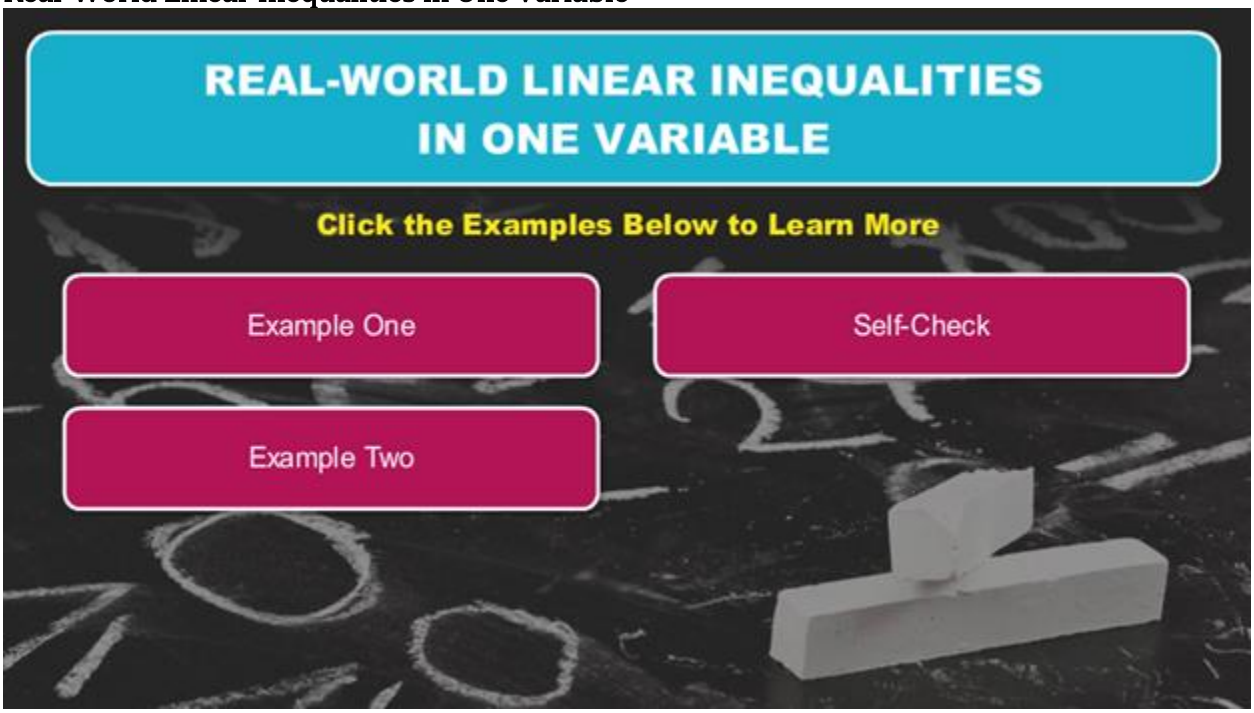


Here are three steps that will help you solve real-world problems that include multiple pieces of information:

Step 1: Read through the problem
Step 2: Highlight the key information
Step 3: Use the key information to solve the problem

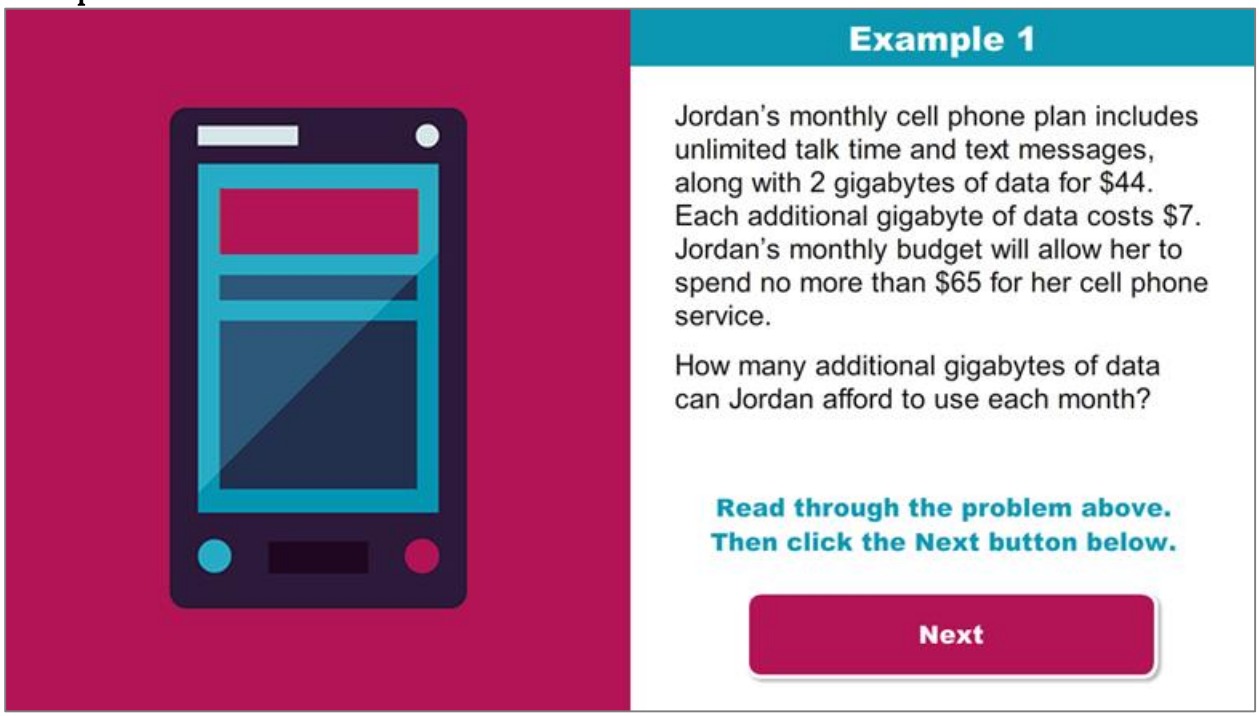
Keep these steps in mind while you work through the following examples.

Real-World Linear Inequalities in One Variable



Click the examples below to learn more.

