Solving Inequalities
Using Addition & Subtraction

Objective:

Students will be able to:

- graph inequalities on a number line.

- solve inequalities using addition and subtraction.

An *inequality* is like an equation, but instead of an equal sign (=) it has one of these signs:

$<$: less than
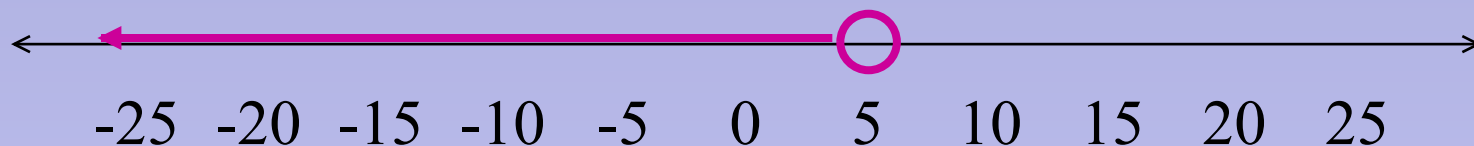
$\leq$: less than or equal to

$>$: greater than

$\geq$: greater than or equal to

"x < 5"

means that whatever value *x* has, it must be less than 5.

Try to name ten numbers that are less than 5!

# Numbers less than 5 are to the left of 5 on the number line.

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◄━━━━━━━━━━━━━━━━○────────────────►
-25  -20  -15  -10  -5   0   5   10  15  20  25
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- If you said 4, 3, 2, 1, 0, -1, -2, -3, etc., you are right.
- There are also numbers in between the integers, like 2.5, 1/2, -7.9, etc.
- The number 5 would *not* be a correct answer, though, because 5 is not less than 5.

"x ≥ -2"

means that whatever value *x* has, it must be greater than <u>or</u> equal to -2.

Try to name ten numbers that are greater than or equal to -2!

Numbers greater than -2 are to the right of 5 on the number line.

-25 -20 -15 -10 -5   0   5   10   15   20   25

-2
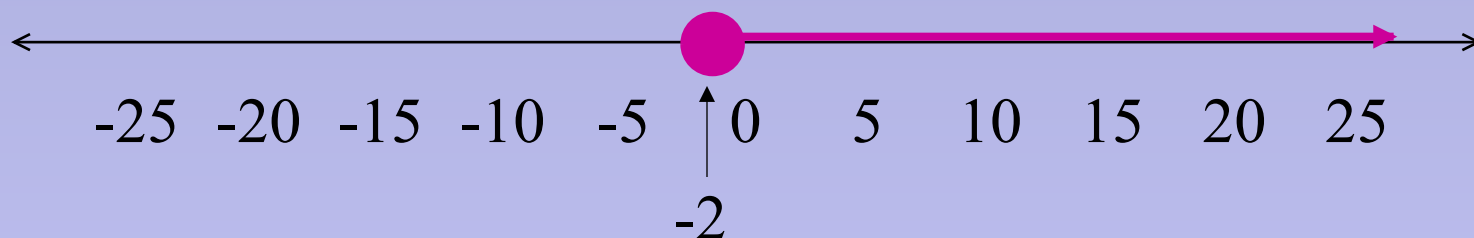
- If you said -1, 0, 1, 2, 3, 4, 5, etc., you are right.
- There are also numbers in between the integers, like -1/2, 0.2, 3.1, 5.5, etc.
- The number -2 *would also* be a correct answer, because of the phrase, "or equal to".

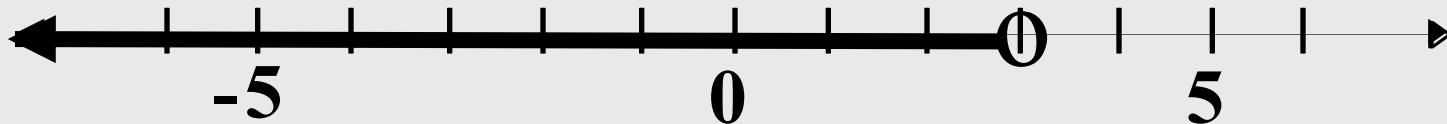# Where is -1.5 on the number line? Is it greater or less than -2?

