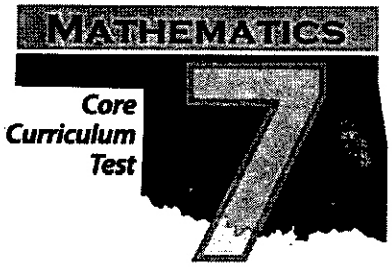
Chapter 6
One-Step Inequalities



This chapter covers the following OK 7 Math standard:

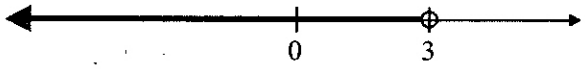
	Content Standard
Algebraic Reasoning	1.3

6.1 Graphing Inequalities

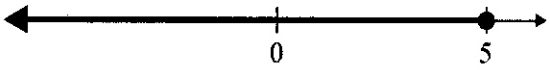
An inequality is a sentence that contains a $<$, $>$, $\leq$, or $\geq$ sign. Look at the following graphs of inequalities on a number line. Graphing an inequality shows all the numbers that make the inequality true.

$x < 3$ is read "x is less than 3" since it is $<$ and not $\leq$.

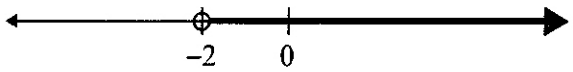
NUMBER LINE



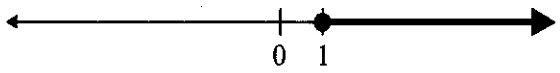
$x \leq 5$ is read "x is less than or equal to 5" since the inequality is $\leq$. The endpoint is filled in. The graph uses a **closed** circle because the number 5 is included in the graph.



$x > -2$ is read "x is greater than -2."

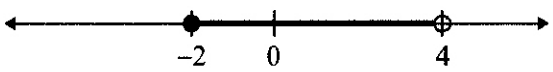


$x \geq 1$ is read "x is greater than or equal to 1."

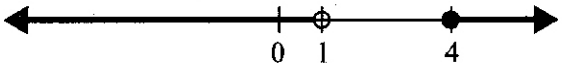


There can be more than one inequality sign. These are called **compound inequalities**. For example:

$-2 \leq x < 4$ is read "-2 is less than or equal to x and x is less than 4."

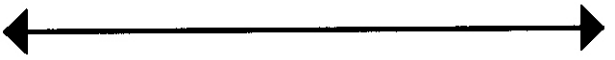


$x < 1$ or $x \geq 4$ is read "x is less than 1 or x is greater than or equal to 4."

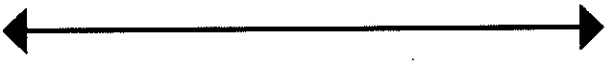


Graph the solution sets of the following inequalities.

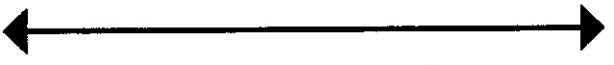
1. $x > 8$



2. $x \leq 5$

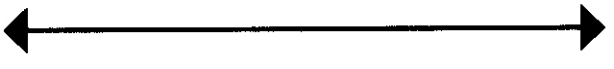


3. $-5 < x < 1$



4. $x > 7$

5. $1 \leq x < 4$



6. $x < -2$ or $x > 1$

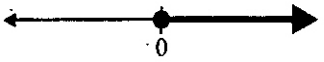
7. $x \geq 10$

8. $x < 4$

9. $x \leq 3$ or $x \geq 5$

10. $x < -1$ or $x > 1$

Give the inequality represented by each of the following number lines.

11. 

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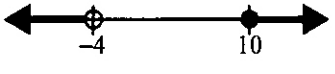
12. 

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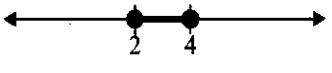
13. 

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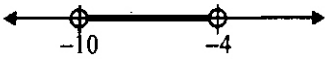
15. 