Example 1

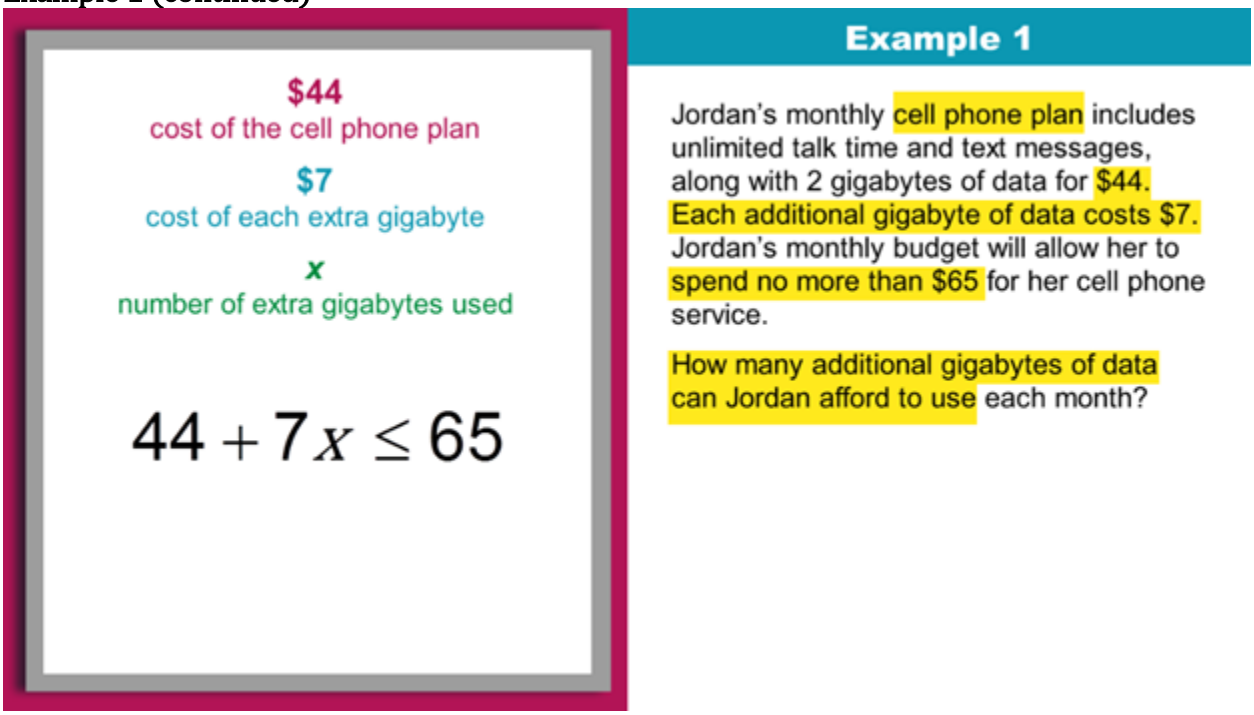


Jordan's monthly cell phone plan includes unlimited talk time and text messages, along with 2 *gigabytes of data for* $44*. Each additional gigabyte of data costs* $7*. Jordan's monthly budget will allow her to spend no more than* $65 *for her cell phone service.*

How many additional gigabytes of data can Jordan afford to use each month?

Read through the problem above. Then click the Next button below.

Example 1 (continued)

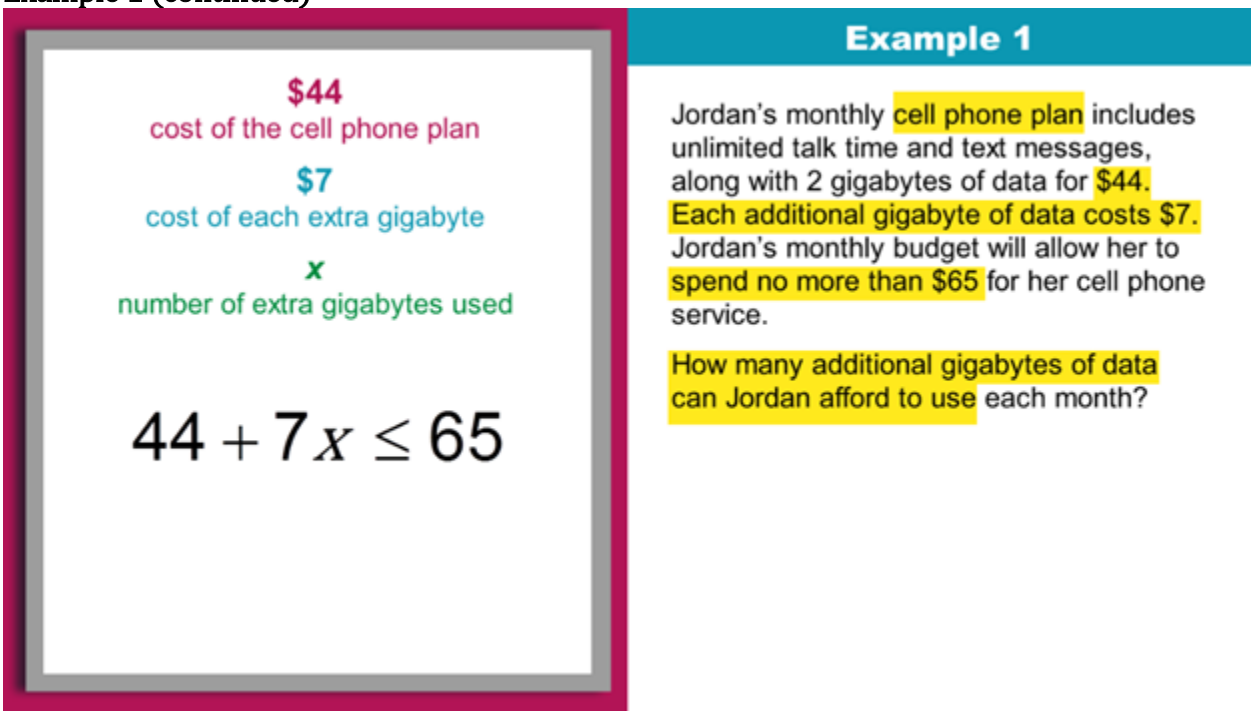


Now that you have read through the problem once, read through it one more time. This time, highlight the information you think will be helpful in solving the problem.

