Fluency, Word Problems, and Mathematics Intervention

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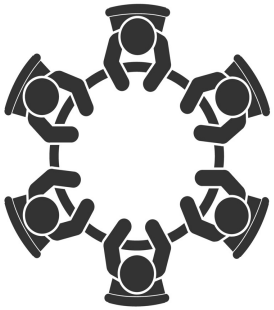

Introduce yourself.

Describe your strengths in supporting mathematics.

Describe an opportunity for growth.

Fluency, Word Problems, and Mathematics Intervention for Students

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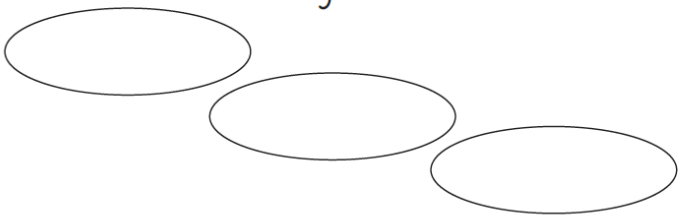
Instructional Platform

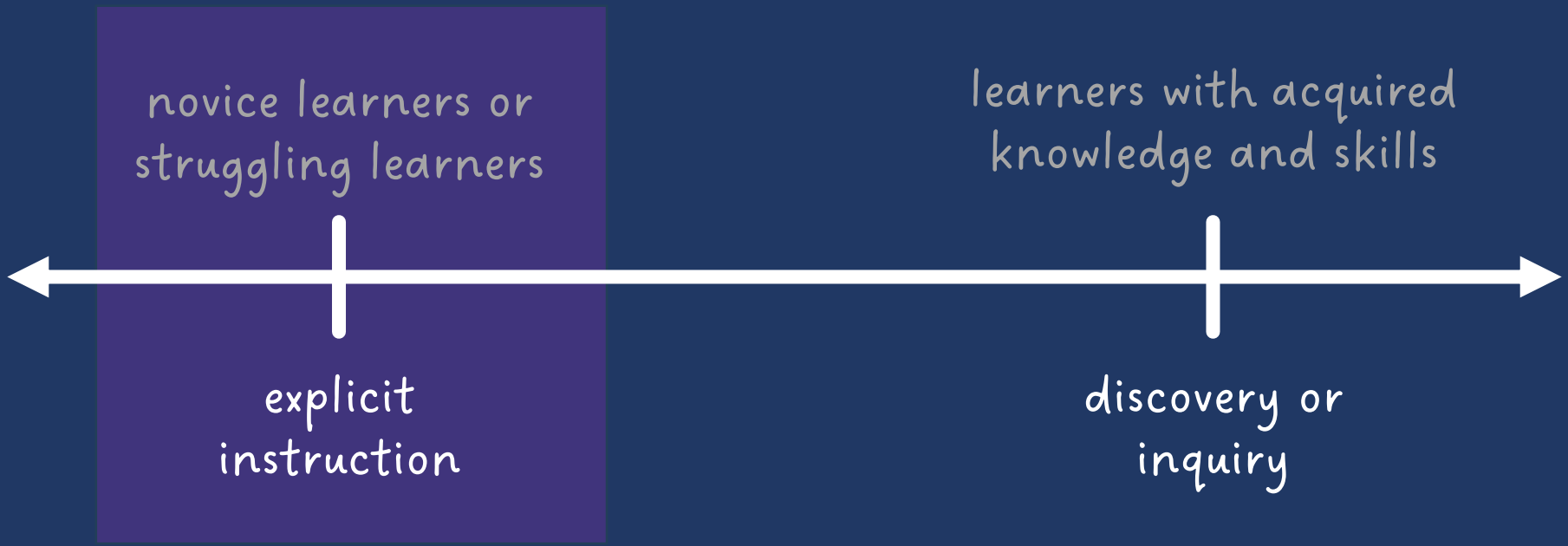
Instructional Delivery



Instructional Strategies

Instructional Platform

What's the continuum of mathematics support?



Anita Archer (2019)

Instructional Platform

evidence-based practice

A practice that has shown **consistent and positive** results

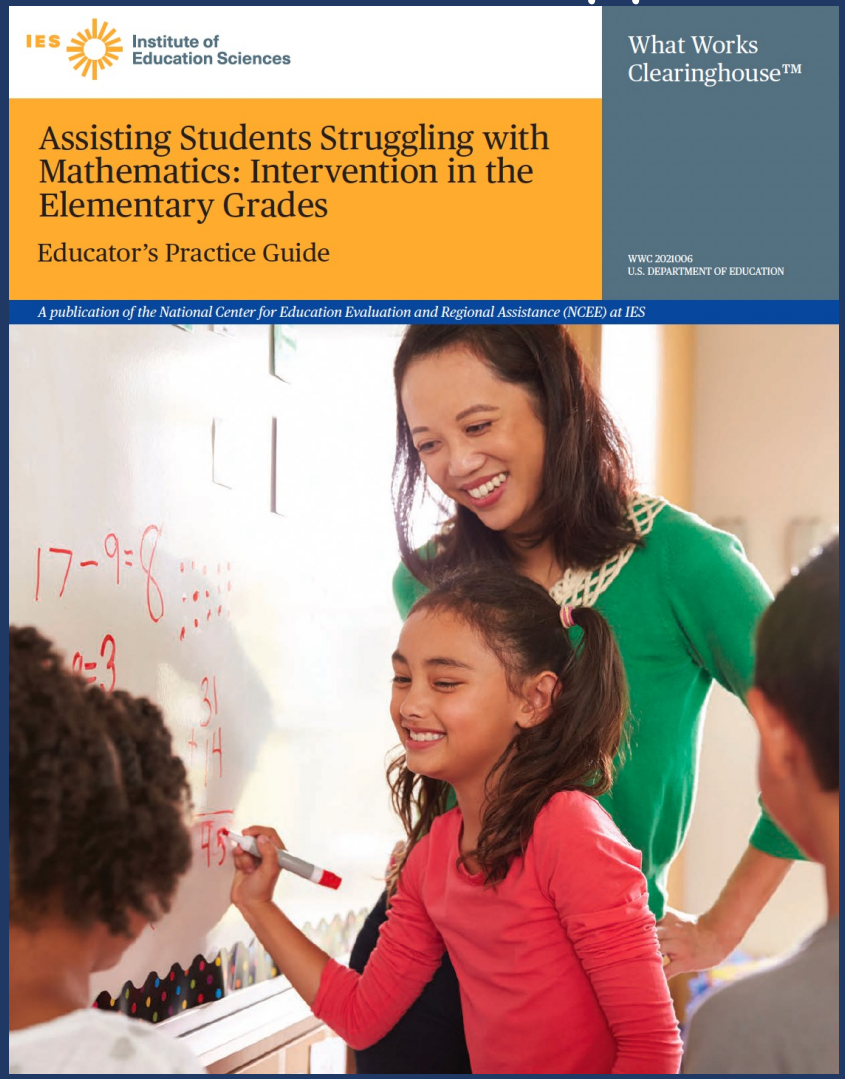
evidence-based practice

evidence-based intervention

An intervention (i.e., packaged program) that has shown **consistent and positive** results

A method or strategy that has shown **consistent and positive** results

What's the continuum of mathematics support?