-25 -20 -15 -10 -5 0 5 10 15 20 25

-2
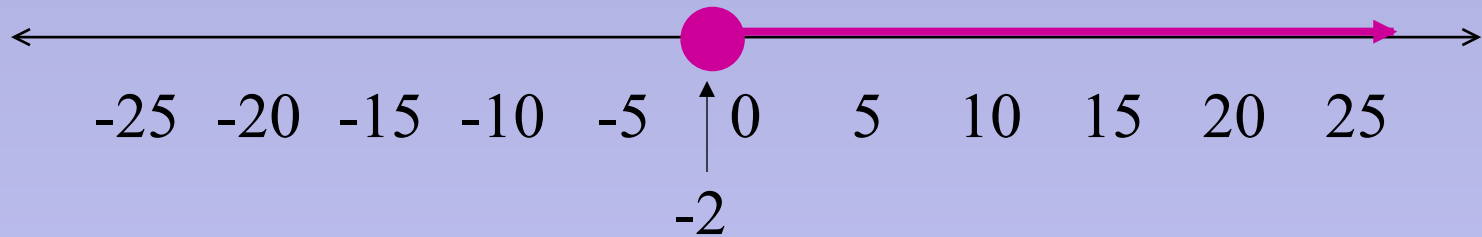
- -1.5 is between -1 and -2.
- -1 is to the right of -2.
- So -1.5 is also to the right of -2.

How to graph an inequality

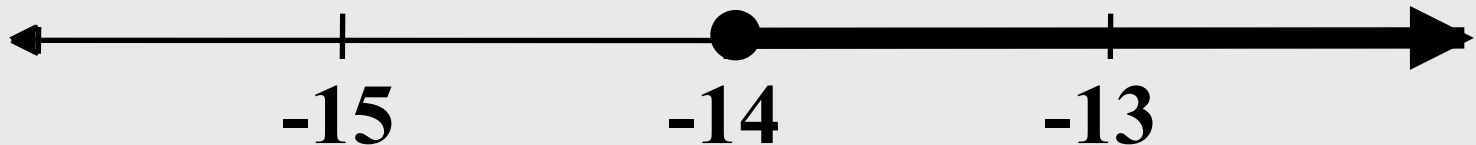When you have < or >, use an open dot!
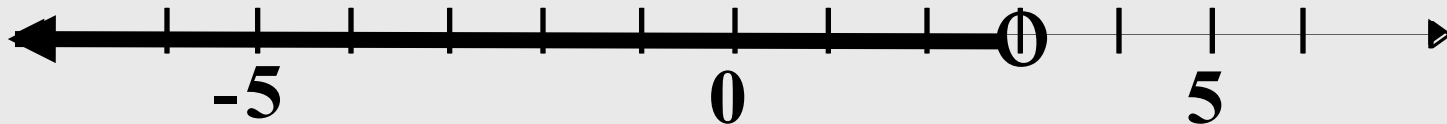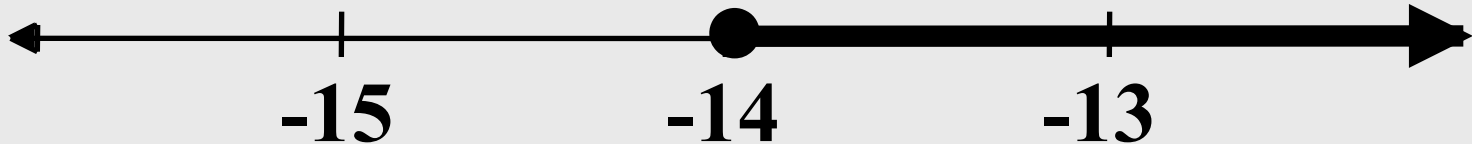
X < 3

-5 0 5

When you have a ≤ or ≥, use a closed dot!

X ≥-14

-15 -14 -13

How to graph an inequality

How to know which way the arrow is going

X < 3

-5 0 5

X ≥ -14

-15 -14 -13

What do you do if it the number is written first?