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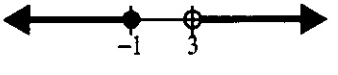
16. 

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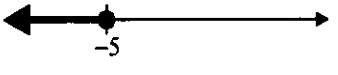
17. 

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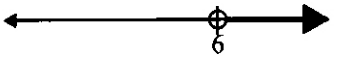
18. 

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6.2 Solving Inequalities by Addition and Subtraction

Solving inequalities is similar to solving equations.

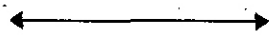
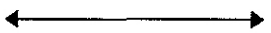
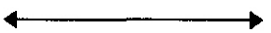
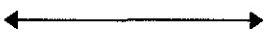
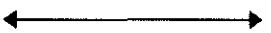
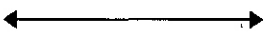
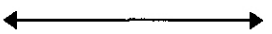
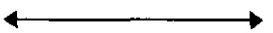
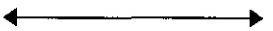
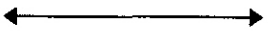
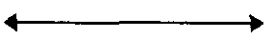
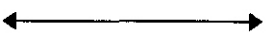
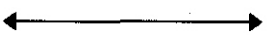
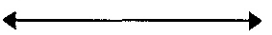
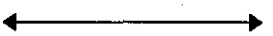
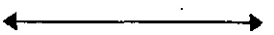
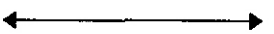
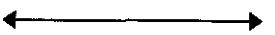
Example 1: Solve and graph the solution set for $x - 2 \leq 5$.

Step 1: Add 2 to both sides of the inequality so the variable will be by itself..

$$\begin{array}{r} x - 2 \leq 5 \\ +2 \quad +2 \\ \hline x \leq 7 \end{array}$$

Step 2: Graph the solution set for the inequality.

Solve and graph the solution set for the following inequalities.

1. $x + 5 > 3$ 
2. $x - 10 < 5$ 
3. $x - 2 \leq 1$ 
4. $9 + x \geq 7$ 
5. $x - 4 > -2$ 
6. $x + 11 \leq 20$ 
7. $x - 3 < -12$ 
8. $x + 6 \geq -3$ 
9. $x + 12 \leq 8$ 
10. $15 + x > 5$ 
11. $x - 6 < -2$ 
12. $x + 7 \geq 4$ 
13. $14 + x \leq 8$ 
14. $x - 8 > 24$ 
15. $x + 1 \leq 12$ 
16. $11 + x \geq 11$ 
17. $x - 3 < 17$ 
18. $x + 9 > -4$ 
19. $x + 6 \leq 14$ 
20. $x - 8 \geq 19$ 

6.3 Solving Inequalities by Multiplication and Division

If you multiply or divide both sides of an inequality by a **positive** number, the inequality symbol stays the same. However, if you multiply or divide both sides of an inequality by a **negative** number, **you must reverse the direction of the inequality symbol.**

Example 2: Solve and graph the solution set for $4x \leq 20$.

Step 1: Divide both sides of the inequality by 4. $\frac{\overset{1}{\cancel{4}}x}{\underset{1}{\cancel{4}}} \leq \frac{\overset{5}{\cancel{20}}}{\underset{1}{\cancel{4}}}$

Step 2: Graph the solution. $x \leq 5$

Example 3: Solve and graph the solution set for $6 > -\frac{x}{3}$.

Step 1: Multiply both sides by -3 and **reverse the direction of the inequality symbol.**

$$(-3) \times 6 < \frac{x}{\cancel{-3}} \times \cancel{-3}$$

Step 2: Graph the solution. $-18 < x$

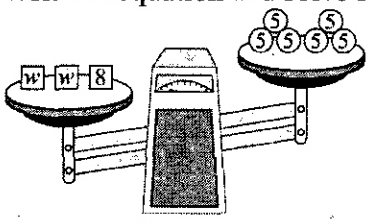
Solve and graph the following inequalities.