Students require modeling and practice on how to use the language of mathematics.

Students should use hands-on tools, virtual manipulatives, drawings, and other visuals to understand mathematics concepts and procedures.

Teachers should use systematic and explicit instruction to help students develop a strong foundation for specific mathematics skills.

Teachers should use fluency building activities to build counting fluency and fluency with the operations.

Students should learn how to set up and solve word problems by combining an attack strategy with a focus on word-problem schemas.

Instructional Platform

INSTRUCTIONAL DELIVERY

Vocabulary

Representations

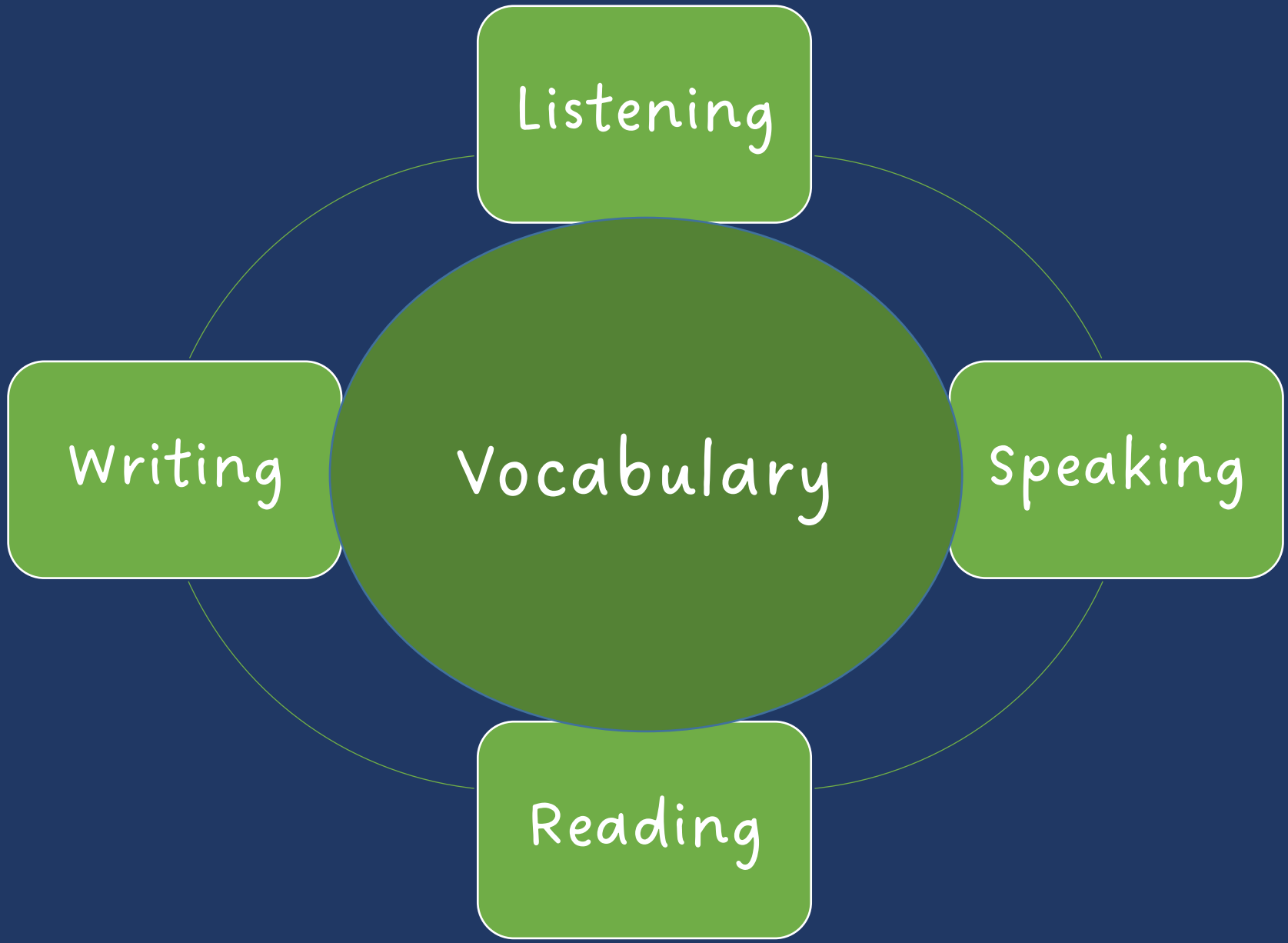
Model and Practice

INSTRUCTIONAL STRATEGIES

Fluency

Word Problems

Vocabulary



Use formal math language

Use terms precisely

Use semantic maps

Term	Definition	Example	Nonexample
integer	(... -3, -2, -1, 0, 1, 2, 3...)	15	$\frac{1}{3}$
denominator	The equal parts of a whole or set.	$\frac{5}{8}$ 8 is the denominator 	$\frac{5}{8}$ 
numerator	The equal parts of a given fraction.	$\frac{5}{8}$ 5 is the numerator 	$\frac{5}{8}$ 

(Stevens et al., 2022)

Use word walls

difference

The result of subtracting or the result when comparing two numbers.

5 – 4 = 1

1 is the difference

horizontal line

A straight line that goes from left to right or right to left.

equivalent

Two numbers that have the same value.

$\frac{2}{4}$ **is equivalent to** $\frac{1}{2}$

total

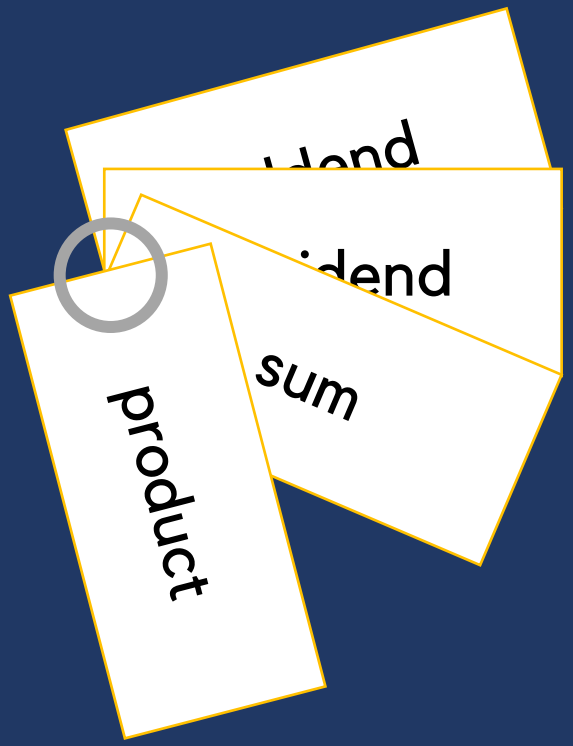
The result or sum when adding numbers.

