Mathematical pointers for checking a line of reasoning

Original LFDP writing with AI assistance. Prepared on 10 October 2026. No endorsement by the organisations cited.

Mathematics helps us compare, estimate and explain. Results become more reliable when quantities, units and assumptions remain visible. This guide brings together everyday concepts and examples you can check. Its purpose is to give you a checking method, rather than a list of formulas to apply without understanding their conditions.

Ratios, proportions and percentages

A ratio compares two quantities: three litres for two people is 1.5 litres per person. A proportion expresses a part relative to the whole. A percentage uses a total of one hundred: 20% of 120 is 24. Always ask, 'a percentage of what?' The chosen base determines the result.

Successive percentage changes cannot always be added. Reducing 100 by 20% gives 80. Increasing 80 by 20% then gives 96, not 100. The second change uses a different base. Before comparing two claims, also check whether they refer to percentage points or to a relative percentage change.

Variables, equations and functions

A variable represents a quantity that can change or has yet to be determined. An equation states an equality to be solved: in 3 × x = 12, x is 4. Performing the same permitted operation on both sides preserves the equality. Division by zero is not permitted. Any step that assumes it invalidates the calculation.

A function assigns one output to each input in its domain. If total price is proportional to quantity, we can write price = unit rate × quantity. This model assumes a constant rate and no other charges. An elegant formula does not make those assumptions true. They must be checked against the situation being studied.

Mean, median and probability

The mean is the sum of the values divided by their number. The median divides an ordered set into two parts. With an even number of values, take the mean of the two middle values. For 2, 3 and 100, the mean is 35 while the median is 3. An extreme value can shift the mean substantially; showing both measures can be useful.

A probability describes how likely an event is within a given model. A probability of 0.2 equals 20%, but does not predict what will happen in a particular trial. Events are not always independent. A past observation alone guarantees neither the next outcome nor the validity of the model.

Dimensions and a checking method

Length, area and volume are different quantities. A rectangle measuring 3 metres by 2 metres has an area of 6 square metres and a perimeter of 10 metres. Pythagoras' theorem applies to right-angled triangles, not to every triangle. The condition for using a formula is part of that formula's meaning.

Before calculating, estimate the expected result and write down the units. Then work through one step at a time and check the answer against the original question. Finally, state any rounding and the limits of the model. This method can reveal an error even when a calculator or an AI supplied the calculation.

Primary sources

Ministère français de l'Éducation nationale, Éduscol - La proportionnalité au cycle 3
https://eduscol.education.fr/document/18493/download

NIST/SEMATECH e-Handbook of Statistical Methods - Moyenne, médiane et mode
https://www.itl.nist.gov/div898/handbook/eda/section3/eda351.htm

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