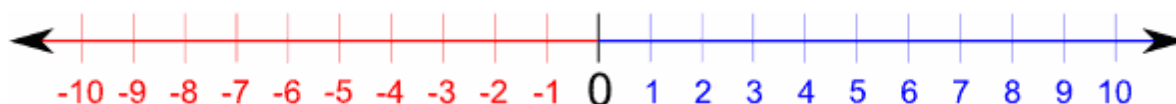


### Numbers Can be Positive or Negative:



Negative Numbers (-)

Positive Numbers (+)

Note the arrowhead on the far-right end of the number line above. That arrow tells you the direction in which the numbers are getting bigger. The arrow on the left tells you that the negatives are getting *smaller* as they move off to the left. That is, *-5 is smaller than -4*.

**An opposite number of any number (n) is a number which, if added to n, results in 0. The opposite number for n is written as -n.**

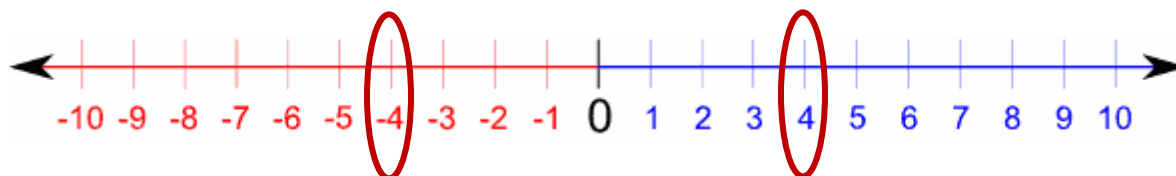
**For example, -7 is opposite to 7, because  $-7 + 7 = 0$ .**

**Opposites lie at the same distance from zero on the number line, but in the opposite directions.**

For any number  $x$  (whether positive or negative), we can find the opposite by putting “-“before it. For example:  $-x$  the opposite of  $x$ .

For example, the opposite of  $-2$  would be  $-(-2)$  and that is equal to 2.

**Absolute value.** The distance of a number from zero on the number line is called absolute value. So, we can say that the opposites have the same absolute value. The symbol for absolute value is  $| |$ . For example,  $|4| = |-4| = 4$ .

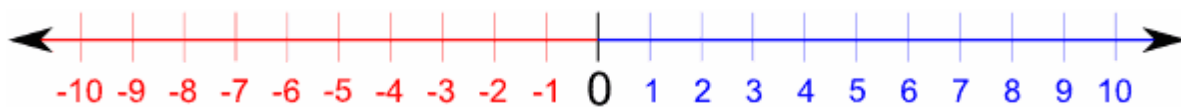



**Comparing negative numbers.** When comparing negative numbers, remember that the smaller number is the one to the left on the number line.

For example,  $-2 < -1$ .


**Addition and subtraction.** If we add a positive number to any number, we move to the right along the number line. If we add a negative number to any number, we move to the left along the number line. So, adding  $(-5)$  is moving 5 units to the left on the number line which is the same as subtracting 5. This rule holds in general:


$$a + (-b) = a - b$$

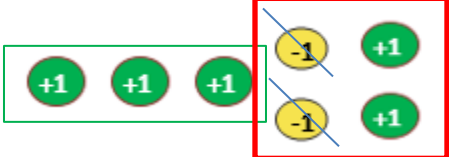





Move to the left

  
 $3 + (-2) = (-2) + 3 = 3 - 2$ 




 $3 - (-2) =$ 


“-“ means take away

We start from 3, but we can't take away negative numbers from it because there are no negatives here, so I add them using a trick: I add two negatives and two positives. In sum, my change is not a change at all since two negatives and two positives cancel each other out, but now, I have enough negatives to work with. Now, I can subtract two negatives from 3.

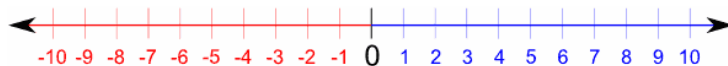
The answer is 5.

It is also  $3 + (-(-2)) = 3 + 2$

Opposite of -2 which is +2



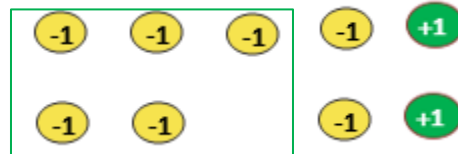
$$-5 - (-2) = -3$$



180° turn



$$-5 - (-7) = 2$$

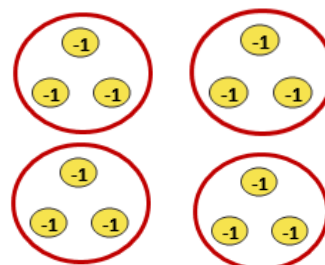


I have only 5 negatives. So there aren't enough negatives here to take away 7 negatives, so I add them using the same trick.

### Multiplication and Division of negative numbers

$$4 \times (-3) = (-3) \times 4 =$$

(commutative property)



You are taking 4 groups of negative 3. You get negative 12 in total

What about multiplying negative by a negative? Let's get to it doing some exercise:



$$-4 \times -3 = ?$$

$$-4 \times 0 = 0$$

$$-4 \times (-3 + 3) = 0 \text{ Use distributive property to get:}$$

$$-4 \times (-3) + (-4 \times 3) = 0$$

?
-12



From this we see that in order to get a "0", we need to add 12 to "-12". So

$$-4 \times (-3) = 12$$

Pattern showing why *negative x negative = positive*:

$$4 \times (-3) = -12$$

$$0 \times (-3) = 0$$

$$3 \times (-3) = -9$$

$$-1 \times (-3) = 3$$

$$2 \times (-3) = -6$$

$$-2 \times (-3) = 6$$

$$1 \times (-3) = -3$$

$$-3 \times (-3) = 9$$

$$-4 \times (-3) = 12$$

### Shortcuts/Rules Multiplication and Division of negative numbers:

$$\text{negative} \times \text{positive} = \text{negative}: \quad -1 \times 3 = -3$$

$$\text{negative} \times \text{negative} = \text{positive}: \quad -1 \times (-3) = 3$$

$$\text{negative} \div \text{positive} = \text{negative}: \quad -1 \div 3 = -1/3$$

$$\text{negative} \div \text{negative} = \text{positive}: \quad -1 \div (-3) = 1/3$$