5 + 7 = 12

(mathspiral.com)

Use flash cards

addend	quotient
divisor	dividend
factor	sum
product	difference

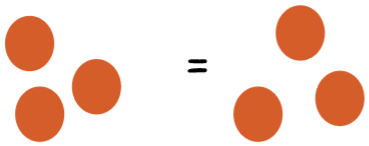


(Petersen-Brown et al., 2019)

Use glossaries

E

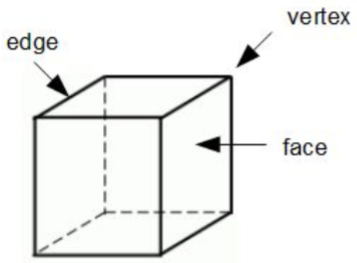
equal - with the same value



equation - expressions with an equal sign

$$5 = 2 + 3$$

edge - line segment between faces



Glosario de Matemáticas

Término	Definición
adición *(add)*	Juntar o agregar.
algoritmo *(algorithm)*	Es una serie de pasos organizados que describe el proceso que se debe seguir, para dar solución a un problema específico.
alinear *(array)*	Un conjunto de objetos, imágenes o números alineados en columnas y filas.
ancho *(width)*	La medida de un lado de un objeto, generalmente el lado más corto.
ángulo *(angle)*	Dos semirrectas o segmentos de línea recta que comparten un punto final.
ángulo agudo *(acute angle)*	Un ángulo que mide menos de 90°.
ángulo obtuso *(obtuse angle)*	Un ángulo que mide entre 90° y 180°.
ángulo recto *(right angle)*	Un ángulo que mide exactamente 90°.
área *(area)*	La cantidad de unidades cuadradas que cubre una figura geométrica cerrada.
balance presupuestario *(balance the budget)*	Un presupuesto es cuando la cantidad total de dinero gastado, ahorrado y compartido es igual al ingreso total.
báscula *(balance scale)*	Instrumento de medición que se utiliza para medir el peso o la carga.
base (computación) *(base (computation))*	Un número que se multiplica por un exponente.
base (geometría) *(base (geometry))*	La forma inferior de una figura tridimensional.

SPIRAL
Specialized Math Intervention to Reach All Learners

(mathspiral.com)

Use anchor charts

Addition Computation

1
17 ← addend
+ 59 ← addend
76 ← sum

Quadrilaterals

Kite

Rhombus

Parallelogram

Square

Rectangle

Trapezoid

Use graphic organizers

horizontal

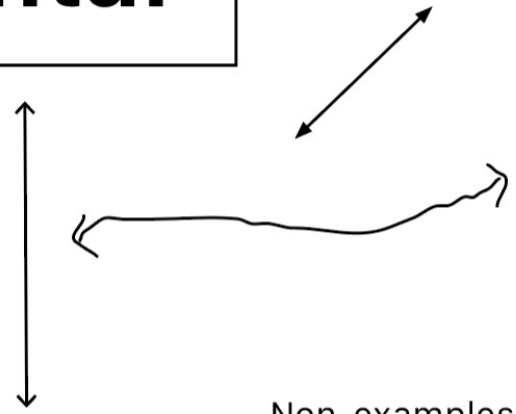
Definition

a straight line that goes left to right or right to left

Picture

Examples

Non-examples



Use games

Name: _____ Date: _____

3RD GRADE MATH

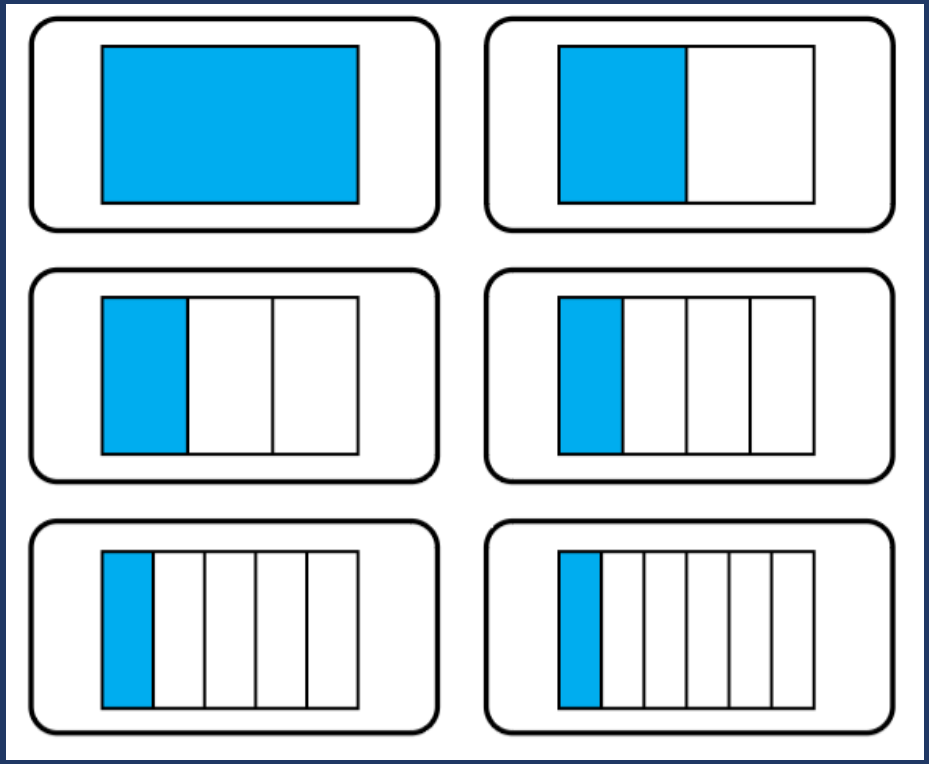
T W D H P T R I Y T S F T O Y T S P X G U C I C
M S G C E N T I M E T E R S Y S C Y Z D R G D J
I M I E U J R L H F O A W Z X U A L F J O Q F T
U P F N Z L R V C N N P Z D D H L P H F A V J Z
Y R U P M I A C O R D P I V J T E I H Y M F M S
E K X H R T T Y U J E S V X S V A T Z W M S E T
W Z Z W G E Q G M P C V C Z E H E L W L T T A A
N U V V B R J F H Y N E O Z H T K U K F A Z S W
Q Y J P S H A C D X A M Y G C U K M Z L J E U P
T Z W B P N R Z Y F L I Y D N A J J Z M W D R S
O W W U W T G I T I A T F F I S Q G X K K I E Z
E W R Q C S U U C U B J L E Z P B H G B C V M Q
F R A C T I O N S K Z O W M D X B M M C O I E C
N Z C A T L I J B J M U F O X X A D O Y L D N K
D E V P T U C M Y S A H K Z S U O W R S C V T G
M X N L N S O L V E R R I Y I B Z N Q O X C P W
M V W Z C D Q Z Z U G X L U K P Y O B S W I M N
K F L J U R J G J R O Q E M X C U O H N M S F D
S U B T R A C T G U L Y Y A K W U N U S O L H H
E G F D D A I O I A I Y R R J I C A P A C I T Y
I L W B A T R D O X K C J G H T D X E G C S M Z
X J Q Y A H L T B J R A I W J B C K I U S S I U
N U O D N R L V T I T L C U P C L W C B F S Z Q
J F N P R R K P Y M R E L U R Q H M A E Y Y Z H