- Jordan's cell phone plan is $44
- Each additional gigabyte costs $7
- Jordan can spend no more than $65
- How many additional gigabytes can she afford to use?

Now use this key information to set up an inequality to model the situation and solve the problem.

Example 1 (continued)



You know that Jordan's cell phone plan costs \$44, plus \$7 for each additional gigabyte of data she uses. If you let x represent the number of additional gigabytes Jordan uses, then you can represent this part of the problem with the expression:

$$44 + 7x$$

You also know that Jordan can spend no more than \$65, or in other words, \$65 or less. So,

$$44 + 7x \leq 65$$

Example 1 (continued)

You have now set up an inequality that you can use to solve the problem.

$$44 + 7x \leq 65$$

$$-44 \qquad -44$$

Subtract 44 from each side.

$$\frac{7x}{7} \leq \frac{21}{7}$$

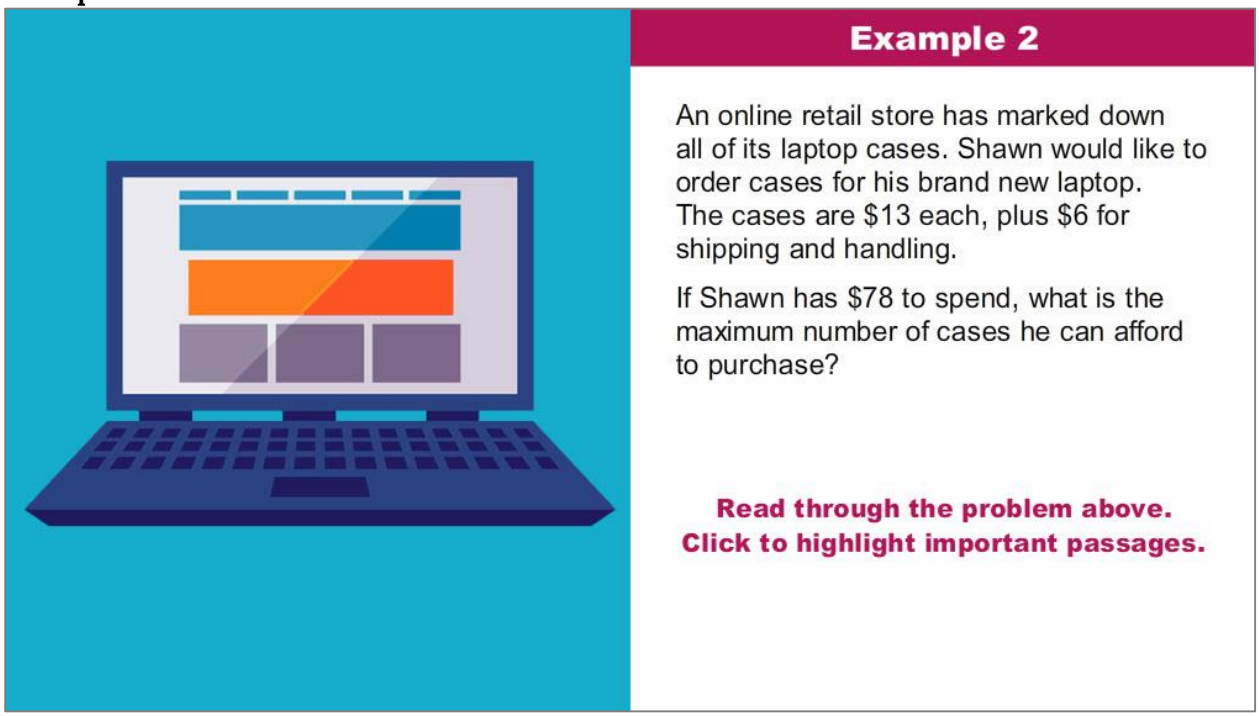
Now, divide each term by 7.

$$x \leq 3$$

In order to remain within her budget, Jordan can use no more than 3 additional gigabytes of data.

It is worth mentioning that although all values of x that are less than or equal to 3 will make the inequality true, values that are less than 0, negative numbers, will not make sense in this real-world situation. It isn't possible for Jordan to use a negative number of additional gigabytes. In reality, she can use anywhere between 0 and 3 additional gigabytes and still remain within her budget. You can represent this restriction on the values of x with the compound inequality, $0 \leq x \leq 3$ or in set notation, $\{x|0 \leq x \leq 3\}$.

Example 2



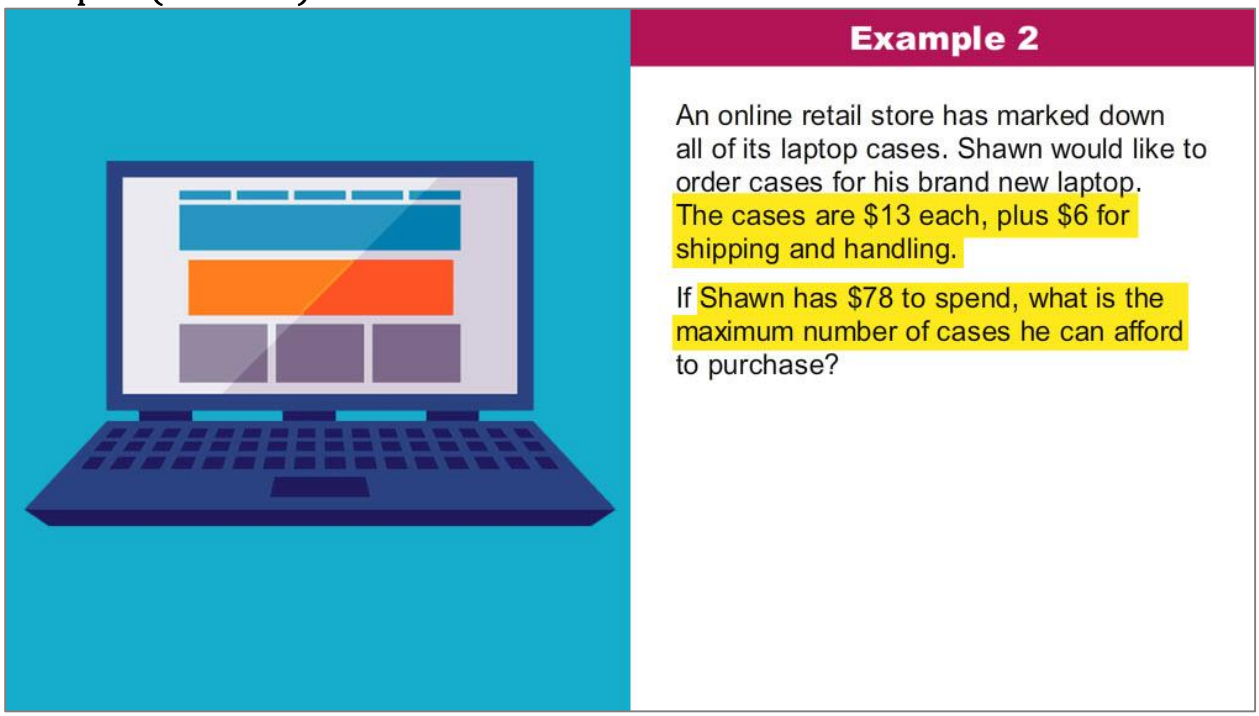
Read the scenario given in Example 2. Then take a few moments to highlight the key information that will help you solve the problem.

