Mom,
Don’t Make Me Think —
Just Tell Me the Answer

info@RightStartMath.com

based on the work of Dr. Joan A. Cotter

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Answer?

$37 + 26 =$

Answer?

$37 + 26 =$

$$\begin{array}{r} {\scriptstyle 1} \\ 37 \\ +\ 26 \\ \hline 63 \end{array}$$

Answer?

$37 + 26 =$

$7 + 6 = 13$
$30 + 20 = 50$
$50 + 13 = 63$

Answer?

$37 + 26 =$

$37 + 3 = 40$
$40 + 23 = 63$

Answer?

$37 + 26 =$

$37 + 20 = 57$
$57 + 6 = 63$

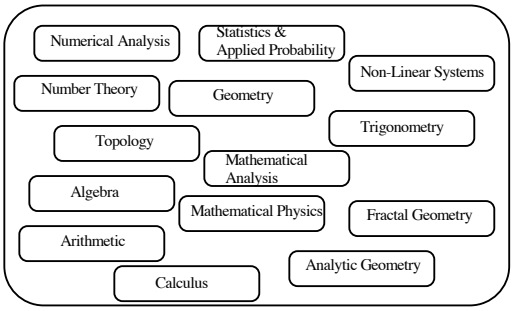
Mathematics

"Mathematics is a very broad and multi-dimensional subject that requires reasoning, creativity, connection making and interpretation of methods.

Math problems should encourage and acknowledge the different ways in which people see mathematics and the different pathways they take to solve problems."

Jo Boaler, Mathematics Mindsets

Mathematics



Time Needed to Memorize

According to a study with college students, measuring the time to memorize:

- 200 nonsense syllables = 93 minutes
- 200 words of prose = 24 minutes
- 200 words of poetry = 10 minutes

We must tell our children that they need to understand math.

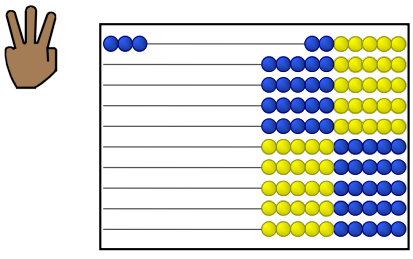
What about Memorization?

"Good mathematics learners expect to be able to make sense out of rules they are taught, and they apply some energy and time to the task of making sense.

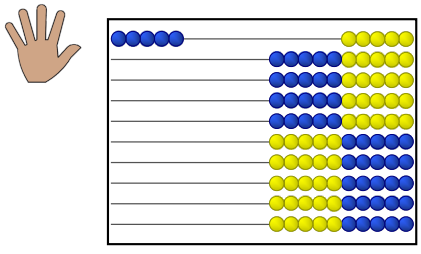
By contrast, those less adept in mathematics try to memorize and apply the rules that are taught, but do not attempt to relate these rules to what they know about mathematics at a more intuitive level."

