

Reading the Structure of Expressions

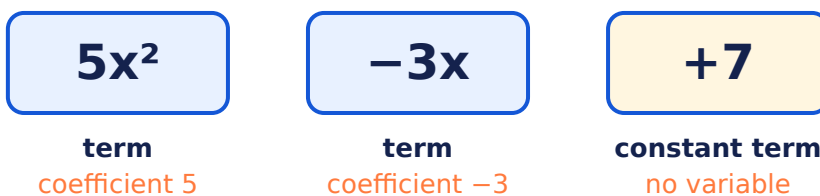
Grade 9 – Algebra 1 math · Lesson · Standards: A-SSE.A.1a, A-SSE.A.1b, N-RN.B.3

Quick answer: A term is a part of an expression separated by plus or minus signs, and a factor is something multiplied inside a term. Coefficients are numerical factors. Reading parts of an expression, such as the growth factor in $P(1 + r)^n$, explains a situation. Rational plus irrational is always irrational.

Standards: A-SSE.A.1a, A-SSE.A.1b, N-RN.B.3 · **Level:** Grade 9 Algebra 1

What are terms, factors and coefficients?

An expression is built from **terms** joined by addition or subtraction. Inside a term, numbers and variables are multiplied, so they are **factors**.



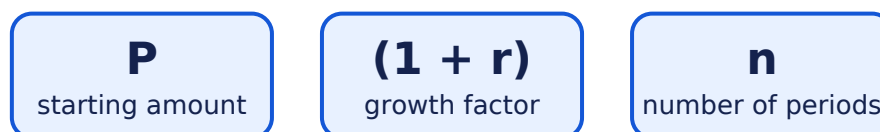
Three terms: two with variables and one constant.

Vocabulary

- **Term:** a piece separated by + or –, such as $5x^2$.
- **Coefficient:** the numerical factor of a term (5 in $5x^2$, and -3 in $-3x$).
- **Constant term:** a term with no variable, like 7.

How do you interpret parts of an expression in context?

Each piece tells a story. In the cost expression $18 + 9.5h$, the constant 18 is a fixed fee and 9.5 is the charge per hour. A factored expression such as $4(x + 7)$ reads as 4 copies of the quantity $(x + 7)$.



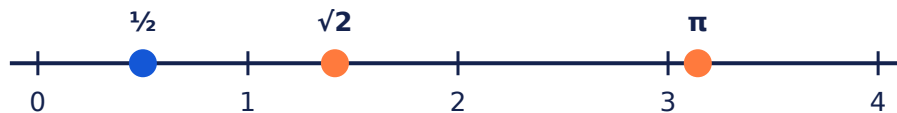
$P(1 + r)^n$: the growth factor is applied n times

Reading $P(1 + r)^n$ part by part.

In $P(1 + r)^n$, the base $1 + r$ is the growth factor. A rate of 6% gives 1.06, and each period multiplies the amount by 1.06.

When is a sum or product of numbers rational?

Operation	Result	Example
rational + rational	always rational	$0.5 + 2.75 = 3.25$
rational $\times$ rational	always rational	$(2/3)(9) = 6$
rational + irrational	always irrational	$4 + \sqrt{3}$
nonzero rational $\times$ irrational	always irrational	5π
irrational + irrational	can be either	$\sqrt{2} + (-\sqrt{2}) = 0$



Rational point in blue, irrational points in orange.

Method: decide if a number is rational

1. Simplify any root: $\sqrt{81} = 9$ is rational, $\sqrt{45}$ is not.
2. Check for a terminating or repeating decimal.
3. For a sum or product, use the table above.
4. If a rule gives "either", test a pair of numbers.

Common mistake

Calling 3π rational because 3 is rational. Multiplying a nonzero rational by an irrational always gives an irrational number.

Mathbot's tip

Ask, "What does this piece do?" Name each term and each factor aloud before you simplify or substitute.

Key points to remember

- Terms are separated by + or $-$; factors are multiplied.
- A coefficient is the numerical factor of a term, including its sign.
- In $P(1 + r)^n$, the factor $1 + r$ multiplies the amount once per period.
- A nonzero rational times an irrational number is irrational.
- The sum of two irrational numbers can be rational, as in $\sqrt{2} + (-\sqrt{2})$.

Reading the Structure of Expressions: frequently asked questions

How can you tell terms from factors?

Terms are separated by addition or subtraction, while factors are multiplied together. In $3a(b + 4)$, there is one term made of three factors: 3, a and $(b + 4)$.

Is a negative sign part of the coefficient?

Yes. In $9y^2 - 4y + 11$, the coefficient of the y term is -4 , because subtraction is adding the opposite. The constant term is 11.

What does the $1 + r$ in $P(1 + r)^n$ mean?

It is the growth factor for one period. If $r = 0.05$, the factor is 1.05, so the amount grows by 5 percent each period. A decay factor like 0.85 means a 15 percent loss.

Why is $5 + \sqrt{3}$ irrational?

If $5 + \sqrt{3}$ were rational, then subtracting 5 would leave $\sqrt{3}$ rational, but $\sqrt{3}$ is irrational. So the sum has to be irrational.

Can two irrational numbers multiply to a rational number?

Yes. $\sqrt{2}$ times $\sqrt{8}$ equals $\sqrt{16}$, which is 4. Because irrational numbers can combine either way, always test the actual numbers.