Lesson 17
Foundations of College Algebra

Graph Inequalities on the Number Line

Review

The inequality symbols are:

- $<$ means "less than"
- $>$ means "greater than"

- $\leq$ means "less than or equal to"
- $\geq$ means "greater than or equal to"

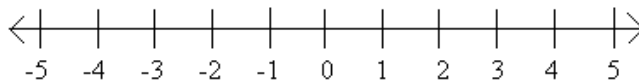### How To: Graphing Inequalities

To graph an inequality in one variable, e.g. $x < a$, on a number line:

1. Put a filled-in circle for "or equal to" over a or an open circle over a otherwise.
2. Shade to the left of the circle for "less than" or to the right for "greater than".
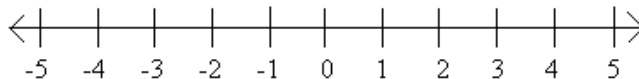
Examples

Graph on the number line.

1. $x \leq 1, x < 5, x > -1$

You Try It

Graph on the number line.

1. $x > 2, x < -3, x \geq -1$

Use the Properties of Inequality
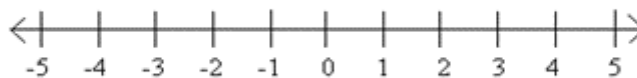
Addition Property of Inequality

For any numbers a, b, and c, if $a < b$ then $a + c < b + c$.

- Subtraction is covered by this rule too.
- This works for all inequality symbols.

Example

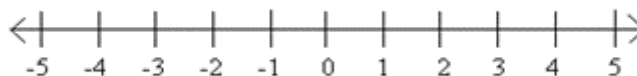Solve the inequality. Graph the solution set. Write the answer in set notation.

$$n - \frac{1}{2} \leq \frac{5}{8}$$

You Try It

Solve the inequality. Graph the solution set. Write the answer in set notation.

$$u + 25 > 21$$

Multiplication Property of Inequality

For any real numbers a, b, c:

- if $a < b$ and $c > 0$, then $\frac{a}{c} < \frac{b}{c}$ and $ac < bc$.
- If $a < b$ and $c < 0$, then $\frac{a}{c} > \frac{b}{c}$ and $ac > bc$.
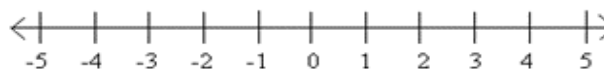
When we divide or multiply an inequality by a:

- **positive** number, the inequality **stays the same**.
- **negative** number, the inequality **reverses**.

Example

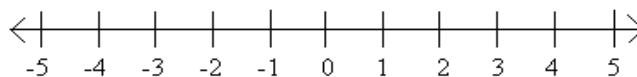Solve the inequality. Graph the solution set. Write the answer in set notation.

$$-8q < 32$$

You Try It

Solve the inequality. Graph the solution set. Write the answer in set notation.

$$-7r \leq -35$$

Solve Inequalities That Require Simplification

Examples

Solve the inequality. Write each answer using set notation.

1. $4m \leq 9m + 17$

2. $8p + 3(p - 12) > 7p - 28$

You Try It

Solve the inequality. Write each answer using set notation.

1. $3q \geq 7q - 23$

2. $6u + 8(u - 1) > 10u + 32$

Use Interval Notation

Definition – Interval Notation

- An **interval** is a set of numbers between two numbers (possibly ∞ or $-\infty$) called **endpoints**.
- Brackets denote that an endpoint is included in the interval.
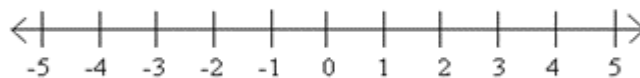- Parentheses indicate that an endpoint is not included in the interval.

Interval Notation Rosetta Stone

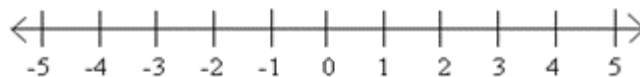| Set	Interval
$\{x \mid x < a\}$	$(-\infty, a)$
$\{x \mid x > a\}$	(a, ∞)
$\{x \mid x \leq a\}$	$(-\infty, a]$
$\{x \mid x \geq a\}$	$[a, \infty)$
$\{x \mid a < x < b\}$	(a, b)
$\{x \mid a \leq x \leq b\}$	$[a, b]$
$\{x \mid a < x \leq b\}$	$(a, b]$
$\{x \mid a \leq x < b\}$	$[a, b)$

Examples

Graph the solution set of each inequality on a number line and then write it in interval notation.

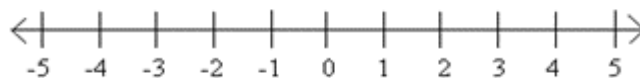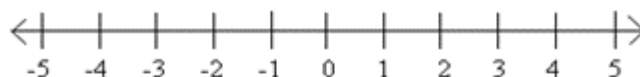1. $\{x | x \leq -4\}$

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

3. $\{x | -3 < x \leq 4\}$

You Try it

Graph the solution set of each inequality on a number line and then write it in interval notation.

1. $\{x | x > 2\}$

2. $\{x | 2 \leq x < 5\}$