

Year 7 Maths · Unit 7.2 Directed Number

The big idea. Positive and negative numbers: the number line, ordering, adding, subtracting, multiplying, dividing and the order of operations.

The number line and ordering

- A **directed number** has a sign (+ or -) and a size. The sign says which side of zero; the number says how far.
- -5 and 5 are the same distance from zero, on opposite sides.
- Real examples: temperature below zero, floors below ground, money owed.
- **Order** by position on the number line: numbers to the right are bigger. $-2 > -7$, even though $7 > 2$.
- Use $<$ and $>$ carefully: $-7 < -2$ and $3 > -10$.

Adding directed numbers

- Use **zero pairs**: one positive and one negative counter cancel to 0.
- On a number line, a positive moves right and a negative moves left.
- $-3 + 5 = 2$ and $-3 + (-4) = -7$.
- Tidy double signs: $+ (-3)$ becomes $- 3$, so $5 + (-3) = 5 - 3 = 2$.

Subtracting directed numbers

- Subtracting a negative is the same as **adding** the positive: $5 - (-3) = 5 + 3 = 8$.
- Taking away a negative removes a debt, so you end with more. Build zero pairs to see why.
- Four sign combinations: $+(+3) = + 3$; $+(-3) = - 3$; $-(+3) = - 3$; $-(-3) = + 3$.
- Temperature change: from -4°C to 6°C is $6 - (-4) = 10$ degrees. Height and depth work the same way.

Multiplying and dividing

- Same signs give a **positive**; different signs give a **negative**.
- $(+) \times (+) = +$, $(-) \times (-) = +$, $(+) \times (-) = -$, $(-) \times (+) = -$. Division has the same rules.
- $-4 \times 6 = -24$, $-4 \times (-6) = 24$, $-24 \div 4 = -6$, $-24 \div (-4) = 6$.
- Three or more numbers: an **even** number of negatives gives a positive. $(-2) \times (-3) \times (-1) = -6$.

Order of operations

- An agreed order stops different answers: **B**rackets, then squares and roots (**I**ndices), then **D**ivision and **M**ultiplication, then **A**ddition and **S**ubtraction.
- Work left to right when operations tie, and set out one step per line.
- Example: $3 + 4 \times 2 = 3 + 8 = 11$. And $(3 + 4) \times 2 = 14$.
- $(-3)^2 = 9$ but $-3^2 = -9$: the brackets mean the -3 is squared; without them only the 3 is squared.

Common mistakes

- $\times$ “-7 is bigger than -2 because 7 is bigger than 2.” $\checkmark$ -7 is further left on the number line, so $-7 < -2$.
- $\times$ “ $5 - (-3) = 2$.” $\checkmark$ Subtracting a negative adds: $5 - (-3) = 5 + 3 = 8$.
- $\times$ “ $-3 \times -4 = -12$.” $\checkmark$ Two negatives make a positive: $-3 \times (-4) = 12$.
- $\times$ “ $-3^2 = 9$.” $\checkmark$ Without brackets only the 3 is squared: $-3^2 = -9$. $(-3)^2 = 9$.
- $\times$ “ $3 + 4 \times 2 = 14$.” $\checkmark$ Multiply first: $3 + 8 = 11$.