# 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

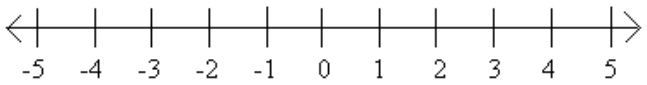
To graph an inequality in one variable, e.g. $x < a$, on a number line:

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.

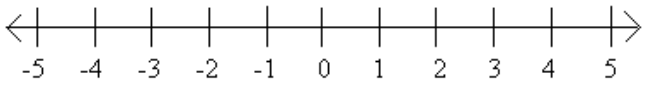
1. $x \leq 1, x < 5, x > -1$




### 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

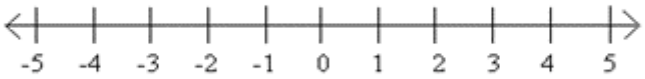
For any numbers $a$, $b$, and $c$, if $a < b$ then $a + c < b + c$.

- 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.

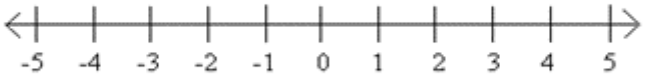
$$n - \frac{1}{2} \leq \frac{5}{8}$$




### 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 $ac > bc$.

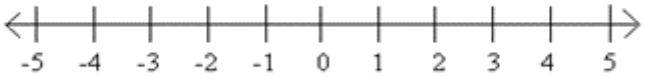
When we divide or multiply an inequality by a:

- **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.

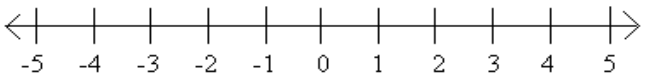
$$-8q < 32$$




### 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 $\infty$ 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.

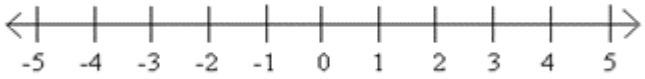
### Interval Notation Rosetta Stone

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

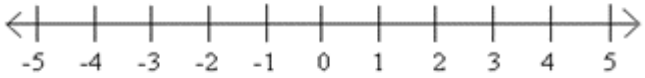
## Examples

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

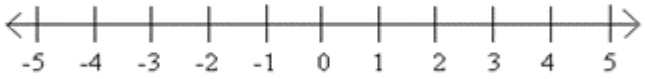
1. $\{x|x \leq -4\}$




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



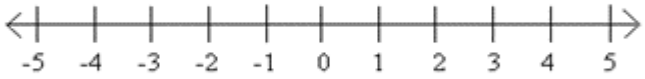

3. $\{x|-3 < x \leq 4\}$




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