Lauren Resnick
--educational psychologist

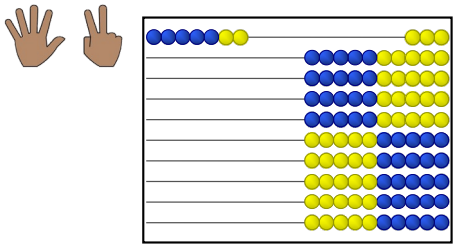
Quantities



Quantities

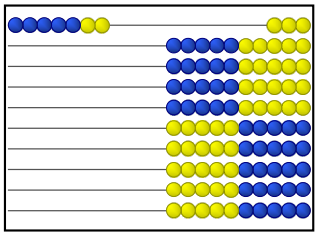


Quantities

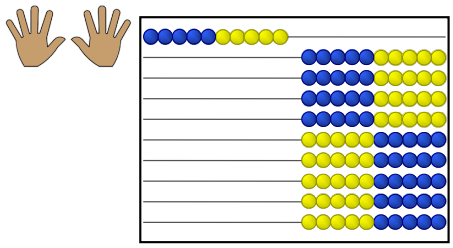


Quantities

7

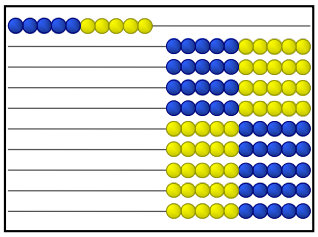


Quantities



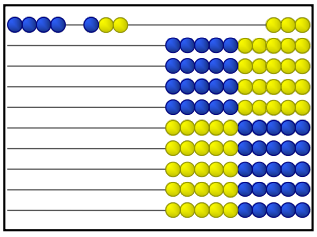
Quantities

10



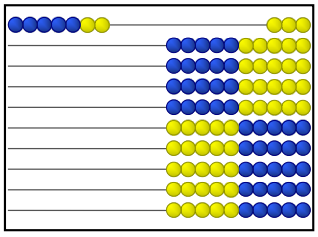
Adding

4 + 3 = ___

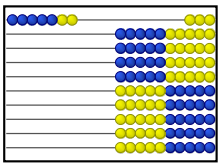


Adding

4 + 3 = 7



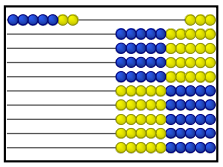
Abacus



"The role of physical manipulatives is to help the child form those visual images and thus to eliminate the need for the physical manipulatives."

—Ginsberg and others

Abacus



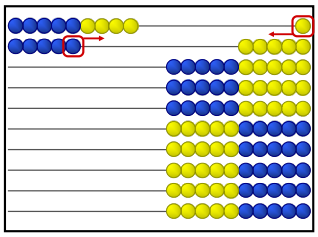
- Visual and tactile manipulative
- Promotes subitizing
- Develops mental images of
  - Quantities
  - Strategies
  - Mathematical Operations

Strategies

- A strategy is a way to learn a new fact or recall a forgotten fact.
- A visual representation is a powerful strategy.