An online retail store has marked down all of its laptop cases. Shawn would like to order cases for his brand new laptop. The cases are $13 *each, plus* $6 *for shipping and handling.*

If Shawn has $78 *to spend, what is the maximum number of cases he can afford to purchase?*

Read through the problem above and click to highlight important passages.

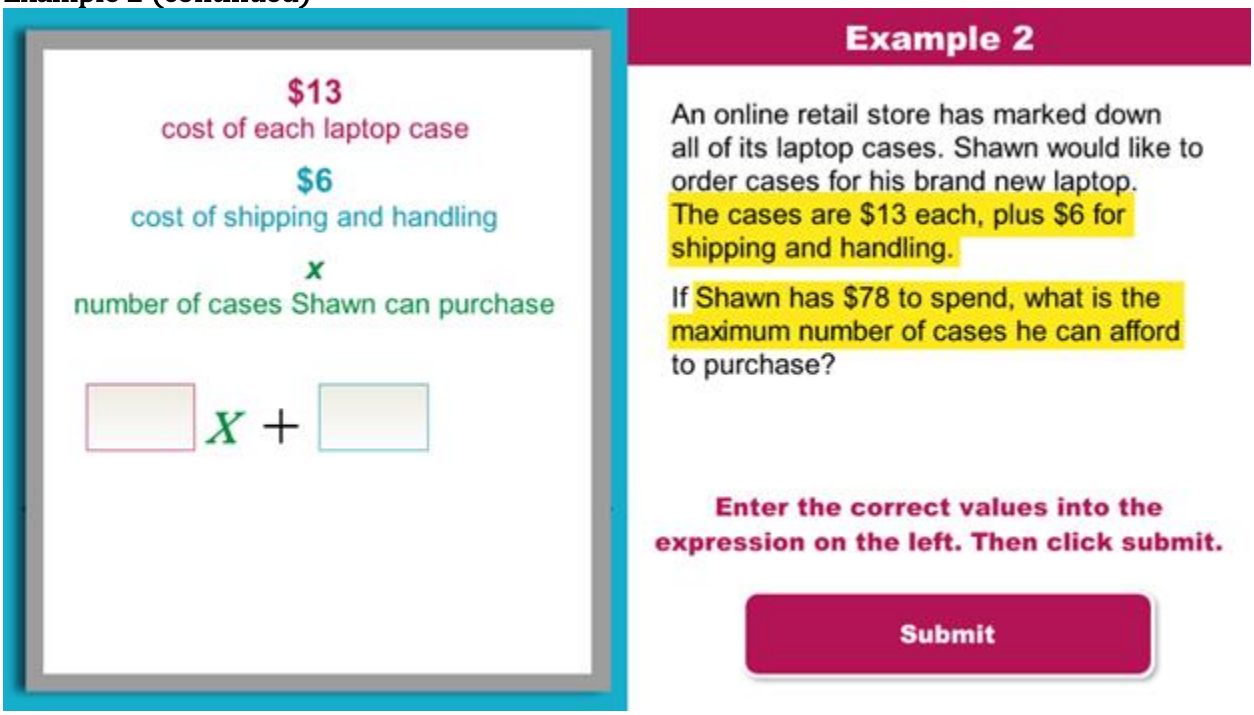
Example 2 (continued)



Now that you have read through the problem and highlighted the important information, you are able to summarize the key parts:

- The cases are $13 each, plus $6 for shipping and handling
- Shawn has $78 to spend
- What is the maximum number of cases he can afford?

Example 2 (continued)

