

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

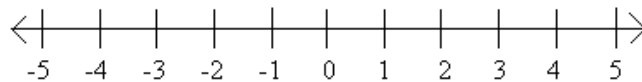
To graph an inequality in one variable, e.g. $x < a$, on a number line:

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.

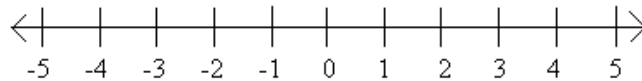
1. $x \leq 1, x < 5, x > -1$



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

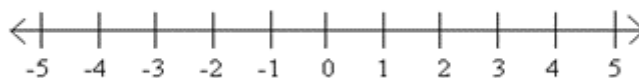
For any numbers a , b , and c , if $a < b$ then $a + c < b + c$.

- 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.

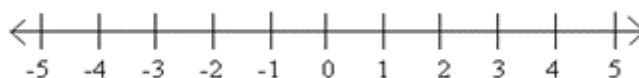
$$n - \frac{1}{2} \leq \frac{5}{8}$$



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 $ac > bc$.

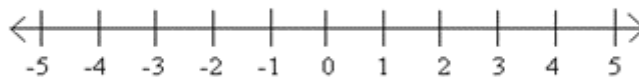
When we divide or multiply an inequality by a:

- **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.

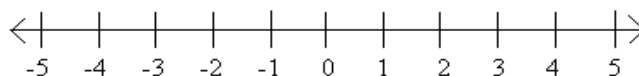
$$-8q < 32$$



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.

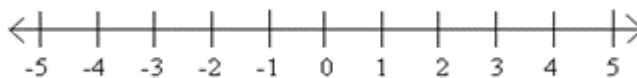
Interval Notation Rosetta Stone

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

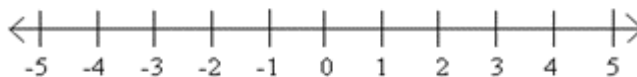
Examples

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

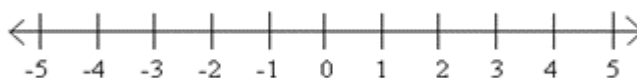
1. $\{x|x \leq -4\}$



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



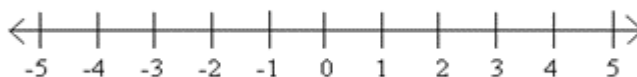
3. $\{x|-3 < x \leq 4\}$



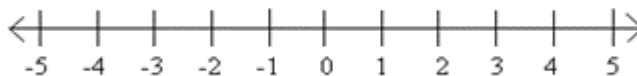
You Try it

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

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



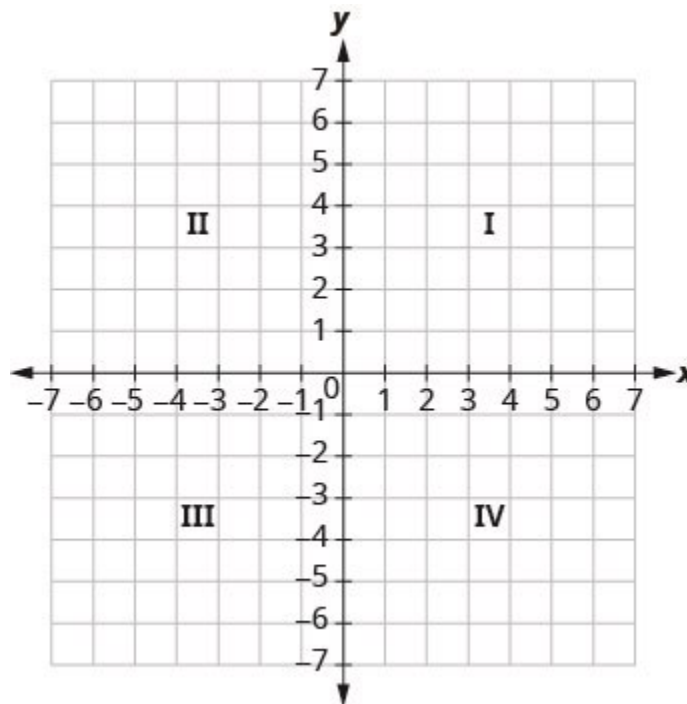
2. $\{x|2 \leq x < 5\}$



The Rectangular Coordinate System

Definitions

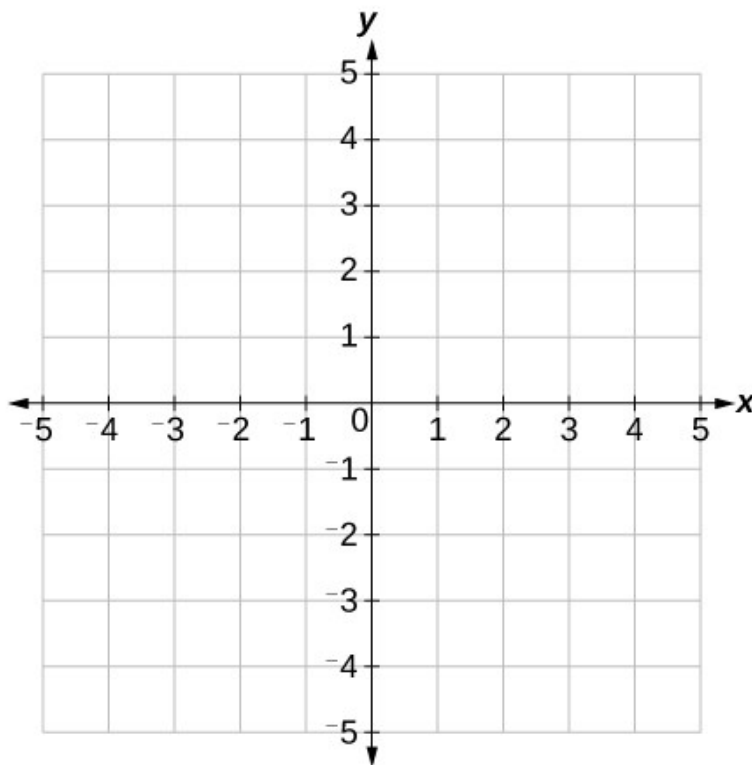
- The **rectangular coordinate system** is shown on the right.
- The horizontal number line is called the ***x*-axis**.
- The vertical number line is called the ***y*-axis**.
- These axes divide a plane into four regions, called **quadrants**.
- An **ordered pair**, (x, y) , gives the coordinates of a point in a rectangular coordinate system.
- The first number is the *x*-coordinate.
- The second number is the *y*-coordinate.
- The point $(0,0)$ is called the **origin**. It is the point where the *x*-axis and *y*-axis intersect.



Examples

Plot each point in the rectangular coordinate system and identify the quadrant in which the point is located:

$$(-5, 4)(-3, -4)(2, -3)(-2, 3)\left(3, \frac{5}{2}\right).$$



You Try It

Plot each point in the rectangular coordinate system and identify the quadrant in which the point is located:

$$(-2, 1)(-3, -1)(4, -4)(-4, 4)\left(-4, \frac{3}{2}\right).$$