ADD
BALANCED
CAPACITY
CENTIMETERS
CLOCK
DIVIDE
FRACTIONS
GRAM
INCHES
KILO GRAM
LITER
MEASUREMENT
MULTIPLY
NOON
RULER
SCALE
SOLVE
SUBTRACT
TIME

square	circle	decagon	triangular prism	cone
cylinder	cube	sphere	line	pyramid
parallelogram	octagon	FREE	trapezoid	oval
kite	pentagon	cylinder	rectangle	line segment
hexagon	rhombus	triangle	quadrilateral	rectangular prism

https://wordmint.com/public_puzzles/13055

Use games

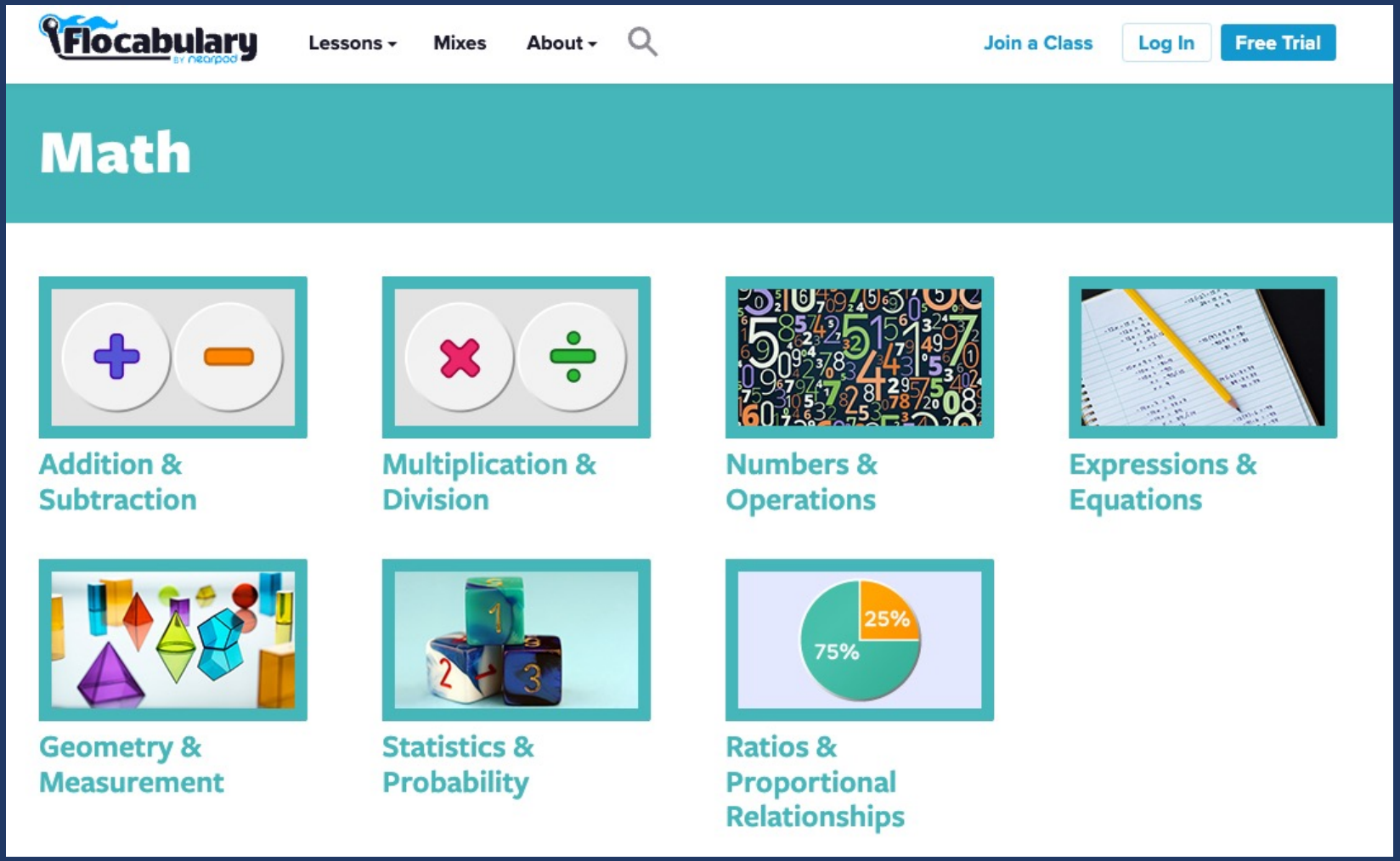


one	one-half
one-third	one-fourth
one-fifth	one-sixth

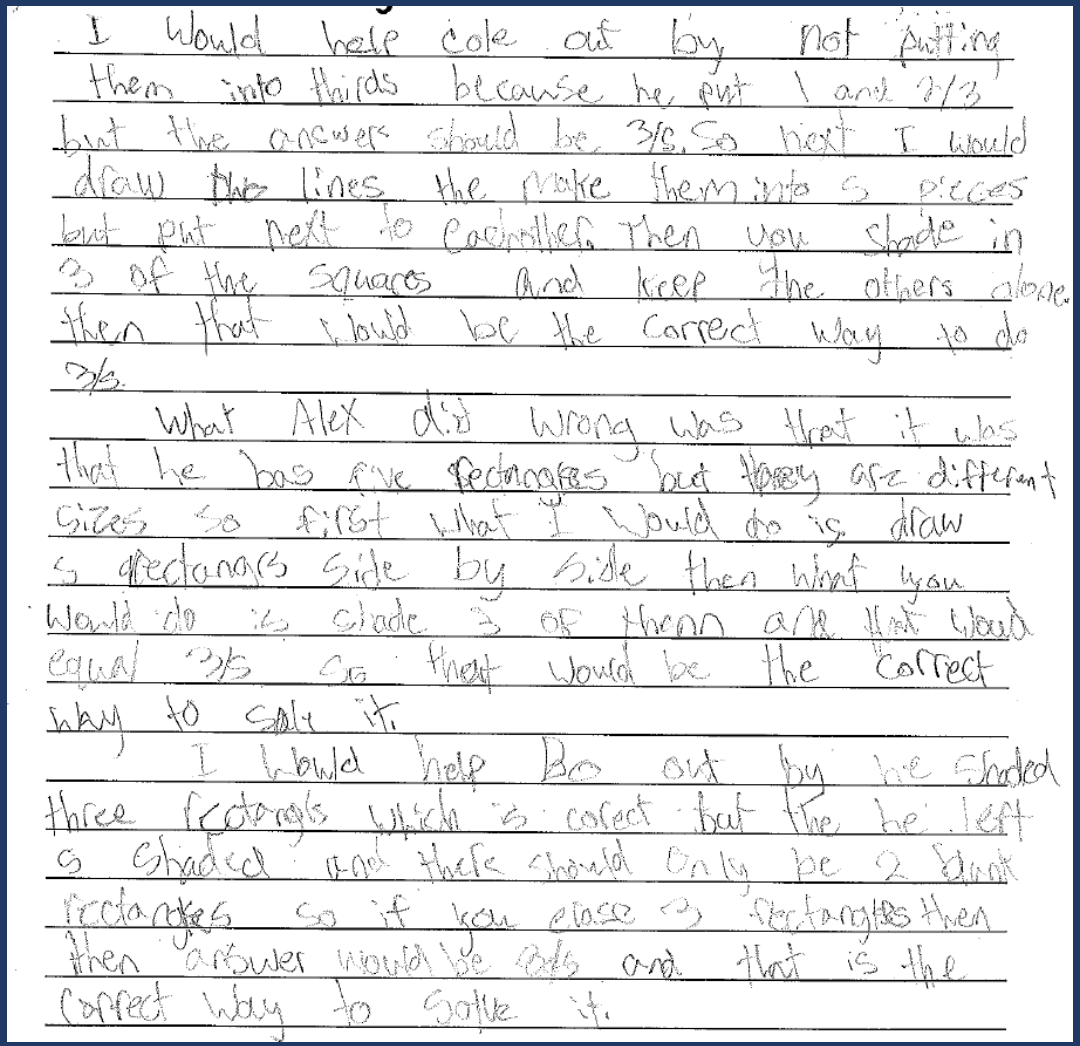
Use discussion

add
change
compare
decrease
difference
increase
part
put together
subtract
total

Use technology



Use math writing

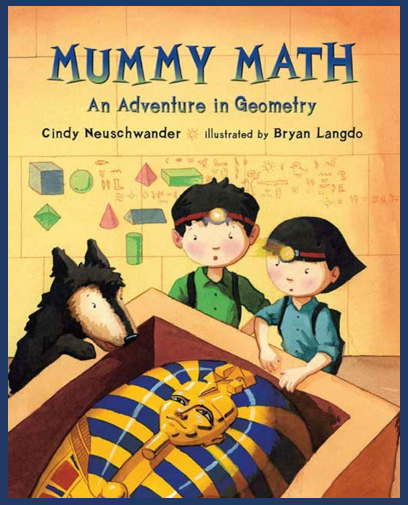


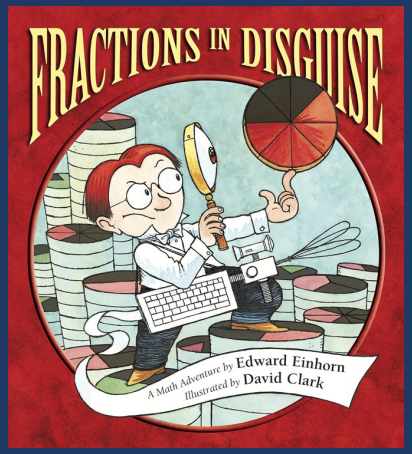
I would help Cole out by not putting them into thirds because he put 1 and 2/3 but the answers should be 3/5. So next I would draw the lines the make them into 5 pieces but put next to eachother. Then you shade in 3 of the squares And keep the others alone. then that would be the correct way to do 3/5.

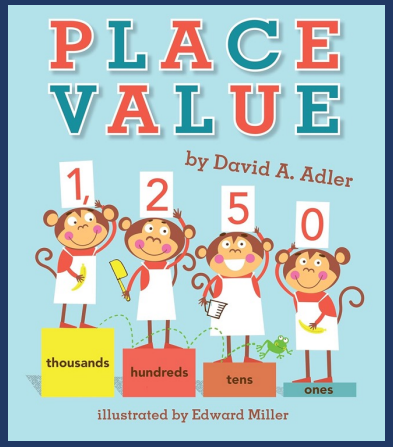
What Alex did wrong was that it was that he has five rectangles but they are different sizes so first what I would do is draw 5 rectangles side by side then what you would do is shade 3 of them and that would equal 3/5 so that would be the correct way to solve it.

