Skill Check:
solve and graph the inequality

$10 \geq 3p - 2p - 7$

2-3 Solving Inequalities Using Multiplication & Division

Multiplication and Division Properties of Inequality ($c > 0$)

Words Multiplying or dividing each side of an inequality by the same *positive* number produces an equivalent inequality.

Numbers

$-6 < 8$ $\qquad$ $6 > -8$

$2 \cdot (-6) < 2 \cdot 8$ $\qquad$ $\frac{6}{2} > \frac{-8}{2}$

$-12 < 16$ $\qquad$ $3 > -4$

Algebra If $a > b$ and $c > 0$, then $ac > bc$. If $a > b$ and $c > 0$, then $\frac{a}{c} > \frac{b}{c}$.

If $a < b$ and $c > 0$, then $ac < bc$. If $a < b$ and $c > 0$, then $\frac{a}{c} < \frac{b}{c}$.

These properties are also true for $\leq$ and $\geq$.

EXAMPLE 1 Multiplying or Dividing by Positive Numbers

Solve (a) $\frac{x}{8} > -5$ and (b) $-24 \geq 3x$. Graph each solution.

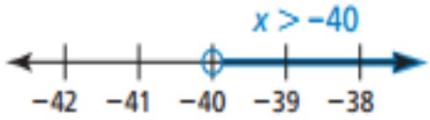
SOLUTION

a. $\frac{x}{8} > -5$ Write the inequality.

$8 \cdot \frac{x}{8} > 8 \cdot (-5)$ Multiply each side by 8.

$x > -40$ Simplify.

▶ The solution is $x > -40$.

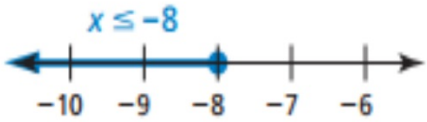


b. $-24 \geq 3x$ Write the inequality.

$\frac{-24}{3} \geq \frac{3x}{3}$ Divide each side by 3.

$-8 \geq x$ Simplify.

▶ The solution is $x \leq -8$.



Solve the inequality. Graph the solution.

1. $\frac{n}{7} \geq -1$

2. $-6.4 \geq \frac{1}{5}w$

3. $4b \geq 36$

4. $-18 > 1.5q$

EXAMPLE 2 Multiplying or Dividing by Negative Numbers

Solve each inequality. Graph each solution.

a. $2 < \frac{y}{-3}$

b. $-7y \leq -35$

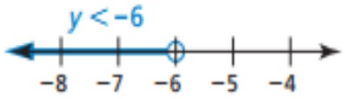
SOLUTION

a. $2 < \frac{y}{-3}$ Write the inequality.

→ $-3 \cdot 2 > -3 \cdot \frac{y}{-3}$ Multiply each side by -3. Reverse the inequality symbol.

$-6 > y$ Simplify.

▶ The solution is $y < -6$.

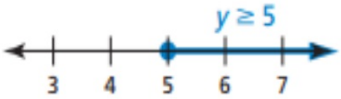


b. $-7y \leq -35$ Write the inequality.

→ $\frac{-7y}{-7} \geq \frac{-35}{-7}$ Divide each side by -7. Reverse the inequality symbol.

$y \geq 5$ Simplify.

▶ The solution is $y \geq 5$.



Solve the inequality. Graph the solution.

5. $\frac{p}{-4} < 7$

6. $\frac{x}{-5} \leq -5$

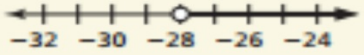
7. $1 \geq -\frac{1}{10}z$

8. $-9m > 63$

9. $-2r \geq -22$

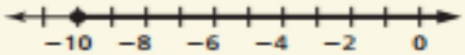
10. $-0.4y \geq -12$

5. $p > -28$

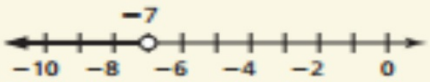


6. $x \geq 25$

7. $z \geq -10$



8. $m < -7$



9. $r \leq 11$

10. $y \leq 30$

Solving Real-Life Problems

EXAMPLE 3 Modeling with Mathematics

You earn $9.50 per hour at your summer job. Write and solve an inequality that represents the numbers of hours you need to work to buy a digital camera that costs $247.

SOLUTION

1. **Understand the Problem** You know your hourly wage and the cost of the digital camera. You are asked to write and solve an inequality that represents the numbers of hours you need to work to buy the digital camera.
2. **Make a Plan** Use a verbal model to write an inequality. Then solve the inequality.
3. **Solve the Problem**

Words Hourly wage · Hours worked ≥ Cost of camera

Variable Let n be the number of hours worked.

Inequality $9.5 \cdot n \geq 247$

$9.5n \geq 247$ Write the inequality.

y of Inequality → $\frac{9.5n}{9.5} \geq \frac{247}{9.5}$ Divide each side by 9.5.

$n \geq 26$ Simplify.

▶ You need to work at least 26 hours for your gross pay to be at least \$247. If you have payroll deductions, such as Social Security taxes, you need to work more than 26 hours.

4. **Look Back** You can use estimation to check that your answer is reasonable.

\$247 ÷ \$9.50/h

↓ ↓

\$250 ÷ \$10/h = 25 h Use compatible numbers.

Your hourly wage is about \$10 per hour. So, to earn about \$250, you need to work about 25 hours.

Unit Analysis Each time you set up an equation or inequality to represent a real-life problem, be sure to check that the units balance.

$$\frac{\$9.50}{\cancel{\text{h}}} \times 26\,\cancel{\text{h}} = \$247$$