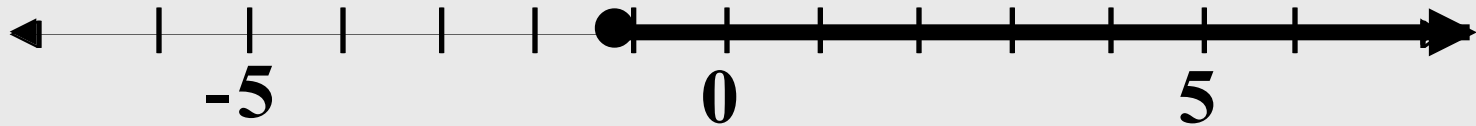10 < x-5 ≥ x

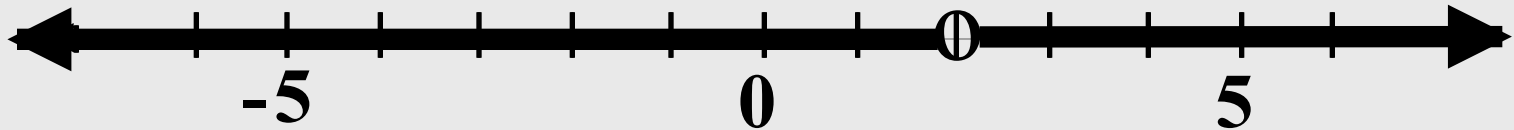# 1) Graph the solution set of x < 3.
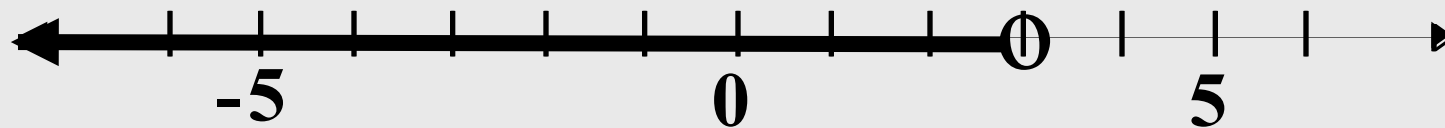
When you have < or >, use an open dot!

2) Graph the solution set of y ≥ -5/4.

When you have ≤ or ≥, use a closed dot!

Converting -5/4 to a decimal = -1.25

3) Graph the solution set of
$p \neq 2$.

When you have $\neq$, use an open dot and shade both ways!

4) Which inequality would have a closed dot on the number line?

- $>$

- $<$

✔ • $\geq$

- $\neq$

🙂
Answer Now

5) Which inequality does NOT use an open dot on the number line?

✔ • ≤

• <

• >

• ≠

🙂
Answer Now

Solve an Inequality

$$w + 5 < 8$$

We will use the same steps that we did with equations, if a number is added to the variable, we add the opposite sign to both sides:

$$w + 5 + (-5) < 8 + (-5)$$

$$w + 0 < 3$$

$$w < 3$$

All numbers less than 3 are solutions to this problem!

More Examples

$$8 + r \geq -2$$

$$8 + r + (-8) \geq -2 + (-8)$$

$$r + 0 \geq -10$$

$$w \geq -10$$

All numbers from -10 and up (including -10) make this problem true!

More Examples

$$x - 2 > -2$$

$$x + (-2) + (2) > -2 + (2)$$

$$x + 0 > 0$$

$$x > 0$$

All numbers greater than 0 make this problem true!

More Examples

$$4 + y \leq 1$$

$$4 + y + (-4) \leq 1 + (-4)$$

$$y + 0 \leq -3$$

$$y \leq -3$$

All numbers from -3 down (including -3)
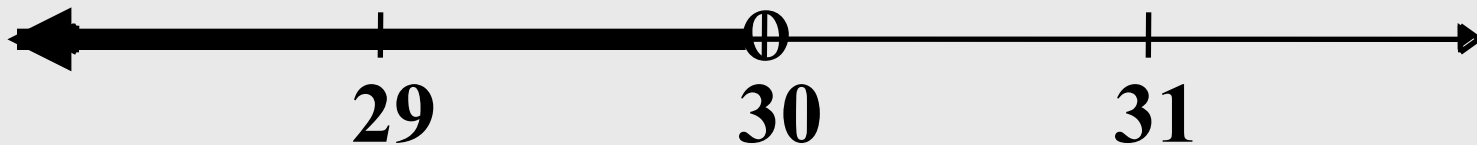make this problem true!