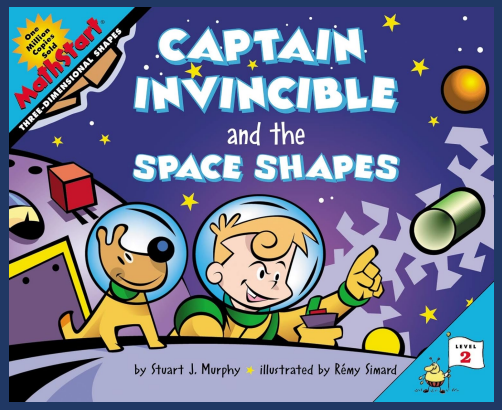
I would help Bo out by he shaded three rectangls which is corect but the he left 5 shaded and there should only be 2 blank rectangles so if you close 3 rectangles then then answer would be 3/5 and that is the correct way to solve it.

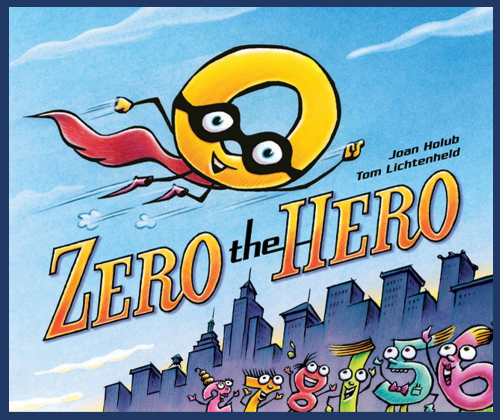
Use read-alouds

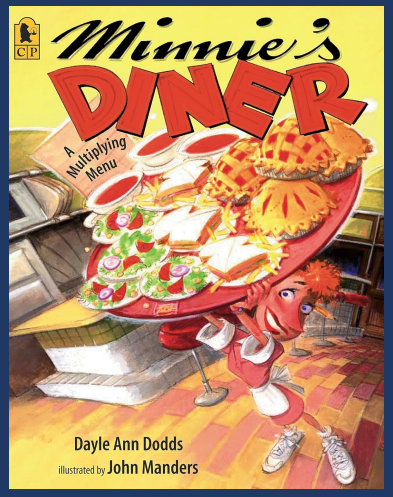












(Purpura et al., 2017)

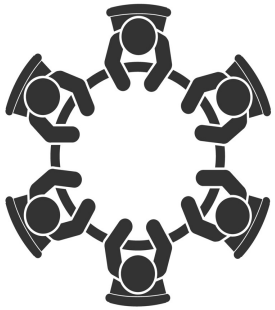
Model and practice

Teacher	**Let's work on addition. Today, let's think about addition as combining. What does it mean to combine?**
Students	Put together.
Teacher	**When we combine, we put things together. When you cook, you put ingredients together. For example, to make macaroni and cheese, you combine what?**
Students	Macaroni noodles and cheese!
Teacher	**That's right. You combine macaroni and cheese! Now, let's think about combining numbers. Look at this problem.** (Show problem.)

(Powell & Driver, 2015; Stevens et al., 2022)

Make sure students use mathematics vocabulary as much as adults do!

SCOPE AND SEQUENCE



Where does VOCABULARY fit within your scope and sequence? What are your plans for your teachers?