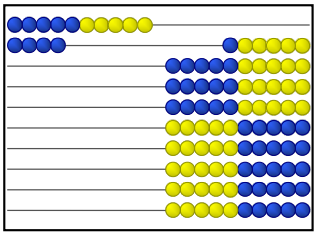
Strategy: Complete the Ten

$9 + 5 =$ ___



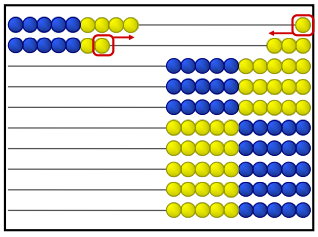
Strategy: Complete the Ten

$9 + 5 =$ 14



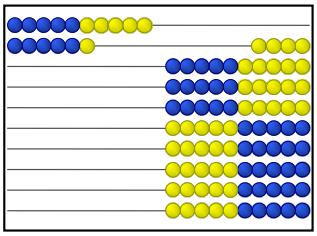
Strategy: Complete the Ten

$9 + 7 =$ ___



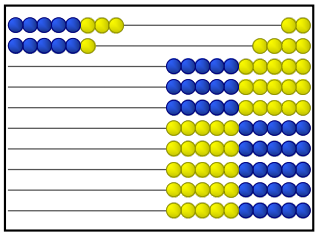
Strategy: Complete the Ten

$9 + 7 = \underline{16}$



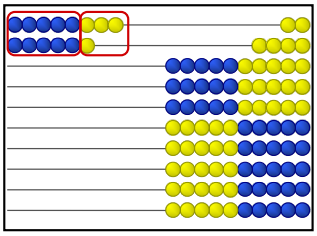
Strategy: Two Fives

$8 + 6 =$



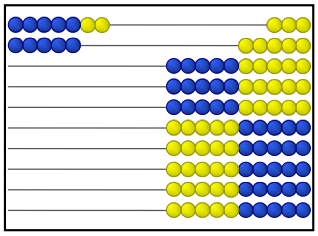
Strategy: Two Fives

$8 + 6 = 10 + 4 = 14$



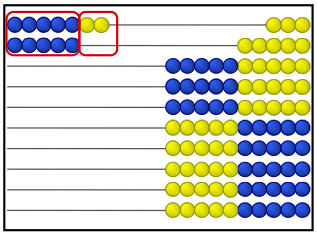
Strategy: Two Fives

$7 + 5 =$

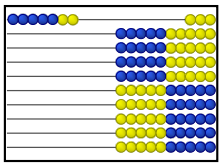


Strategy: Two Fives

$7 + 5 = 10 + 2 = 12$



Abacus



"Think in pictures, because the brain remembers images better than it does anything else."

—Ben Pridmore
World Memory Champion, 2009

How to Assist Thinking

How did you get your answer?

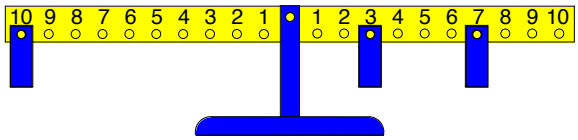
Why did that work?

Will that work every time?

Be quiet!

Allow processing and thinking time.

Math Balance



Problem Solving

A problem is not a problem if the solution is obvious.

Don't have the child look for "key" words.

There are 76 tiles per box and we bought 38 boxes. How many tiles do we have ***altogether****?*

Using "key words" as a problem solving strategy turns an opportunity to THINK into just another procedure to follow, masking understanding.

Problem Solving

- is NOT rote memorizing
- is NOT following rules blindly
- is NOT passive learning

Problem Solving

Problem solving is:

- thinking carefully about the situation
- discovering what is given
- figuring out what is needed
- and deciding on methods to get there

Problem Solving

Japanese teachers discuss one problem in depth, rather than four problems superficially.

They encourage multiple solutions.

Wrong solutions are discussed.

If an error isn't addressed, it will happen again. And again and again!

Guided Discovery

To encourage and guide the child to discovery. And to get them to think.

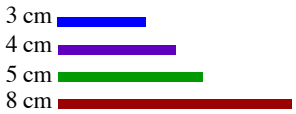
Ask questions, encouraging the child to find the "trick" or "secret pattern".

It is vitally important that children think about what they are doing and not be satisfied with memorizing a rule.

This promotes critical thinkers!

Guided Discovery

Using the following lengths, make triangles.



Guided Discovery

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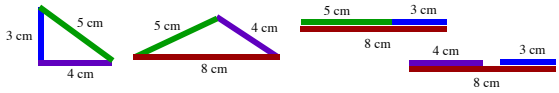
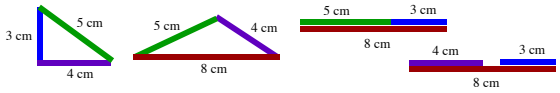


Guided Discovery

Using the following lengths, make triangles.



So, what did we discover?

Two sides of a triangle must be greater than the third side.

Magic Squares

2	7	6
9	5	1
4	3	8

Magic Squares

2	7	6
9	5	1
4	3	8

- Includes all the numbers 1 through 9.
- Even numbers in the corners; other numbers are odd.
- Each row and column add up to the magic number.
- Both diagonals add up to the magic number.
- Corners and opposite sides equal 10.
- The middle number times 3 is the magic number.

Magic Squares

5	-2	
8	4	0
-1	10	3

- What's the missing number?
- What's the magic number?

Magic Squares

5	-2	9
8	4	0
-1	10	3

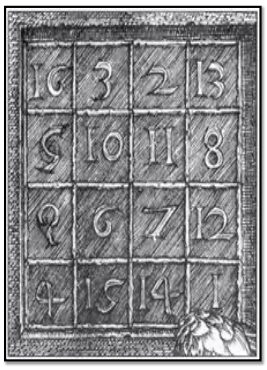
- What's the missing number?
- What's the magic number?