6) Solve $x + (-14) < 16$

Solve this problem like an equation

1. Draw "the river"
2. Eliminate double signs
3. Add 14 to both sides
4. Simplify
5. Check your answer
6. Graph the solution

$$x - 14 < 16$$
$$+ 14 \quad + 14$$
$$\overline{}$$
$$x < 30$$

$$30 + (-14) = 16$$
$$16 = 16 \checkmark$$

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<----|----------⊕----------|----------->
    29          30          31
```

7) Solve $y + 21 \geq 7$

$$- 21 \quad | \quad -21$$

$$y \geq -14$$

1. Draw the "river"
2. Subtract 21 from both sides
3. Simplify
4. Check your answer
5. Graph the solution

$$30 + (-14) = 16$$

$$16 = 16 \checkmark$$
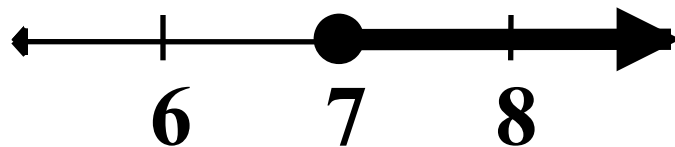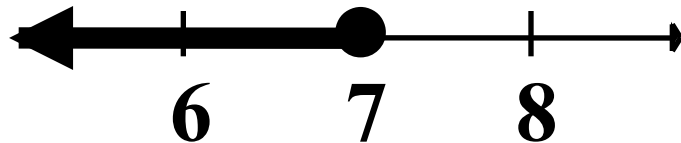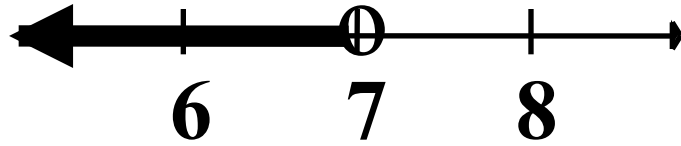
-15 -14 -13
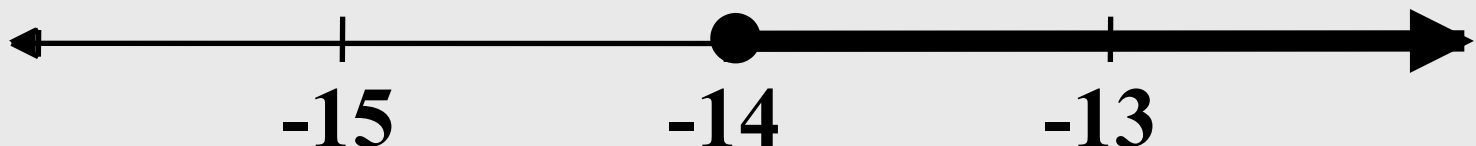
8) Solve $8y + 3 > 9y - 14$

- Draw "the river"
- Subtract 8y from both sides
- Simplify
- Add 14 to both sides
- Simplify
- Rewrite inequality with the variable first
- Check your answer
- Graph the solution

$$-8y \qquad -8y$$

$$3 > y - 14$$

$$+14 \qquad +14$$

$$17 > y$$

$$y < 17$$

$$8(17) + 3 = 9(17) - 14$$

✔

16   17   18
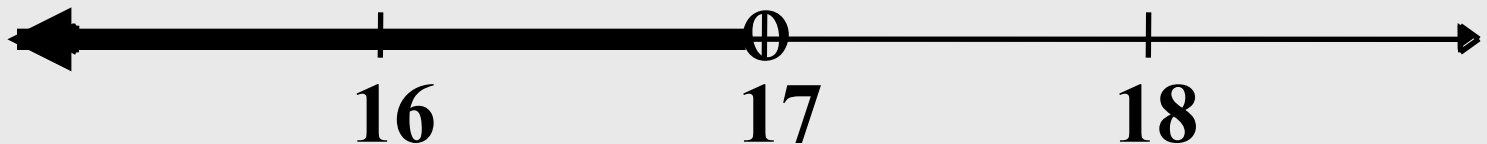
9) What is the graph of $7 \leq m$?

-
  6   7   8

-
  6   7   8

-
  6   7   8

- ✔
  6   7   8

Answer Now

10) Solve $3r - 17 \geq 2r + 14$

1. Draw "the river"
2. Subtract 2r from both sides
3. Simplify
4. Add 17 to both sides
5. Simplify
6. Check your answer
7. Graph the solution

$$- 2r \qquad - 2r$$
$$r - 17 \geq \quad 14$$
$$+ 17 \qquad + 17$$

$$r \geq 31$$

$3(31) - 17 = 2(31) + 14$

✓

30   31   32

11) Solve $-2x + 6 \geq 3x - 4$

- $x \geq -2$
- $x \leq -2$
- $x \geq 2$
- ✔ $x \leq 2$

😊
Answer Now

12) Joanna's tests were 87, 93, 88 and 94. What must her 5th grade be to get a total of at least 459?

- 96
✔ - 97
- 98
- 100

🙂
Answer Now