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2.2 Solving Inequalities Using Addition or Subtraction

For use with Exploration 2.2

Essential Question How can you use addition or subtraction to solve an inequality?

1 EXPLORATION: Quarterback Passing Efficiency

Work with a partner. The National Collegiate Athletic Association (NCAA) uses the following formula to rank the passing efficiencies P of quarterbacks.

$$P = \frac{8.4Y + 100C + 330T - 200N}{A}$$

Y = total length of all completed passes (in **Y**ards)

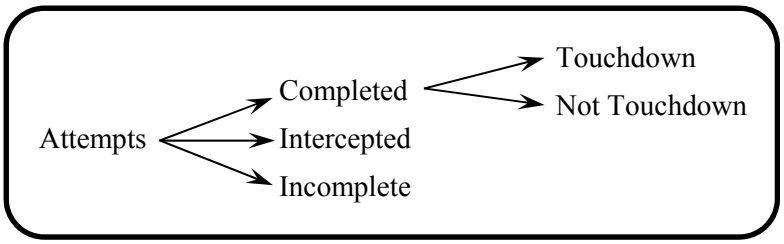
C = **C**ompleted passes

T = passes resulting in a **T**ouchdown

N = i**N**tercepted passes

A = **A**ttempted passes

M = inco**M**plete passes



Determine whether each inequality must be true. Explain your reasoning.

a. $T < C$

b. $C + N \leq A$

c. $N < A$

d. $A - C \geq M$

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2 EXPLORATION: Finding Solutions of Inequalities

Work with a partner. Use the passing efficiency formula to create a passing record that makes each inequality true. Record your results in the table. Then describe the values of P that make each inequality true.

	Attempts	Completions	Yards	Touchdowns	Interceptions
a.					
b.					
c.					

a. $P < 0$

b. $P + 100 \geq 250$

c. $P - 250 > -80$

Communicate Your Answer

3. How can you use addition or subtraction to solve an inequality?

4. Solve each inequality.

a. $x + 3 < 4$

b. $x - 3 \geq 5$

c. $4 > x - 2$

d. $-2 \leq x + 1$

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2.2 Practice

For use after Lesson 2.2

Notes:

Core Concepts

Addition Property of Inequality

Words Adding the same number to each side of an inequality produces an equivalent inequality.

Numbers

$$\begin{array}{rcr} -3 & < & 2 \\ \underline{+\,4} & & \underline{+\,4} \\ 1 & < & 6 \end{array} \qquad \begin{array}{rcr} -3 & \geq & -10 \\ \underline{+\,3} & & \underline{+\,3} \\ 0 & \geq & -7 \end{array}$$

Algebra If $a > b$, then $a + c > b + c$. If $a \geq b$, then $a + c \geq b + c$.

If $a < b$, then $a + c < b + c$. If $a \leq b$, then $a + c \leq b + c$.

Notes:

Subtraction Property of Inequality

Words Subtracting the same number from each side of an inequality produces an equivalent inequality.

Numbers

$$\begin{array}{rcr} -3 & \leq & 1 \\ \underline{-\,5} & & \underline{-\,5} \\ -8 & \leq & -4 \end{array} \qquad \begin{array}{rcr} 7 & > & -20 \\ \underline{-\,7} & & \underline{-\,7} \\ 0 & > & -27 \end{array}$$

Algebra If $a > b$, then $a - c > b - c$. If $a \geq b$, then $a - c \geq b - c$.

If $a < b$, then $a - c < b - c$. If $a \leq b$, then $a - c \leq b - c$.

Notes:

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2.2 Practice (continued)

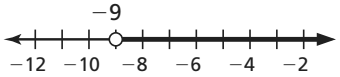
Worked-Out Examples

Example #1

Solve the inequality. Graph the solution.

$$\begin{aligned} 18 - 5z + 6z &> 3 + 6 \\ 18 + z &> 9 \\ -18 \quad & \quad -18 \\ z &> -9 \end{aligned}$$

The solution is $z > -9$.



