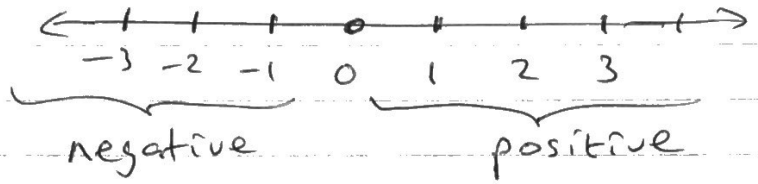
Chapter 2. Signed numbers



In this chapter we focus on working with the integers which are the whole numbers $0, 1, 2, 3, \ldots$ along with the negative integers $-1, -2, -3, \ldots$.

2.1 Absolute value

The absolute value of any number is just its positive part. Has notation "| |". The magnitude of a number is another name for it.

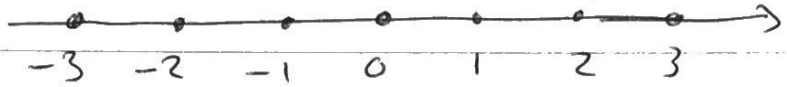
Examples: $|-9| = 9$, $|3| = 3$, $|0| = 0$

Absolute value is always positive or zero, never negative.

Example: Find two numbers with absolute value equal to 98.
Solution: $|98| = 98$ and $|-98| = 98$ so the answer is $\boxed{98 \text{ and } -98}$.

Example: Find a number with absolute value equal to -2.
Answer: No number has absolute value -2.

2.2 Inequalities



The symbol $<$ is "less than" and we use it when the first number is to the left of the second number.

Examples (1) $1 < 3$ is true

(2) $-2 < 1$ is true

(3) $-3 < 0$ is true

(4) $1 < -2$ is false because 1 not to left of -2.

(5) $-2 < -2$ is also false.

The symbol $>$ is "greater than" and we use it when the first number is to the right of the second number.

Examples (6) $2 > 1$ is true

(7) $1 > -2$ is true

(8) $-2 > -3$ is true

(9) $-3 > 2$ is false.

Example (10) Which inequality symbol should go between these numbers:

$5 \_\_ -7$

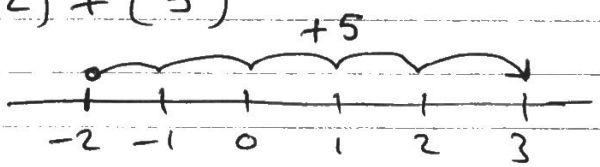
Answer: $5 > -7$ because 5 is to the right of -7.

2.3 Adding signed numbers.

An easy way to think about adding signed numbers uses the number line:

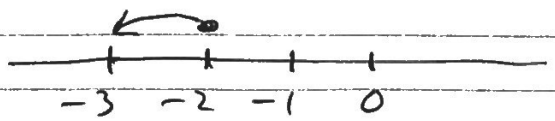
- Move right when you add a positive number
- Move left when you add a negative number.

Example: $(-2) + (5)$



So $(-2)+(5) = 3$ or just $-2+5=3$.

Example: $(-2) + (-1)$



So $(-2)+(-1) = -3$ or $-2+(-1)=-3$.

See more examples in the book on pages 53, 54.

Rule to add two signed numbers

(A) If the numbers have the same sign then add the absolute values and keep the sign.

(B) If the numbers have different signs then subtract the absolute values (larger − smaller) and use the sign of the number with the larger absolute value.

Seems complicated!

Example (1) Find $(-13)+(-12)$.

Solution: We are in case (A) because both numbers have a negative sign. Keep the negative sign for the answer.

$|-13|=13$, $|-12|=12$ and add these absolute values $\begin{array}{r} 13 \\ +12 \\ \hline 25 \end{array}$. Answer $\boxed{-25}$.

Example (2) $(-16)+(13)$.

Solution: Different signs so case (B).

$|-16|=16$, $|13|=13$

↖ larger absolute value

subtract: $\begin{array}{r} 16 \\ -13 \\ \hline 3 \end{array}$ and the number with the larger abs. value was negative

Answer $\boxed{-3}$.

Can also write $-16 + 13 = -3$.

More examples p55, 56.

It is helpful to use money as an example. Think of positive numbers a money you are paid and negative numbers as money you have to pay.

Example: Suppose you have \$90 and a phone bill of \$35 and a paycheck for \$65. Add these to find how much money you have.

Solution: You have $(90) + (-35) + (65)$.

Use case (B) to see $(90) + (-35) = 55$. Then $55 + 65 = 120$. Answer $\boxed{\$120}$.

Definition: To get the opposite of a number you switch its sign.

So the opposite of 17 is -17 and the opposite of -456 is 456. The opposite of 0 is $-0 = 0$.

(The opposite of a number is not the same idea as its absolute value.)

We use the minus sign $-$ for opposites

-10 can be thought of as the opposite of 10

$-(-10)$ means the opposite of -10, which is 10

$$-(-10) = 10.$$

Example: In words, $-(-49)$ means the opposite of -49. That equals 49.

$$-(-49) = 49.$$

If you add a number to its opposite you always get zero. Why? (Hint: use case Ⓑ.)

Examples:
- $49 + (-49) = 0$
- $(-13) + (13) = 0$
- $-1296 + 1296 = 0$
- $-(-38) + (-38) = 0$