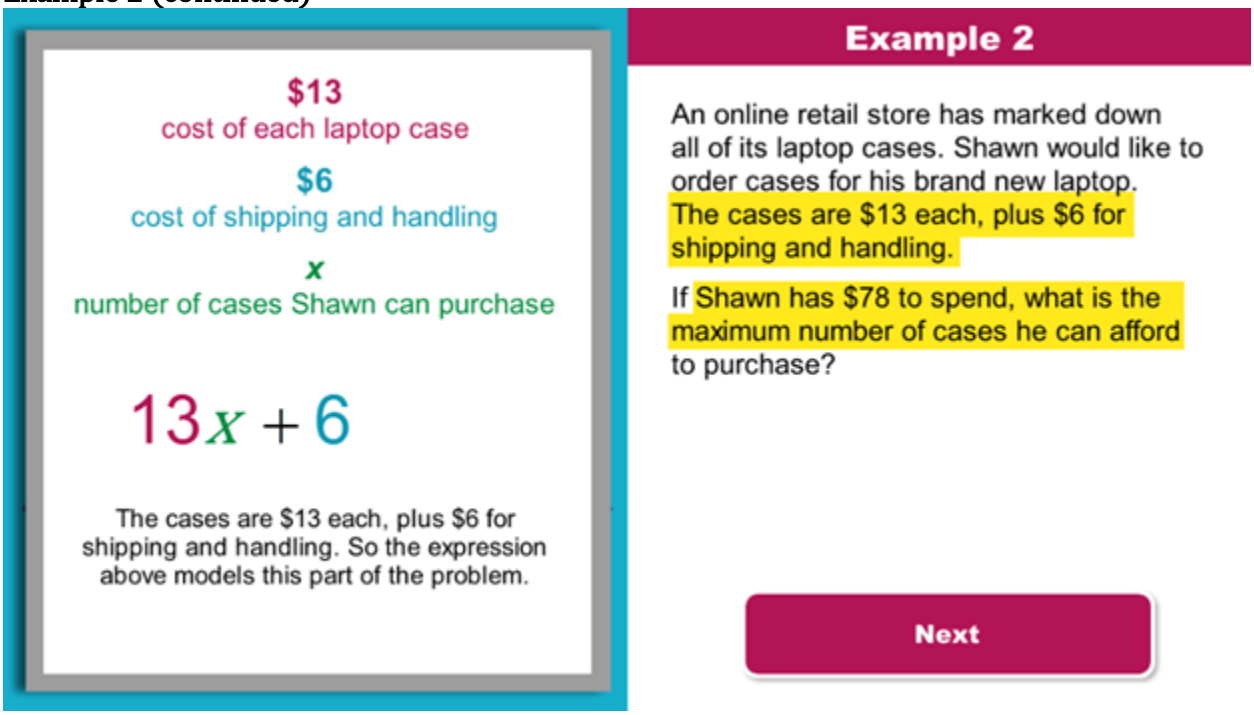


Now use this key information to set up an inequality to model the situation and solve the problem. You know that the laptop cases are $13 each, plus $6 for shipping and handling. Let x represent the number of cases Shawn can purchase. You can represent this part of the problem with the expression:

$$?x + ?$$

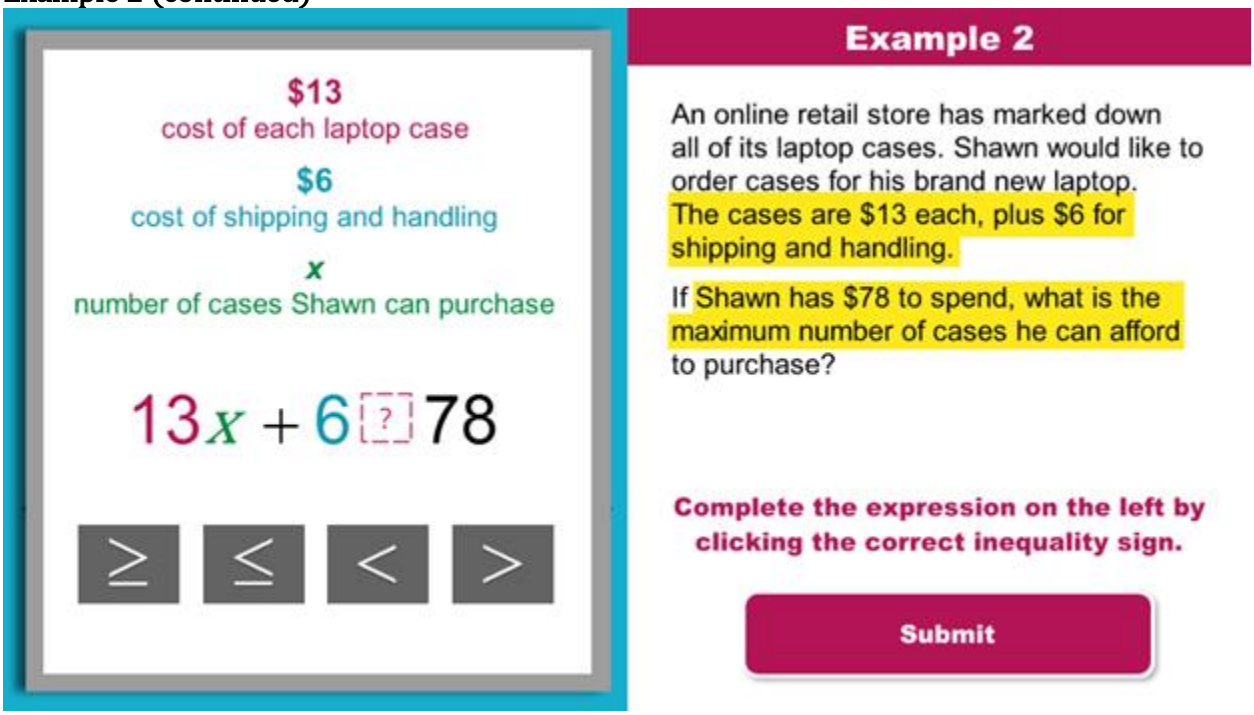
Enter the correct values into the expression on the left. Then click submit.

Example 2 (continued)



The cases are $13 each, plus $6 for shipping and handling. So the expression above models this part of the problem.

Example 2 (continued)