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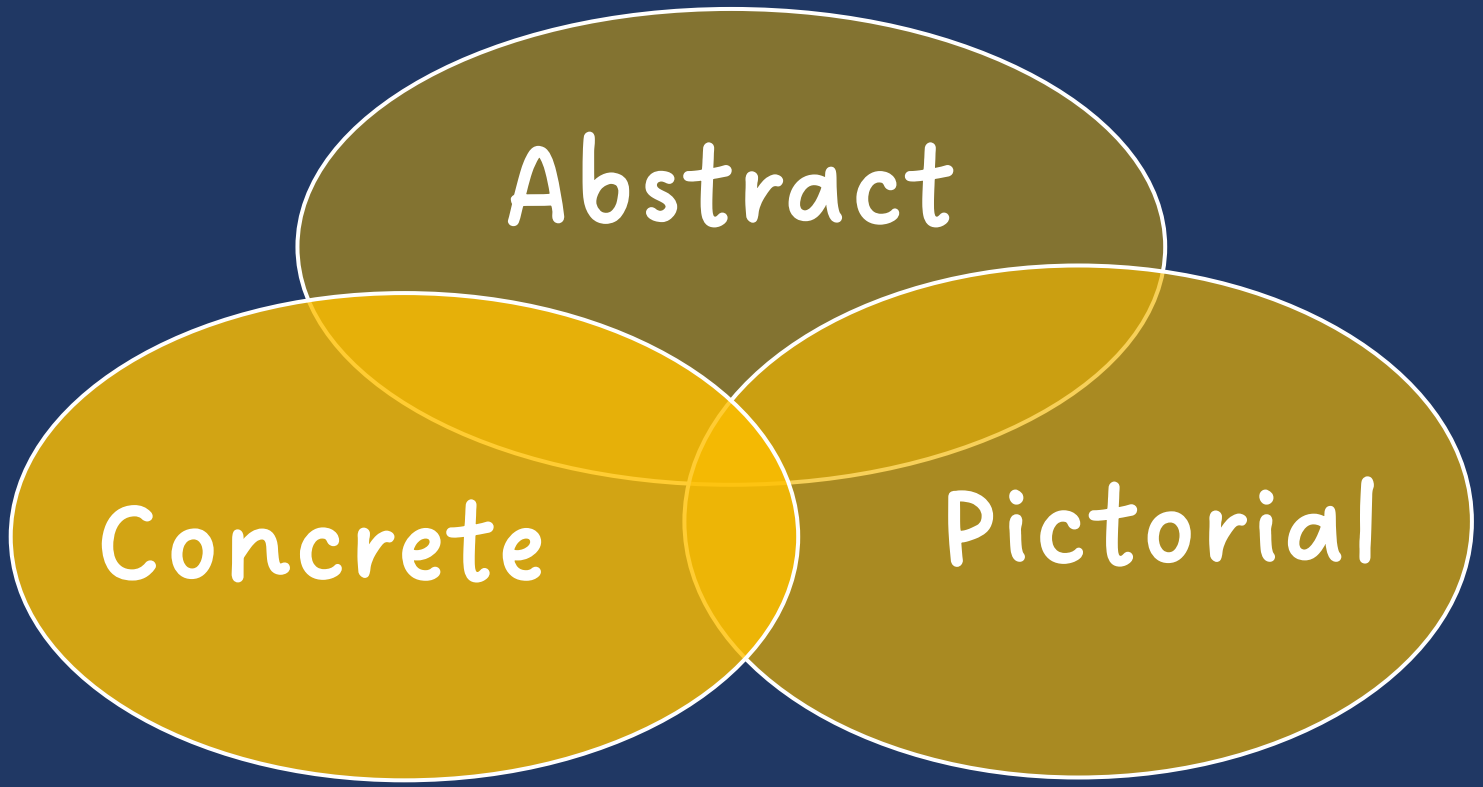
Students should learn how to set up and solve word problems by combining an attack strategy with a focus on word-problem schemas.

Representations



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Model and Practice

MODELING

Step-by-step explanation

Planned examples

PRACTICE

Guided practice

Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback

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Fluency

Instructional Platform

INSTRUCTIONAL DELIVERY

Vocabulary

Representations

Model and Practice

INSTRUCTIONAL STRATEGIES

Fluency

FLUENCY

Research and Information

Types of Fluency

Type	Memorization?	
	Yes	No

Mathematics fluency, particularly fluency with facts and computation, is related to overall mathematics performance.

(Bailey et al., 2012; Cirino et al., 2019; Koponen et al., 2007, 2017; Vukovic et al., 2014

Fact fluency practice improves mathematics fact performance.

(Burns et al., 2010; Codding et al., 2011; McCallum et al., 2004; Nelson et al., 2013; Poncy et al., 2010; Schutte et al., 2015; Stocker & Kubina, 2017)

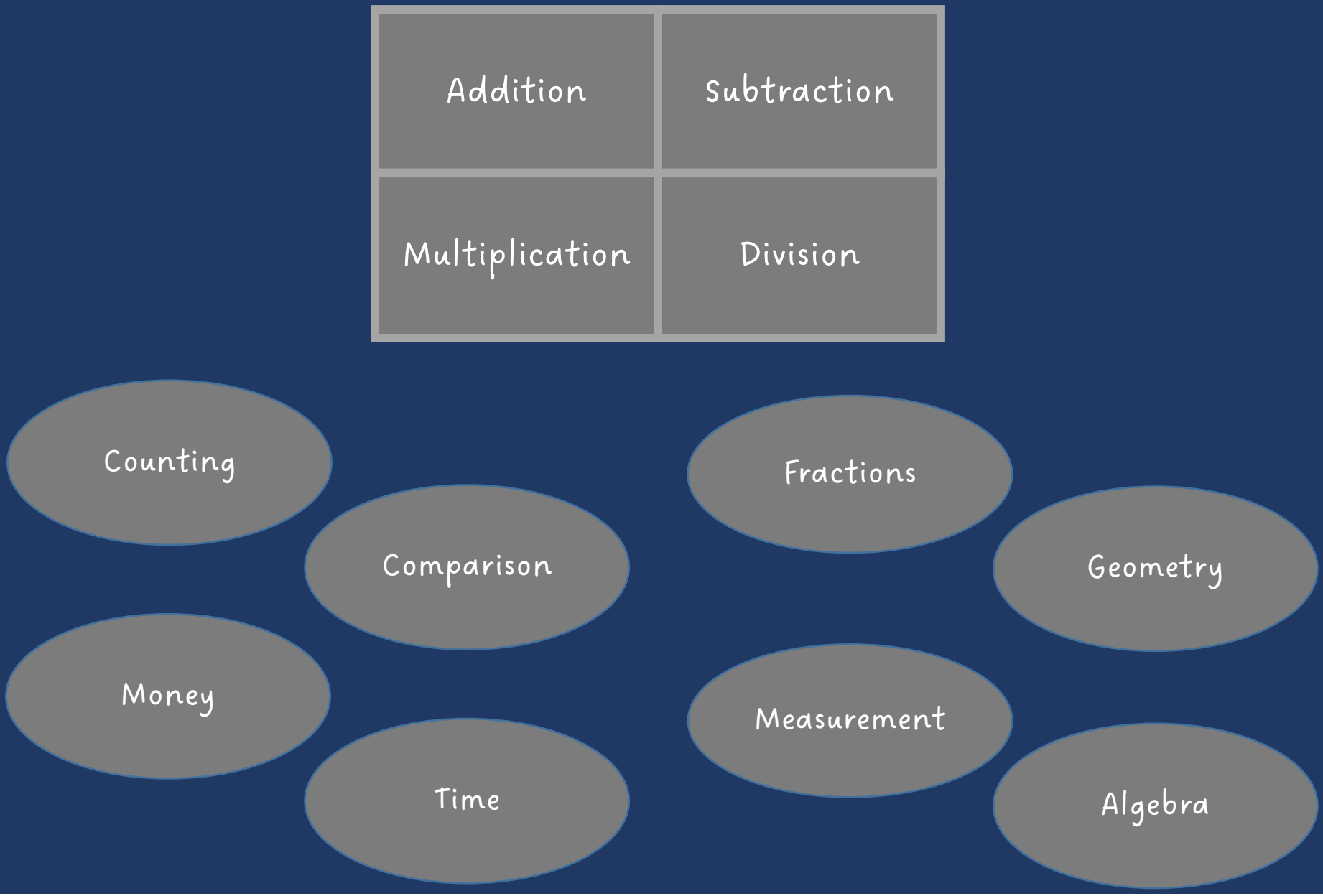
Fluency is doing mathematics easily and accurately.

