MATH FACT FLUENCY

What is math fact fluency?

Math fact fluency is the ability to recall the answers to basic math facts automatically and without hesitation. Fact fluency is gained through significant practice, with mastery of basic math facts being a goal of both teachers and parents.

Spear-Swerling (2006) states that both conceptual understanding and the ability to solve facts accurately under un-timed conditions are prerequisites for automatic recall of facts. When these prerequisites have been achieved, it is imperative that the student practices the facts such that they can be answered automatically (i.e., retrieval of the answer is both quick and accurate). Through repeated exposures with a fact, the brain establishes a memory relationship with the fact, leading to automatic retrieval. The usual speed goal for automatic recall of facts when responding orally is 30 correct per minute—2 seconds per fact.

Why is math fact fluency important?

Information processing theory supports the view that automaticity in math facts is fundamental to success in many areas of higher mathematics. Without the ability to retrieve facts directly or automatically, students are likely to experience a high cognitive load as they perform a range of complex tasks. The added processing demands resulting from inefficient methods such as counting (vs. direct retrieval) often lead to declarative and procedural errors. Accurate and efficient retrieval of basic math facts is critical to a student's success in mathematics. Research published by The National Council of Teachers of Mathematics (NCTM) states that students who cannot retrieve basic facts easily get lost and often cannot follow the logic of an explanation given by the teacher or a peer when the problems are embedded within more complex mathematic operations, such as simple algebra or long division.

Resource

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Required Fluencies in the Common Core State Standards for Mathematics

When it comes to measuring the full range of the Standards, usually the first things that come to mind are the mathematical practices, or perhaps the content standards that call for conceptual understanding. However, the Standards also address another aspect of mathematical attainment that is seldom measured at scale either: namely, whether students can perform calculations and solve problems quickly and accurately. At each grade level in the Standards, one or two fluencies are expected:

Grade	Required Fluency
K	Add/subtract within 5
1	Add/subtract within 10
2	Add/subtract within 20 [1] Add/subtract within 100 (pencil and paper)
3	Multiply/divide within 100 [2] Add/subtract within 1000
4	Add/subtract within 1,000,000
5	Multi-digit multiplication
6	Multi-digit division Multi-digit decimal operations
7	Solve $PX + q = r$, $p(X + q) = r$
8	Solve simple systems by inspection

Fluent in the Standards means 'fast and accurate." It might also help to think of fluency as meaning the same thing as when we say that somebody is fluent in a foreign language: when you're fluent, you flow. Fluent isn't halting, stumbling, or reversing oneself. Assessing fluency requires attending to issues of time (and even perhaps rhythm, which could be achieved with technology).

The word fluency was used judiciously in the Standards to mark the endpoints of progressions of learning that begin with solid underpinnings and then pass upward through stages of growing maturity. In fact, the rarity of the word itself might easily lead to fluency becoming invisible in the Standards—one more among 25 things in a grade, easily overlooked. Assessing fluency could remedy this, and at the same time allow data collection that could eventually shed light on whether the progressions toward fluency in the Standards are realistic and appropriate.

1 By end of year, know from memory all sums of two one-digit numbers. 2 By end of year, know from memory all products of two one-digit numbers

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Addition Fact Strategies

Grades K-2

Strategy	Strategy Description
Counting On- One-more-than/Two-more-than	Used when adding 1 or 2 to a given number.
Facts with O	Used when one of the addends is O especially helpful with story problems,
Doubles	Adding two of the same number together, such as 2+ 2 or 8 + 8.
Doubles + 1	Finding a double hidden in the fact where one addend is one more than the other.
Combinations of Ten	Grouping the numbers to find expressions that would equal 10.
Make Ten	Use with addend of 8 or 9 building up to 10 + adding on the rest.
Doubles + 2 Two-Apart Facts	Finding a double hidden in the fact where one addend is two more than the other.
Add 10 and take 1 away	When an addend is 9, then just add 10 and take 1 away.
Add 2 and add 2	When an added is 4, add 2 and then add 2 again.

Subtraction Fact Strategies

Strategy	Subtraction Description
Think Addition	Using the known addition fact to solve the subtraction problem. Ex. 13-5 think what goes with 5 to make 13?
Fact Families	Think of the fact family to recall the missing number.
Build Up Through Ten	Used when either the subtrahend or minuend is 8 or 9. Ex: 14-9: start with 9 and work up through 10: 9 and 1 is 10 and 4 more makes 5
Back Down Through Ten	Working backward with 10 as a "bridge". Ex. 15-6, Take 5 away from 15 to get to ten. Then take one more away, leaving 9.

Grades 3-8

Multiplication Strategies

Facts	Strategy
1	**It's just that number** $1 \times 5 = 5$
2	**Double it!** $2 \times 6 \rightarrow 6 + 6 = 12$
3	**Double it and Add a Group!** $3 \times 7 \rightarrow 7 + 7 = 14 \rightarrow 14 + 7 = 21$
4	**Double, Double!** $3 \times 7 \rightarrow 7 + 7 = 14 \rightarrow 14 + 14 = 28$
5	**Count by 5's that many times!** $5 \times 7 \rightarrow 5, 10, 15, 20, 25, 30, 35$
6	**Multiply by 5 and Add a Group!** $6 \times 6 \rightarrow 5, 10, 15, 20, 25, 30 \rightarrow 30 + 6 = 36$
7	**Multiply by 5 and Add a Double!** $7 \times 4 \rightarrow 5, 10, 15, 20 \rightarrow 20 + 8 = 28$
8	**Double, Double, Double!** $8 \times 6 \rightarrow 6 + 6 = 12 \rightarrow 12 + 12 = 24 \rightarrow 24 + 24 = 48$
9	**Multiply by 10 and Subtract a Group!** $9 \times 6 \rightarrow 10 \times 6 = 60 \rightarrow 60 - 6 = 54$
10	**Count by 10's or just Add a Zero!** $10 \times 4 \rightarrow 10, 20, 30, 40$ or $40 = 40$
11	**Multiply by 10 and Add a Group!** $6 \times 11 \rightarrow 10 \times 6 = 60 \rightarrow 60 + 6 = 66$
12	**Multiply by 10 and Add a Double!** $6 \times 11 \rightarrow 10 \times 6 = 60 \rightarrow 60 + 12 = 72$