Lesson 3-3: Solving Inequalities Using Multiplication or Division

We learned in Lesson 3-2 that adding or subtracting a number from both sides of a true inequality results in another inequality that is still true. That idea allows us to use addition and subtraction to help us solve inequalities. In this lesson, we will investigate what happens when we multiply or divide both sides of a true inequality by the same number.

Take a moment to convince yourself that questions 1-4 each start with a true inequality on the first line, and then complete the multiplication as shown. Be sure to include the correct inequality symbol.

1. $\begin{array}{ccc} -6 & < & 4 \\ \times(2) & & \times(2) \\ \hline \end{array}$

2. $\begin{array}{ccc} -8 & < & -2 \\ \times(2) & & \times(2) \\ \hline \end{array}$

3. $\begin{array}{ccc} 0 & > & -6 \\ \times(3) & & \times(3) \\ \hline \end{array}$

4. $\begin{array}{ccc} 6 & > & -12 \\ \times(3) & & \times(3) \\ \hline \end{array}$

5. Make a statement (or rule) regarding the effect of **multiplying** a true inequality by a ***positive*** number.

Now let's take the same four inequalities and **multiply** them by ***negative*** values. Will they still be true?

6. $\begin{array}{ccc} -6 & < & 4 \\ \times(-2) & & \times(-2) \\ \hline \end{array}$

7. $\begin{array}{ccc} -8 & < & -2 \\ \times(-2) & & \times(-2) \\ \hline \end{array}$

8. $\begin{array}{ccc} 0 & > & -6 \\ \times(-3) & & \times(-3) \\ \hline \end{array}$

9. $\begin{array}{ccc} 6 & > & -12 \\ \times(-3) & & \times(-3) \\ \hline \end{array}$

10. Make a statement (or rule) regarding the effect of **multiplying** a true inequality by a ***negative*** number.

Take a moment to convince yourself that questions 11-14 each start with a true inequality on the first line, and then complete the division as shown. Be sure to include the correct inequality symbol.

11. $\begin{array}{ccc} -6 & < & 4 \\ \div(2) & & \div(2) \\ \hline \end{array}$

12. $\begin{array}{ccc} -8 & < & -2 \\ \div(2) & & \div(2) \\ \hline \end{array}$

13. $\begin{array}{ccc} 0 & > & -6 \\ \div(3) & & \div(3) \\ \hline \end{array}$

14. $\begin{array}{ccc} 6 & > & -12 \\ \div(3) & & \div(3) \\ \hline \end{array}$

15. Make a statement (or rule) regarding the effect of **dividing** a true inequality by a ***positive*** number.

Now let's take the same four inequalities and **divide** them by ***negative*** values. Will they still be true?

16. $-6 < 4$
$\div(-2) \quad \div(-2)$

17. $-8 < -2$
$\div(-2) \quad \div(-2)$

18. $0 > -6$
$\div(-3) \quad \div(-3)$

19. $6 > -12$
$\div(-3) \quad \div(-3)$

20. Make a statement (or rule) regarding the effect of **dividing** a true inequality by a ***negative*** number.

The same rules apply to "$\le$" and "$\ge$" that apply to "<" and ">".

We can use what we have learned to solve inequalities by multiplying or dividing inequalities.

Solve and graph the following inequalities. Be extra careful whenever you multiply or divide by a *negative* number!

21. $\frac{x}{2} < -3$

22. $-\frac{2}{3}w \ge 2$

23. $-5a \ge 20$

24. $56 < -7d$

25. A cheerleading squad earns $5.50 per car washed. How many cars does the squad need to wash to earn at least $77? (Write an inequality to represent this situation, solve it, and graph the solutions.)

Book Work 3-3: p 181: 7-31 odd, 59