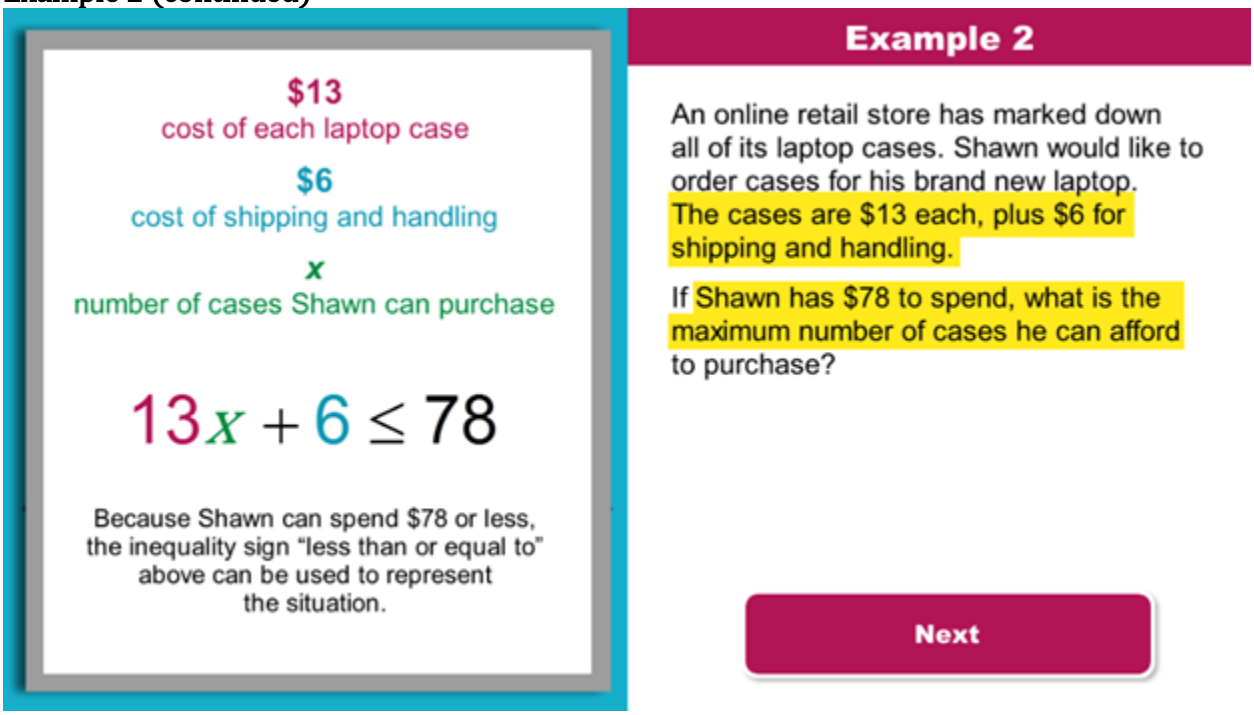


You also know that Shawn can spend no more than \$78, or in other words, \$78 or less. Therefore?

$$13x + 6 \quad ? \quad 78$$

Complete the expression on the left by click the correct inequality sign,

Example 2 (continued)



Because Shawn can spend \$78 or less, the inequality $13x + 6 \leq 78$ can be used to represent the situation.

Example 2 (continued)

You have now set up an inequality that you can use to solve the problem.

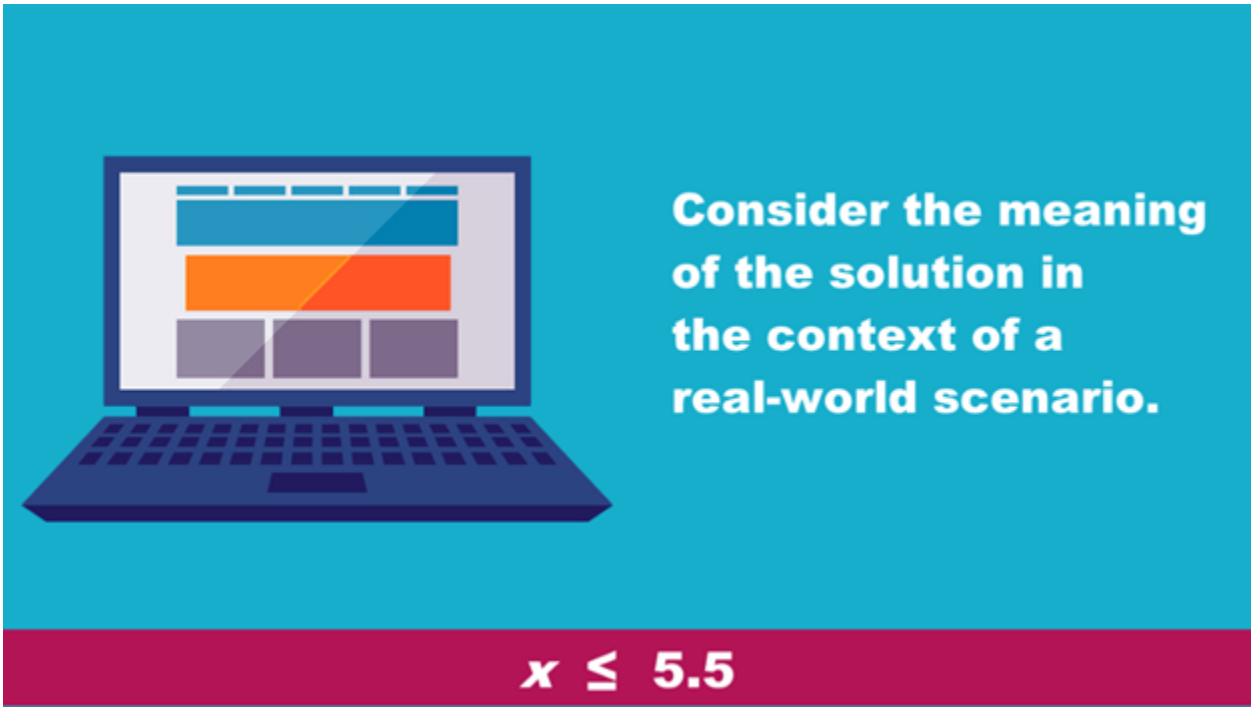
$13x + 6 \leq 78$

$-6 \quad -6$ Subtract 6 from each side.

$\frac{13x}{13} \leq \frac{72}{13}$ Now, divide each term by 13.

$x \leq 5.5$ The final result is $x \leq 5.5$, approximately.

Decimal Values in Real-World Scenarios



Because you are solving a real-world problem and the solution resulted in a decimal value, you have to consider the meaning in the context of the real-world scenario.

Decimal Values in Real-World Scenarios (continued)

A literal translation of the solution would be that Shawn can purchase no more than five and a half laptop cases. However, it is impossible to purchase half of a laptop case. The only values that make sense for this real-world scenario are 0 or positive whole numbers. Normally, when rounding 5.5 to the nearest whole number, you would round up to 6. You would then infer that Shawn can purchase no more than 6 laptop cases and still remain within his budget. However, 6 is not included in the solution set, as it is a value greater than 5.5.

