General Math Examples

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July 27, 2025

Measure

Example 1. magnitude

A sum of money is a quantity, since we may increase it or diminish it.

Example 2. magnitude

Examples of magnitudes include length, area, volume, mass, temperature, speed.

These magnitudes can be measured.

Example 3. ratio

Given a long piece of wood, specify its size without showing it.

To do so requires a reference length.

If we say the wood is three times as long as some smaller piece, then the antecedent is the first part of the ratio (i.e. 3) and the consequent is the second part(the smaller piece length).

So, the ratio is three times as long as the reference length.

The antecedent of the ratio is the length three because that is what is being measured.

The consequent of the ratio is the smaller piece length because that is the reference length.

Arithmetic Operations

Example 4. The division algorithm involves either repeated subtraction or repeated division.

Divide 12 by 3.

Solution. Since $12 - 3 - 3 - 3 - 3 = 0$, then there are 4 subtractions.

Therefore, the result of $12 \div 3$ is $\frac{12}{3} = 4$.

Since $3 + 3 + 3 + 3 = 12$, then there are 4 additions.

Therefore, the result of $12 \div 3$ is $\frac{12}{3} = 4$. $\square$

Example 5. A remainder occurs when the divisor does not exactly measure the dividend as a whole number of times.

Observe that $5 \div 3$ results in a quotient of 1 with remainder 2.

This means that 1 full measure of 3 is possible, but 2 more parts out of 3(i.e. $\frac{2}{3}$ of 3) are needed to complete the measure of 5.

Example 6. An exact measure occurs when there is no remainder which means the divisor exactly measures the dividend a whole number of times.

Observe that $6 \div 3$ results in a quotient of 2 with no remainder (i.e. remainder is zero).

This means that 2 full measures of 3 exactly measure 6.

We write $6 \div 3 = \frac{6}{3} = 2$.

Equivalently, we can say that 3 divides 6, or $3|6$.

Therefore, the divisor is a factor of the dividend.

Example 7. polynomial division

The expressions $3x^3 + 5x - 8$ and $x - 2$ represent numbers, and x represents the placeholder.

Consider $3x^3 + 5x - 8$ divided by $x - 2$.

If $x = 4$, then $3x^3 + 5x - 8$ divided by $x - 2$ represents the division of 204 by 2.

If $x = 5$, then $3x^3 + 5x - 8$ divided by $x - 2$ represents the division of 392 by 3.

Example 8. Factors emerge from the process of division

Consider the measure $5 \div 3$, where 3 acts as the unit.

Observe that 3 does not measure 5 as a whole; instead, it requires one whole unit of 3 and two equal parts of 3, which amount to $\frac{2}{3}$ of the unit 3.

On the other hand, $6 \div 3$ is an exact measure; two whole units of 3 measure 6, so $6 = 3 \cdot 2$ with no remainder.

Hence, 2 is a factor of 6.

Example 9. real number is a flawed concept

The measure $\pi \div \sqrt{2}$ is meaningless in algebra, except as a constant approximation.

Example 10. Division tells us the measure of one magnitude in terms of another.

If we use a foot as a standard measuring magnitude to measure the length of a table, then we observe there are three feet that describe the length of the table.

We write $\frac{3}{1}$ to represent this. Conventionally, this is the same as 3, since $\frac{3}{1} = 3$.

Observe that $\frac{3}{1} = \frac{9}{3}$.

Why is this true?

It is because we can divide 9 and 3 by the greatest common divisor 3, so that $\frac{9}{3} = \frac{\frac{9}{3}}{\frac{3}{3}} = \frac{3}{1} = 3$.

This argument can be generalized, once we have clear theoretical foundation for rational numbers for arithmetic operations of addition, subtraction, multiplication, and division. We should re-write our notes and proofs on rational numbers to do this without using any non-sense set theory equivalence classes of ordered pairs junk.

Then we can prove why two rational numbers must be equal; that is, why $\frac{a}{b} = \frac{c}{d}$ iff $ad = bc$.

We also can update our number theory notes/proofs too to eliminate any set theory junk completely and base it on rational number concepts and arithmetic operations.

Example 11. meaning of division

$3 = 3 \div 1$ means that 3 is being measured or counted by 1.

In this case, the larger is being measured by the smaller.

$\frac{1}{3} = 1 \div 3$ means that 1 is being measured or counted by 3.

In this case, the smaller is being measured by the larger.

Observe that $\frac{3}{4}$, $\frac{6}{8}$, and $\frac{9}{12}$ represent the same number, but the measurement in each case is done with a unit that is partitioned into a different number of equal parts, that is, 4, 8, and 12, respectively.

In geometry, it is possible to divide any line segment into n equal parts.

In algebra, nothing happens when the smaller is measured by the larger.

Since $\frac{9}{12} = \frac{3}{4}$, we say $\frac{3}{4}$ is the ratio in reduced form. This is because the smaller is measured by the larger (i.e. 3 is measured by the larger 4). We use the greatest common divisor of 9 and 12, $\gcd(9, 12) = 3$ to compute the ratio in its reduced form of $\frac{3}{4}$.

There is no equal division of the unit possible to further reduce $\frac{3}{4}$. $\frac{3}{4}$ is as far as the ratio can be reduced, it can't be reduced any further.

Example 12. If a unit consists of 4 equal length line segments and the length of a piece of wood is 3 using any of the segments, then the algebraic ratio is $3 : 4$, so its measure is represented by the number $\frac{3}{4}$.

Therefore, $\frac{3}{4} = \text{measure}(3 : 4)$.

Example 13. The constant magnitude π

The constant magnitude π is not a number, so it is certainly not a rational number.

The magnitude π is best understood as a constant related to measurement, not as a real number.

There is no such thing as a real number. Any number must be rational. Irrational numbers do not exist.

If π were a number, then it should be exactly measurable by the unit 1 or a fraction of 1.

However, π cannot be expressed as a fraction of whole numbers, so it is impossible to measure precisely using 1.

An infinite decimal expansion is not a valid number at all.