Example #2

MODELING WITH MATHEMATICS You are riding a train. Your carry-on bag can weigh no more than 50 pounds. Your bag weighs 38 pounds.

a. Write and solve an inequality that represents how much weight you can add to your bag.

b. Can you add both a 9-pound laptop and a 5-pound pair of boots to your bag without going over the weight limit? Explain.

a. Words: [Current weight of your bag] + [Additional weight] ≤ [Maximum weight]

Variable: Let w be how much weight (in pounds) you can add to your bag.

Inequality: $38 + w \leq 50$

$$\begin{aligned} 38 + w &\leq 50 \\ -38 \quad & \quad -38 \\ w &\leq 12 \end{aligned}$$

So, you can add no more than 12 pounds to your bag.

b. $w \leq 12$

$9 + 5 \stackrel{?}{\leq} 12$

$14 \not\leq 12$

no; Because $9 + 5 = 14$ is *not* less than or equal to 12, you cannot add both a laptop and a pair of boots to your bag without going over the weight limit.

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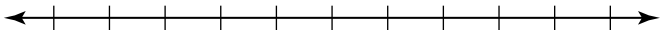
2.2 Practice (continued)

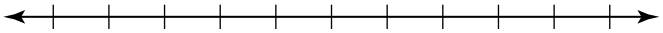
Practice A

In Exercises 1–6, solve the inequality. Graph the solution.

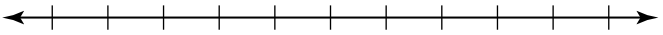
1. $x - 3 < -4$



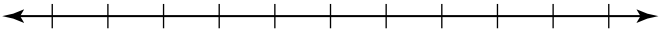
2. $-3 > -3 + h$



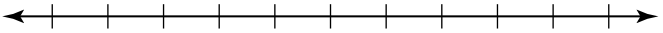
3. $s - (-1) \geq 2$



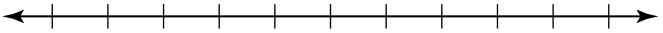
4. $6 - 9 + u < -2$



5. $12 \leq 4c - 3c + 10$



6. $15 - 7p + 8p > 15 - 2$



7. You have \$15 to spend on groceries. You have \$12.25 worth of groceries already in your cart.

a. Write an inequality that represents how much more money m you can spend on groceries.

b. Solve the inequality.

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Practice B

In Exercises 1–9, solve the inequality. Graph the solution.

1. $w + 6 \leq 2$

2. $m - 3 > -6$

3. $4 < 4 + s$

4. $7 \leq x + 15$

5. $p - (-3) > 10$

6. $q + 6 - 5 > 4$

7. $3 - 11 + t > -2$

8. $4 \leq 6a - 4a - 2$

9. $22 + (-9c) + 10c < 5 + 1$

In Exercises 10–13, write the sentence as an inequality. Then solve the inequality.

10. A number plus 10 is less than 34.

11. A number minus 8 is at least 14.

12. The sum of a number and 7 is less than 15.

13. Nine is less than or equal to the difference of a number and 1.

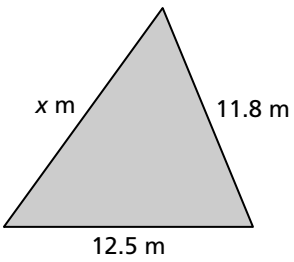
14. You order a new pair of running shoes from a website that offers free shipping on orders of $75 or more. Your shoes cost $69.95.

a. Write and solve an inequality that represents how much more you must spend to get free shipping.

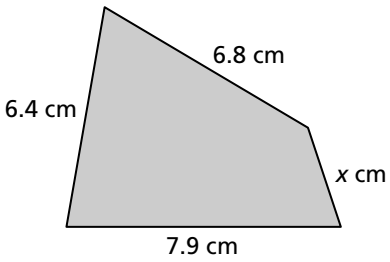
b. The cost of shipping your shoes is $7.79. Would you purchase another item in order to get free shipping? Explain.

In Exercises 15 and 16, write and solve an inequality to find the possible values of *x*.

15. Perimeter < 37.8 meters



16. Perimeter ≤ 24.1 centimeters



17. Write and solve an inequality that represents the numbers that are *not* solutions of each inequality.

a. $x - 7 \leq -10$

b. $x + 3 > 2.5$