Decimal Values in Real-World Scenarios (continued)

You can verify this algebraically. Substitute 6 into the original inequality:

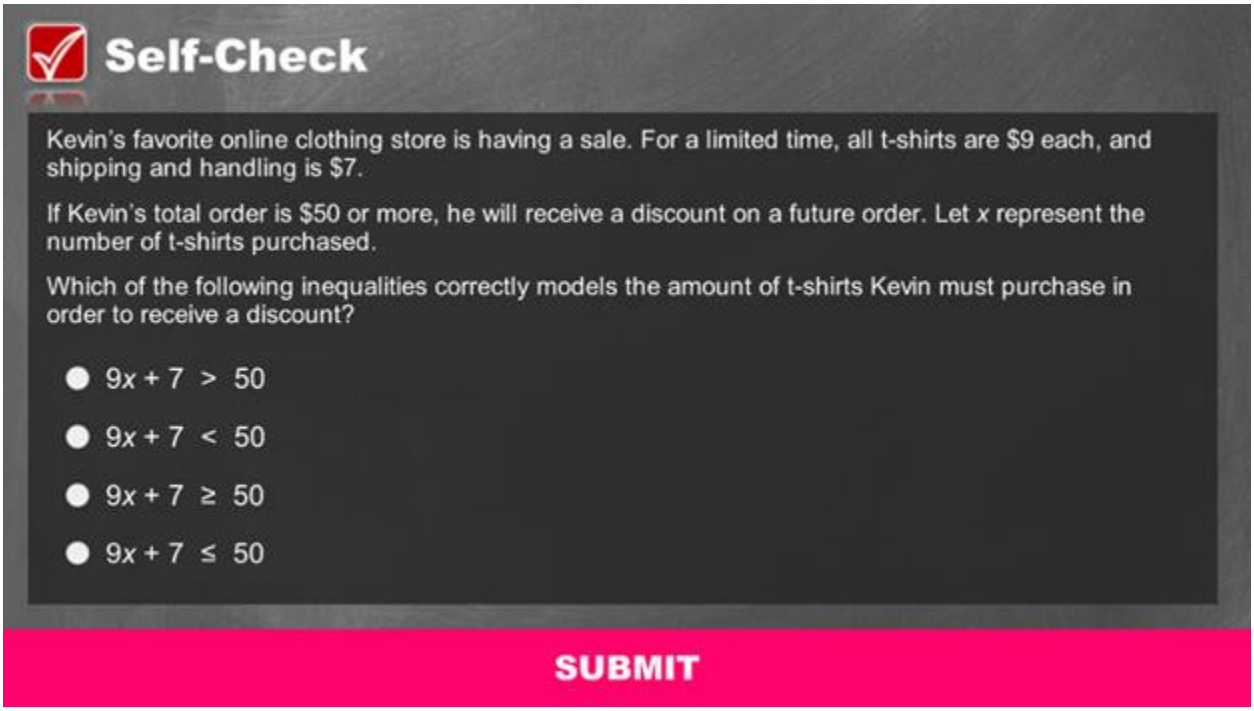
$13x + 6 \leq 78$
$13(6) + 6$
$78 + 6$
$84 \not\leq 78$

The inequality would not hold true.

In order for the inequality to remain true and still make sense in regards to the real-world scenario, you must round to the nearest whole number that is still included in the solution set. In this case, that whole number would be 5.

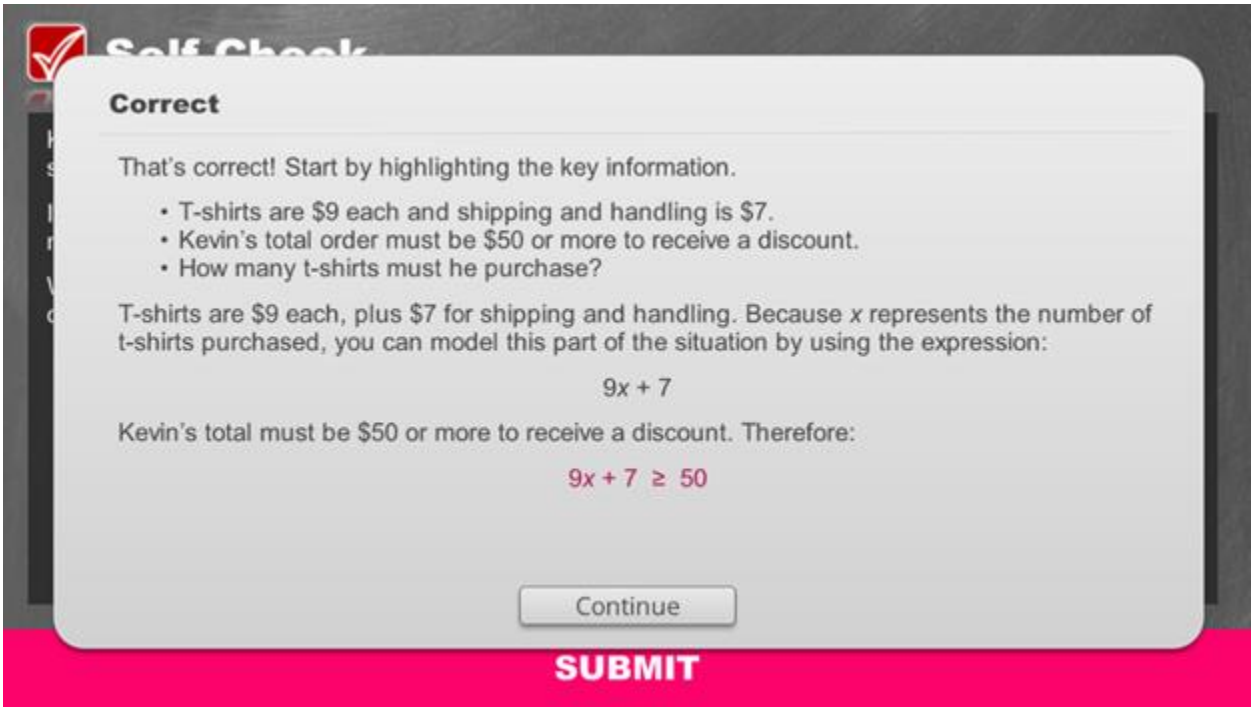
Shawn can purchase no more than 5 laptop cases and still remain within his budget.