Fluency in mathematics makes mathematics easier.

Fluency provides less stress on working memory.

Fluency helps students build confidence with mathematics.

With fluency, it is important to emphasize both conceptual learning and procedural learning.



Ease and accuracy

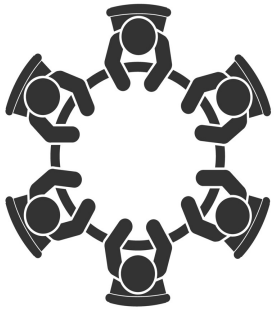
Memorization or automaticity

FLUENCY

Research and Information

Types of Fluency

Type	Memorization?	
	Yes	No



List different types of fluency. Discuss whether they require memorization.

FLUENCY

Fact Fluency

Addition	Subtraction
Multiplication	Division

Addition

100 addition facts

Single-digit addends sum to a single- or double-digit number

```
   5    (addend)
+  4    (addend)
-----
   9    (sum)
```

Total

Addition

Count one set, count another set, put sets together, count sum

$$2 + 3 = 5$$

Change

Addition

Start with a set, add the other set, count sum

$$2 + 3 = 5$$

Total

Addition

Parts put together into a **total**

Karly saw **4** cardinals and **5** blue jays. How many birds did Karly see?

Change

Addition

An amount that **increases** or decreases

Premila had $4. Then they earned $5 for cleaning their room. How much money does Premila have now?

3 + 9 = __

Addition

If you teach elementary:

What's a Total story to show addition?

If you teach secondary:

What's a Change/Join story to show addition?

100 subtraction facts

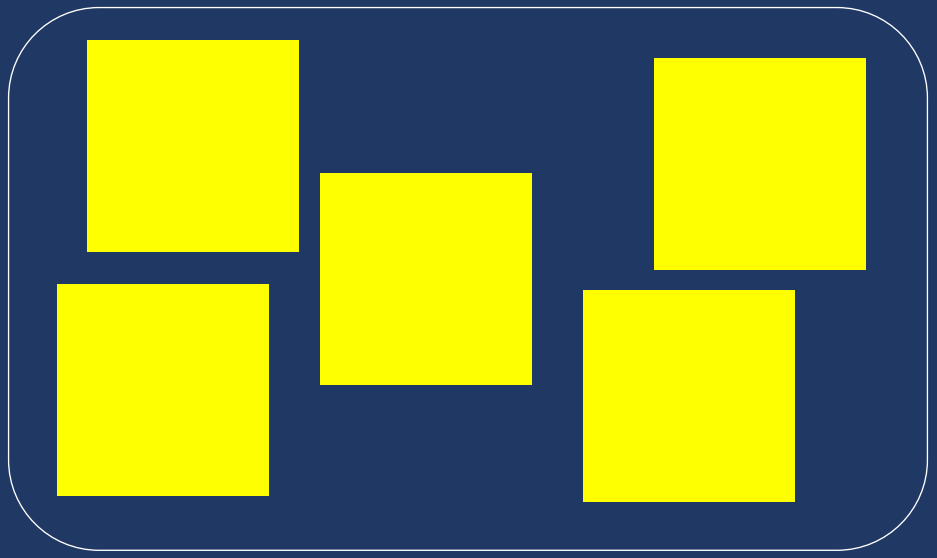
Subtrahend and difference are single-digit numbers and minuend is single- or double-digit number

$$\begin{array}{rl} 16 & \text{(minuend)} \\ -\ \ 8 & \text{(subtrahend)} \\ \hline 8 & \text{(difference)} \end{array}$$

Change

Subtraction

Start with a set, take away from that set, count difference

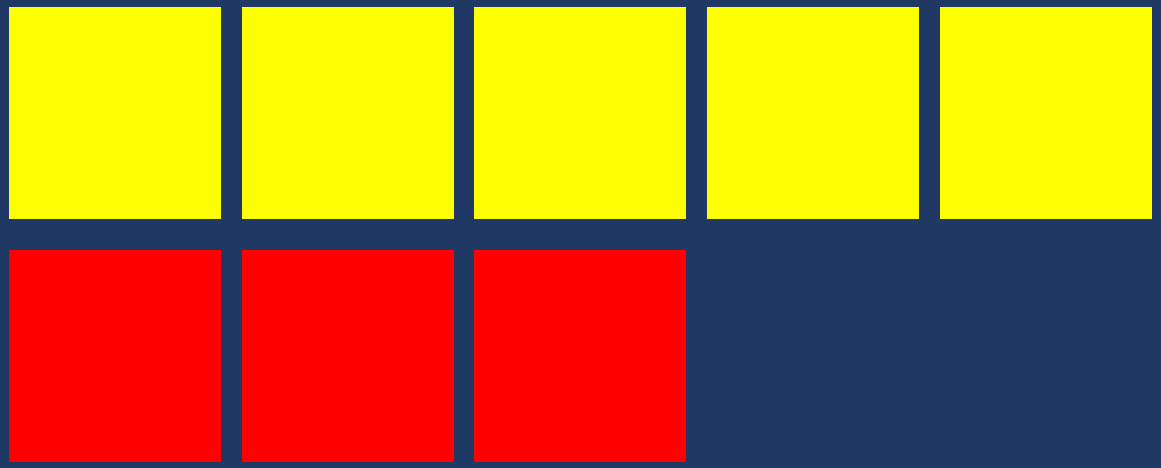


$$5 - 3 = 2$$

Difference

Subtraction

Compare two sets, count difference



$$5 - 3 = 2$$

Change

Subtraction

An amount that increases or **decreases**

Bronwyn had 9 cookies. Then they ate 2 of the cookies. How many cookies does Bronwyn have now?

Difference

Subtraction

Greater and lesser amounts compared for a difference

Rachel has 9 apples. Jodie has 2 apples. How many more apples does Rachel have? (How many fewer does Jodie have?)

9 - 5 = __

Subtraction

If you would chose beaches:

What's a Change/Separate story to show subtraction?

If you would chose mountains:

What's a Difference story to show subtraction?

