

Adding and Subtracting Integers: math lesson, Grade 7 – download the PDF

Temperatures below freezing, a diver far under the surface, a bank account in the red: all of these need numbers on *both sides* of zero. In this chapter you will learn to add and subtract positive and negative numbers with confidence, using the number line as your map.

1. Positive and negative numbers

The **integers** are the whole numbers and their opposites: $\dots, -3, -2, -1, 0, 1, 2, 3, \dots$. Numbers greater than 0 are **positive**, numbers less than 0 are **negative**, and 0 is neither. Negative numbers appear whenever a quantity can go below a starting level: a temperature of -8°F , a depth of -30 feet, a debt of 25 dollars, -25 .

On a horizontal number line, numbers increase from left to right. So $-9 < -2$ because -9 is farther to the left. The same idea works for decimals and fractions such as -2.5 or $-\frac{3}{4}$: together with the integers they form the **rational numbers**, and every rule in this chapter works for them too.

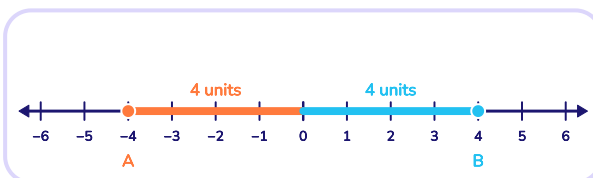
2. Opposites and absolute value

D Opposites

Two numbers are **opposites** if they are the same distance from 0 but on different sides of 0. The opposite of n is written $-n$. The opposite of 0 is 0.

D Absolute value

The **absolute value** of a number is its distance from 0 on the number line. We write it $|n|$. A distance is never negative, so $|n| \geq 0$ always.



In the figure, A is at -4 and B is at 4 . Both are 4 units from zero, so $|-4| = 4$ and $|4| = 4$. Notice that the opposite of -4 is $-(-4) = 4$.

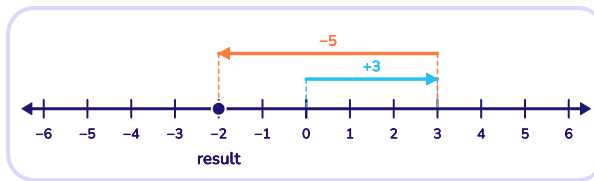
⚠ Common mistake

Absolute value does not simply “erase the sign” of an expression.

$|-3 + 1| = |-2| = 2$, but it is *not* $3 + 1$. Calculate inside the bars first.

3. Adding on the number line

Think of addition as a walk. Start at the first number. Adding a **positive** number means moving to the right. Adding a **negative** number means moving to the left.



E Example 1: a walk on the line

Compute $3 + (-5)$. Start at 3 and move 5 units left. You land on -2 . So $3 + (-5) = -2$.

E Example 2: two negatives

Compute $-4 + (-3)$. Start at -4 and move 3 more units left: -7 . Adding two negatives gives a negative whose absolute value is the sum of the absolute values.

4. Rules for adding integers

M Method: adding two integers

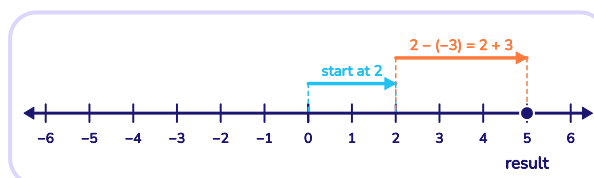
1. Same signs: add the absolute values and keep the common sign.
2. Different signs: subtract the smaller absolute value from the larger one and keep the sign of the number with the larger absolute value.
3. Opposites always give 0.

Sum	Signs	Work	Result
$-6 + (-9)$	same	$6 + 9 = 15$, sign $-$	-15
$12 + (-5)$	different	$12 - 5 = 7$, sign $+$	7
$-12 + 5$	different	$12 - 5 = 7$, sign $-$	-7
$-8 + 8$	opposites	cancel	0

5. Subtraction as adding the opposite

P Rule

Subtracting a number is the same as adding its opposite: $a - b = a + (-b)$.



Why does $2 - (-3)$ equal $2 + 3$? Subtracting -3 removes a debt of 3, and taking away a debt makes you richer by 3. On the line you move 3 units to the *right*, landing on 5.

E Example 3: convert, then add

$$-4 - 7 = -4 + (-7) = -11 \text{ and } -4 - (-7) = -4 + 7 = 3.$$

E**Example 4: rational numbers**

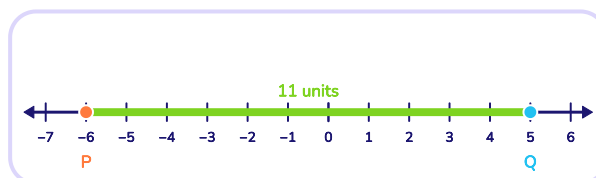
$$1.5 - 4.25 = 1.5 + (-4.25) = -2.75, \text{ and } -\frac{1}{2} - \left(-\frac{3}{4}\right) = -\frac{2}{4} + \frac{3}{4} = \frac{1}{4}.$$

!**Zyro's tip**

On my home planet we say: "Keep, change, change." Keep the first number, change the subtraction to addition, change the second number to its opposite!

6. Distance between two numbers

The distance between two numbers on the number line is how far apart they are. To find it, subtract and take the absolute value: the distance between a and b is $|a - b|$, which equals $|b - a|$.

**E****Example 5: distance across zero**

The distance between -6 and 5 is $|5 - (-6)| = |11| = 11$. When the numbers are on opposite sides of zero, add their absolute values: $6 + 5 = 11$. When they are on the same side, subtract: the distance between -9 and -2 is $9 - 2 = 7$.

7. The additive inverse

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Additive inverse

The **additive inverse** of n is the number that makes a sum of 0: $n + (-n) = 0$. It is the same thing as the opposite of n .

This is why a number and its opposite are called a **zero pair**: $7 + (-7) = 0$, $-2.5 + 2.5 = 0$. Zero pairs help you simplify long sums. For example, in $-9 + 4 + 9$, the -9 and 9 cancel and the answer is simply 4. Subtraction also fits: the opposite of $a - b$ is $b - a$.

8. Real-world contexts

A sign tells you a **direction**: up or down, gained or lost, above or below sea level. To model a word problem, decide what 0 stands for, then write each change as a signed number.

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Example 6: a cold morning

At 6 a.m. it is -7°F . By noon it rises 19°F and by 9 p.m. it falls 14°F . Noon: $-7 + 19 = 12$. Night: $12 - 14 = -2$. The temperature at 9 p.m. is -2°F . In metric units, a change of 19°F is about 10.6°C .

Another example: a hiker at -120 ft (below sea level) climbs to a ridge at $+340$ ft. The climb is $340 - (-120) = 460$ ft, about 140 meters.

Key takeaways

- Opposites are the same distance from 0 on different sides; $|n|$ is the distance from 0 and is never negative.
- Adding a positive moves right; adding a negative moves left.
- Same signs: add and keep the sign. Different signs: subtract and keep the sign of the larger absolute value.
- $a - b = a + (-b)$: subtraction is adding the opposite.
- The distance between a and b is $|a - b|$.
- The additive inverse of n is $-n$, and $n + (-n) = 0$.



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