

Year 8 Maths · Unit 8.3 Number

The big idea. Directed numbers, the order of operations with exponents, and the distributive property (expanding a single bracket).

Multiplying and dividing directed numbers

- **Same signs** give a positive; **different signs** give a negative. This works for $\div$ as well as $\times$.
- $-4 \times 6 = -24$; $-4 \times (-6) = 24$; $-24 \div 4 = -6$; $-24 \div (-4) = 6$.
- Pattern: $3 \times (-2) = -6$, $2 \times (-2) = -4$, $1 \times (-2) = -2$, $0 \times (-2) = 0$, so $-1 \times (-2) = +2$.
- An even number of negatives in a product gives a positive.
- $(-3)^2 = 9$ but $-3^2 = -9$.

Order of operations

- Order: **Brackets**, then **exponents** (powers and roots), then **division and multiplication**, then **addition and subtraction**.
- When operations tie ($\times$ and $\div$, or $+$ and $-$), work **left to right**.
- Include powers and negatives: $2 + 3 \times (-4)^2 = 2 + 3 \times 16 = 50$.
- Set out **one operation per line** and keep the equals signs in a column.
- $(2 + 3)^2 = 25$ but $2 + 3^2 = 11$.

The distributive property

- **Distributive property:** $a(b + c) = ab + ac$. Multiply the outside by every term inside.
- Area model: a rectangle with height 4 and width $(x + 3)$ has area $4x + 12$.
- Positive outside: $5(x + 2) = 5x + 10$. Negative outside: $-3(x - 4) = -3x + 12$ (every sign flips).
- Check by substituting a number: if $x = 2$, $5(x + 2) = 20$ and $5x + 10 = 20$ ✓.
- Use it for mental maths: $6 \times 47 = 6 \times 40 + 6 \times 7 = 282$.

Common mistakes

- ✗ “ $-3 \times -4 = -12$.” ✓ Two negatives give a positive: 12.
- ✗ “ $-3^2 = 9$.” ✓ Only the 3 is squared: -9 . With brackets $(-3)^2 = 9$.
- ✗ “ $2 + 3 \times 4 = 20$.” ✓ Multiply first: $2 + 12 = 14$.
- ✗ “ $-3(x - 4) = -3x - 12$.” ✓ $-3 \times (-4) = +12$, so $-3x + 12$.
- ✗ “ $5(x + 2) = 5x + 2$.” ✓ Multiply every term: $5x + 10$.