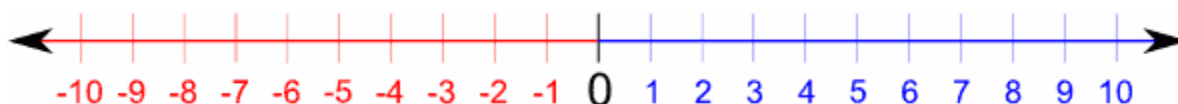


Numbers Can be Positive or Negative:



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*.

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 $-7 + 7 = 0$.

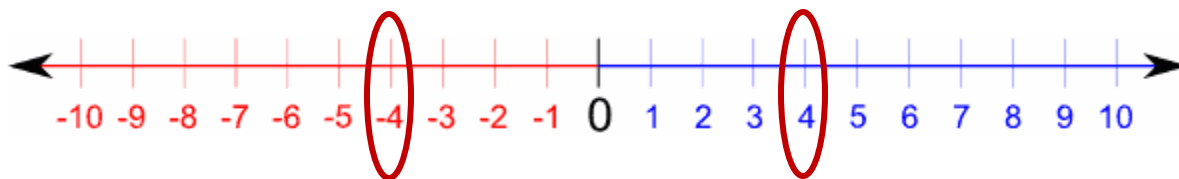
Opposites lie at the same distance from zero on the number line, but in the opposite directions.

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 .

Number	Opposite number
a	
4	
-20	
$-a$	
$-(-a)$	
$-(-(-a))$	

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. For example, $-2 < -1$.

Compare

$$-4 \quad 4$$

$$6 \quad -4$$

$$\frac{2}{3} \quad -\frac{3}{2}$$

$$-4 \quad -2$$

$$-4 \quad 0$$

$$-\frac{2}{3} \quad -1$$

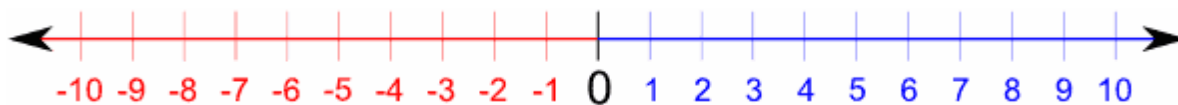
$$-4 \quad -6$$

$$-1 \quad -\frac{1}{2}$$

$$-2 \quad \frac{1}{2}$$

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:

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



180° turn

↓

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

“-“ means take away

+1 +1 +1

+1 +1 +1 -1 -1



$3 - (-2) =$



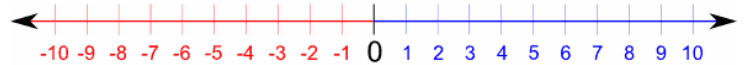
We start from 3, but there are no negatives here so I add them using a trick:

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

Opposite of -2 which is +2



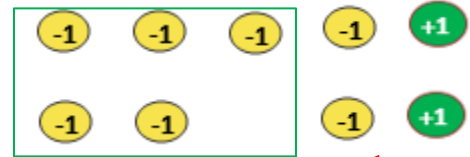
$-5 - (-2) =$



180° turn



$-5 - (-7) =$



There aren't enough negatives here so I add them using the same trick

Compute:

$3 + (-2) =$

$3 + (+2) =$

$-3 - (-2) =$

$3 - (+2) =$

$-3 + (-2) =$

$-3 + (+2) =$

$3 - (-2) =$

$-3 - (+2) =$

$-3 + (+3) =$

Compare without calculation.

$$\begin{array}{llll} 100 - (35 - 20) & 100 - (35 + 20) & 100 + (35 - 20) & 100 + (35 + 20) \\ 100 - (-35 - 20) & 100 - (-35 + 20) & 100 + (-35 - 20) & 100 + (-35 + 20) \end{array}$$

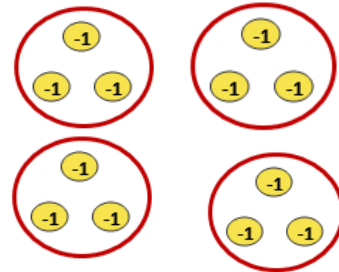
Rewrite without parenthesis:

$$\begin{array}{ll} 20 + (2 - 3) = & 20 - (-2 + 3) = \\ 20 - (2 - 3) = & 20 - (-2 + (-3)) = \end{array}$$

Multiplication and Division of negative numbers

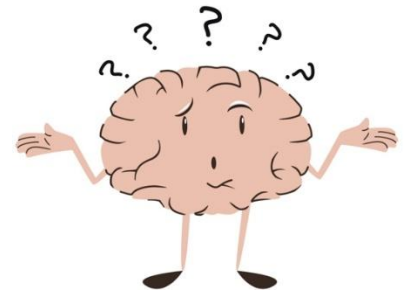
$$4 \times (-3) = (-3) \times 4 =$$

(commutative property)



$$\begin{array}{l} -4 \times -3 = ? \\ -4 \times 0 = 0 \\ -4 \times (-3 + 3) = 0 \\ -4 \times (-3) + (-4 \times 3) = 0 \end{array}$$

? -12



Pattern:

$$\begin{array}{ll} 4 \times (-3) = -12 & 0 \times (-3) = \\ 3 \times (-3) = -9 & -1 \times (-3) = \\ 2 \times (-3) = -6 & -2 \times (-3) = \\ 1 \times (-3) = -3 & -3 \times (-3) = \end{array}$$

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

Shortcuts/Rules Multiplication and Division of negative numbers:

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

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

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

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

1. Positive or negative number will be the product of
 - a) Two negative and one positive numbers.
 - b) One negative and two positive numbers
 - c) Three negative numbers.

2. A swimming pool can be filled by one pipe in 10 hours or by another pipe in 15 hours. How long it will take to fill up the pool with both pipes opened?

3. A swimming pool can be filled with one pipe in 10 hours. When full, the pool can be drained out with another pipe in 20 hours. How long it will take to fill up the pool if the drain pipe is open?