12

Durer's Magic Square

Durer's Magic Square

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1



Durer's Magic Square

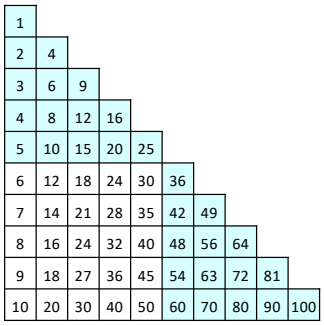
16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

- Includes all the numbers 1 through 16.
- Each row, column, and diagonals add up to the magic number of 34.
- Inner square adds to 34.
- Middle numbers on top and bottom add up to 34.
- Middle numbers on left and right add up to the magic number.
- The year 1514 is included!

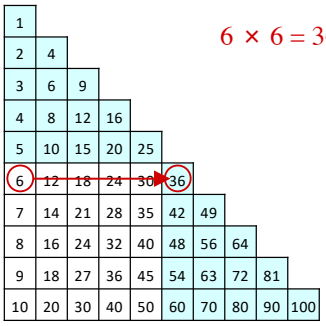
Patterns in Multiples

3	6	9
12	15	18
21	24	27
30		

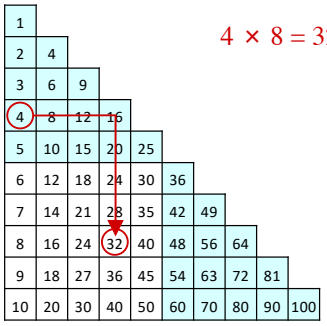
Short Multiplication Chart



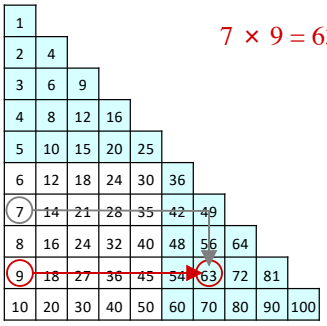
Short Multiplication Chart



Short Multiplication Chart



Short Multiplication Chart



Puzzle Numbers

Make an equation using

2 9 8 3

with mathematics symbols,

= + − × ÷) ‾ /

keeping the numbers in the same order.

Puzzle Numbers

Make an equation using

2 + 9 = 8 + 3

with mathematics symbols,

= + − × ÷) ‾ /

keeping the numbers in the same order.

Puzzle Numbers

Make an equation using

$$2 + 9 - 8 = 3$$

with mathematics symbols,

= + − × ÷) /

keeping the numbers in the same order.

Puzzle Numbers

Make an equation using

$$-2 = 9 - 8 - 3$$

with mathematics symbols,

= + − × ÷) /

keeping the numbers in the same order.

Puzzle Numbers

Make an equation using

3 4 2 5

with mathematics symbols

= + − × ÷) /

keeping the numbers in the same order.

Puzzle Numbers

Make an equation using

4 2 8 4

with mathematics symbols

= + − × ÷) /

keeping the numbers in the same order.

Puzzle Numbers

Make an equation using

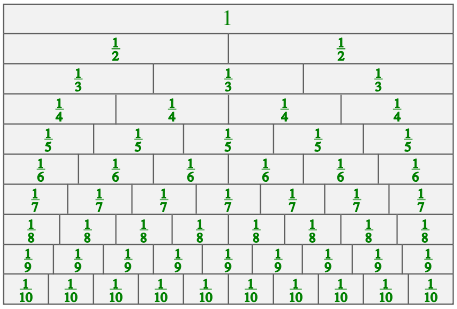
1 2 3 4

with mathematics symbols

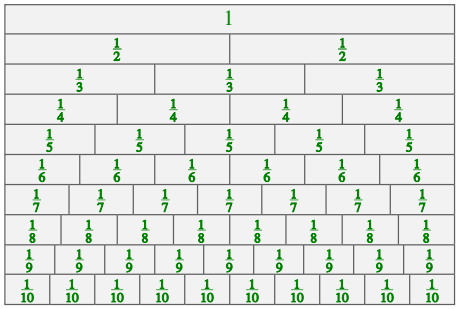
= + − × ÷) /

keeping the numbers in the same order.