Self-Check 1



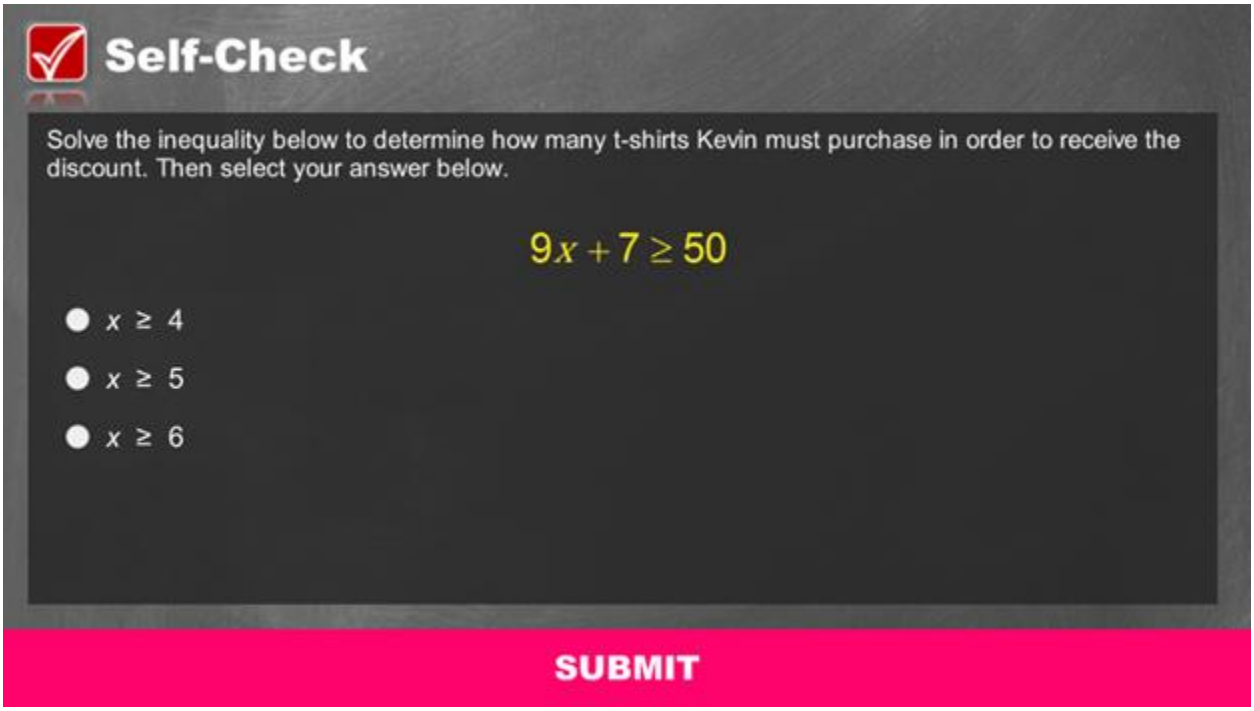
Solve the problem in the image above to check your understanding of the content.

Self-Check 1: Answer



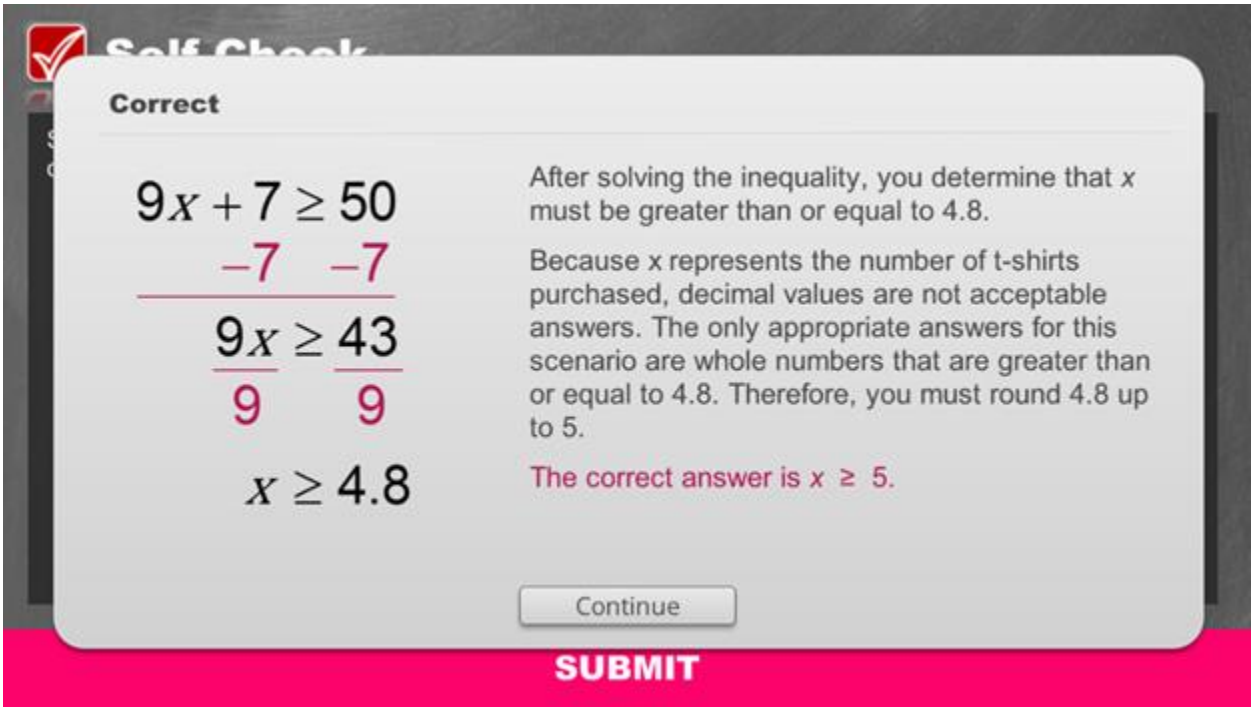
For your reference, the image above shows the correct solution to the self-check problem.

Self-Check 2



Solve the problem in the image above to check your understanding of the content.

Self-Check 2: Answer



For your reference, the image above shows the correct solution to the self-check problem.

Conclusion

Congratulations! You have reached the end of your lesson on solving real-world problems involving inequalities in one variable. You were able to combine your reading skills, as well as your math skills in order to successfully progress through this lesson. Great job!