1. $\frac{x}{5} > 4$ ⟷
2. $2x \leq 24$ ⟷
3. $-6x \geq 36$ ⟷
4. $\frac{x}{10} > -2$ ⟷
5. $-\frac{x}{4} > 8$ ⟷
6. $-7x \leq -49$ ⟷
7. $-3x > 18$ ⟷
8. $-\frac{x}{7} \geq 9$ ⟷
9. $9x \leq 54$ ⟷
10. $\frac{x}{8} > 1$ ⟷
11. $-\frac{x}{9} \leq 3$ ⟷
12. $-4x < -12$ ⟷
13. $-\frac{x}{2} \geq -20$ ⟷
14. $10x \leq 30$ ⟷
15. $\frac{x}{12} > -4$ ⟷
16. $-6x < 24$ ⟷

6.4 Modeling Inequalities

Inequalities can be modeled using scale pictures. The heavier side of a scale is the side that is lower and is known as the "greater than" side. The lighter side of a scale is the side that is higher and is known as the "less than" side.

Example 4: Write an equation and solve for the scale picture below.



$2w + 8 > 30$
$-8 \quad -8$
$\frac{2w}{2} > \frac{22}{2}$
$w > 11$

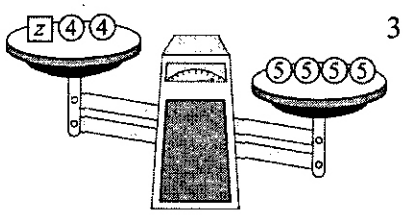
Step 1: Determine what is on each side of the scale.
On the left side: $w + (2 \times 8)$
On the right side: 5×6

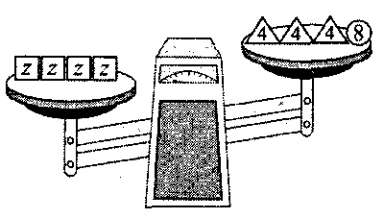
Step 2: Determine which side is greater or less than and write the equation.
$w + 16 > 30$

Step 3: Solve.
$w + 16 > 30$
$w + 16 - 16 > 30 - 16$
$w > 14$

Answer: $w > 14$

Write an inequality to fit each scale picture, then solve.

1.


3.


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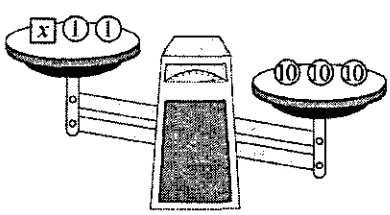

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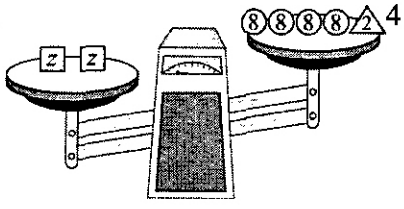

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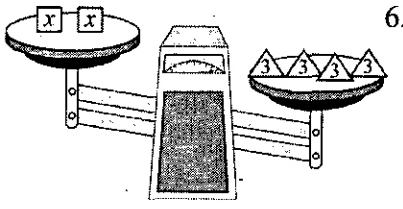

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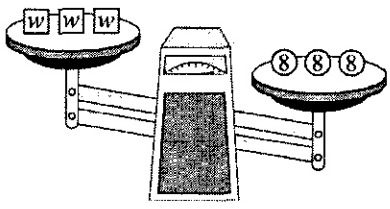


6.5 Solving Inequality Word Problems

Write an inequality for the word problems below, then solve.

1. Jacob weighs more than 50 pounds more than his younger brother, Jared. Jared weighs 46 pounds.

2. Analice is 16 years old. If you add together Analice's age and her cousin, Emily's age together, you will get more than 31 years.