Fractions

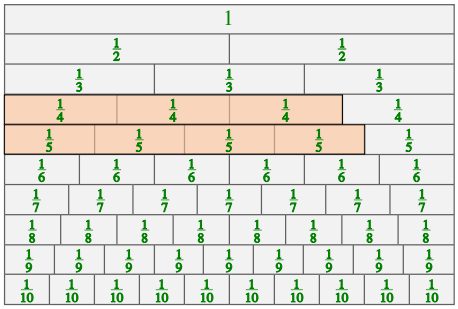


Fractions



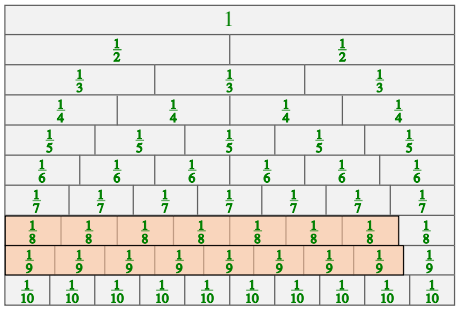
How many fourths in a whole? How many fifths? Eighths?

Fractions



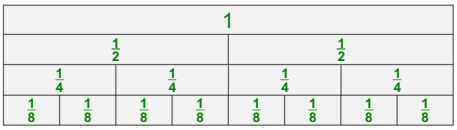
Which is more, 3/4 or 4/5?

Fractions

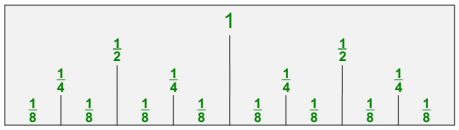


Which is more, 7/8 or 8/9?

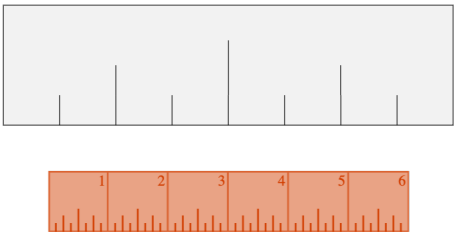
Partial Chart



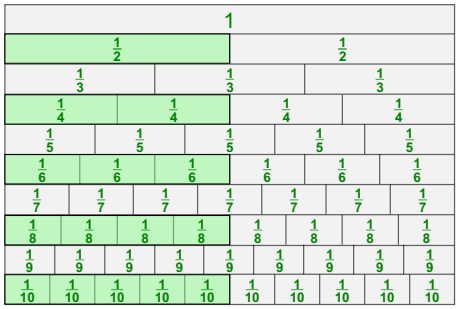
Partial Chart



Partial Chart



Simplifying Fractions



Simplifying Fractions

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

Simplifying Fractions

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

$\frac{21}{28}$

Simplifying Fractions

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

$\frac{45}{72}$

Simplifying Fractions

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	~~10~~	~~15~~	~~20~~	~~25~~	~~30~~	~~35~~	~~40~~	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	~~16~~	~~24~~	~~32~~	~~40~~	~~48~~	~~56~~	~~64~~	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

$\frac{45}{72}$

Why does this work?

Simplifying Fractions

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

$\frac{12}{16}$

Remember, let the child **discover** the algorithm.

How to Assist Thinking

How did you get your answer?

Why did that work?

Will that work every time?

Be quiet!

Allow processing and thinking time.

In Conclusion …

Math needs to be taught so
95 percent is understood and
only 5 percent memorized.

Richard Skemp
– major pioneer in mathematics education

In Conclusion …

Our goal as a teacher of mathematics
is to help our children transform,
expand, and refine these beginning ideas
into deeper mathematical thinking.

– Dr. Joan A. Cotter