3. Maria scored more than 4 times as many points than Jennifer, who scored 6 points. How many points did Maria score?

4. This month's sales of $\$85,000$ are greater than $\frac{1}{2}$ of the sales of March, represented by the letter s.

5. The Furry Friends Animal Shelter had less than 27 dogs at the beginning of the month. At the end of the month, they had 14 dogs. How many dogs were adopted? (Assume they did not take in any extra dogs.)

6. Pine City (x) is less than or equal to 20 miles from Sun Valley, depending on the route you take.

7. Molly's age, x, plus Betty's age, 11, is less than 23.

8. There is more than twice as much rain in November as there is in August, which had 4 inches.

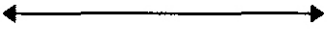
9. Mark had to read more than 200 pages in 5 days. How many pages, x, must Mark read each day to complete the assignment?

10. If the temperature goes up 6 degrees, it will be hotter than 100 degrees.

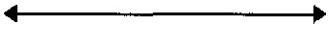
Chapter 6 Review

Graph the solution sets of the following inequalities.

1. $x \leq -3$ 

2. $x > 6$ 

3. $x < -2$ 

4. $x \geq 4$ 

Give the inequality represented by each of the following number lines.

5. 

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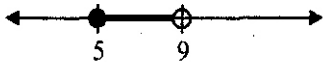
6. 

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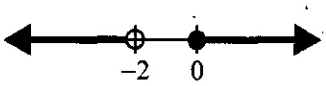
7. 

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8. 

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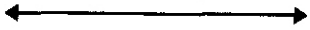
Solve and graph the solution set for the following inequalities.

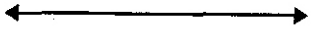
9. $x - 2 > 8$ 

10. $4 + x < -1$ 

11. $6x \geq 54$ 

12. $-\frac{x}{3} \leq 5$ 

13. $x + 10 \leq 4$ 

14. $x - 6 \geq -2$ 

Write an inequality to fit the word problems and solve.

15. Mrs. Watson is 28 years older than her youngest daughter Sarah's age, x. Mrs. Watson is less than 54 years old.

16. Mr. Andrews paid less than 50 cents more per gallon this week than last week, when he paid \$2.50 per gallon.

Chapter 6 Test

1. What is the value of n?
$n + 9 > 27$

A $n > 3$
B $n > 36$
C $n > 18$
D $n > 19$

2. What is the value of y?
$y - 21 \leq 29$

A $y \leq 50$
B $y \leq 8$
C $y \leq 49$
D $y \leq 54$

3. Solve for x: $4x < 20$

A $x < 4$
B $x < 5$
C $x < 80$
D $x < 16$

4. Solve for x: $\frac{x}{4} \geq 16$

A $x \geq 4$
B $x \geq 24$
C $x \geq 32$
D $x \geq 64$

5. Which inequality represents the following: If Janelle adds 8 more carrots to a serving plate, there will be more than 22 carrots on the plate.

A $x - 8 = 22$
B $x + 8 > 22$
C $x + 8 < 22$
D $x + 8 = 22$

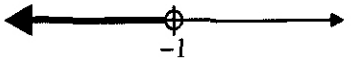
6. Solve for x: $-3x < 15$

A $x < 5$
B $x < -5$
C $x > -5$
D $x < -\frac{1}{5}$

7. Solve for x: $\frac{x}{-6} > -6$

A $x < 36$
B $x < -36$
C $x < 1$
D $x < 36$

8. Which inequality does the number line represent?



A $x \leq -1$
B $x < -1$
C $x > -1$
D $x \geq -1$

9. Which inequality does the number line represent?

A $x \geq 3$
B $x \geq 3, x \leq 2$
C $-3 \leq x < 2$
D $-3 < x \leq 2$

10. Solve for x.

$x - 2 \leq 5$

A $x \leq 7$
B $x \leq 9$
C $x \leq 5$
D $x \leq 4$