Multiplication

100 multiplication facts

Multiplication of single-digit factors results in a single- or double-digit product

$$\begin{array}{rl} 2 & \text{(factor)} \\ \times\ 3 & \text{(factor)} \\ \hline 6 & \text{(product)} \end{array}$$

Equal Groups

Multiplication

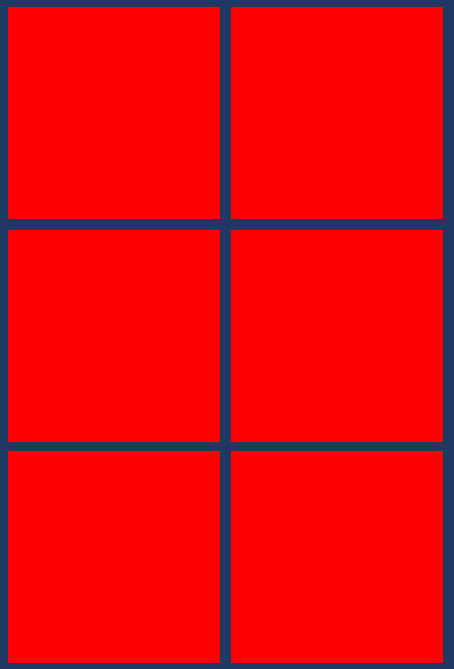
Show the groups, show the amount for each group, count product

$$3 \times 2 = 6$$

Equal Groups

Multiplication

Show the groups, show the amount for each group, count product

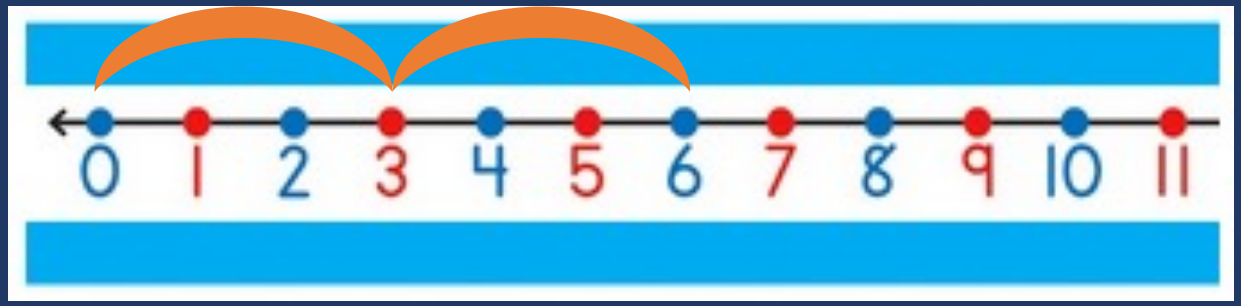


$3 \times 2 = 6$

Comparison

Multiplication

Show a set, then multiply the set



$$3 \times 2 = 6$$

Equal Groups

Multiplication

Groups multiplied by number in each group for a product

Rhiannon has 3 boxes of crayons. There are 8 crayons in each box. How many crayons does Rhiannon have altogether?

Comparison

Multiplication

Set multiplied by a number of times for a product

Vivienne had 8 stickers. Jessica had 3 times as many stickers as Vivienne. How many stickers did Jessica have?

$2 \times 5 = \_\_$

Multiplication

If you wear glasses:

What's an Equal Groups story to show multiplication?

If you don't wear glasses:

What's a Comparison story to show multiplication?

Division

90 division facts

Divisor and quotient are single-digit numbers and dividend is single- or double-digit number

8 ÷ 4 = 2

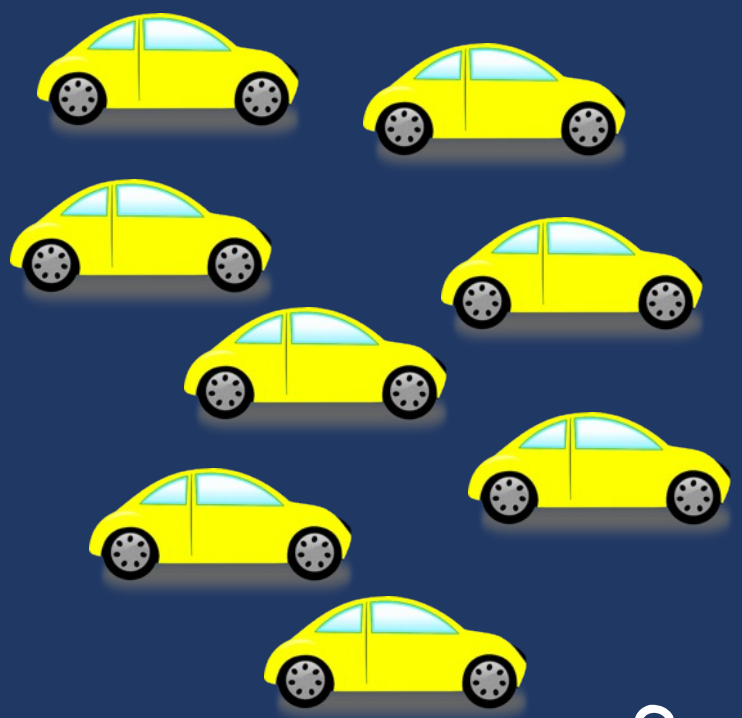
(dividend) (divisor) (quotient)

Equal Groups

(Partitive Division)

Division

Show the dividend, divide equally among divisor, count quotient



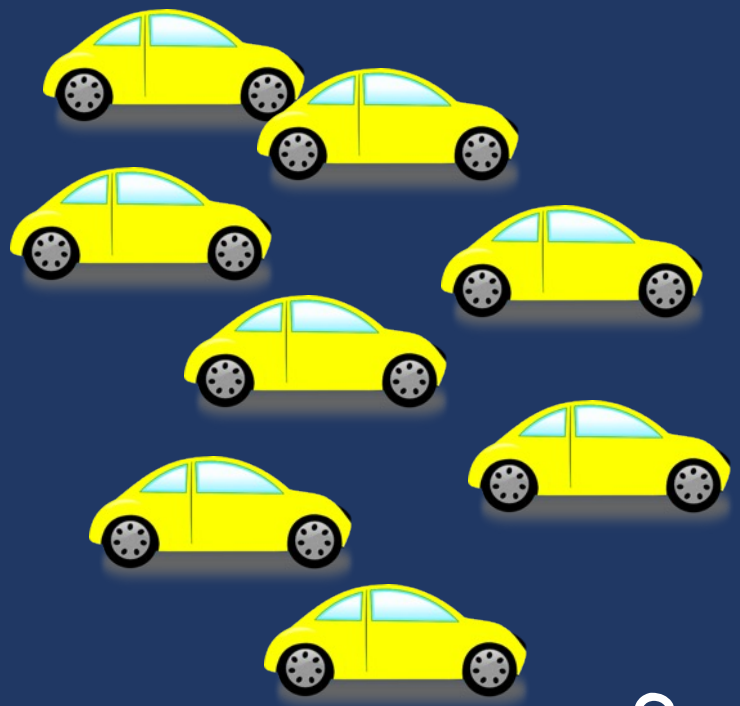
$$8 \div 2 = 4$$

Equal Groups

(Quotative Division)

Division

Show the dividend, make groups of the divisor, count groups



$$8 \div 2 = 4$$

Equal Groups

Division

Groups multiplied by number in each group for a product

Stefanie has 12 pencils. She wants to share them equally among her 2 friends. How many pencils will each friend receive?

Nicole has 12 pencils. She put them into pencil pockets with 6 pencils each. How many pencil pockets did Nicole use?

12 ÷ 4 = __

Division

If you watch comedies:

What's a Partitive story to show division?

If you watch dramas:

What's a Quotative story to show division?

Addition	Subtraction
Multiplication	Division

Build fluency with math facts.

- Addition: single-digit addends
- Subtraction: single-digit subtrahend
- Multiplication: single-digit factors
- Division: single-digit divisor

$$\begin{array}{r} 5 \\ +\ 8 \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ -\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 6 \\ \times\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 56 \\ \div\ 8 \\ \hline \end{array}$$

DAILY

BRIEF

Work on small sets of facts

Work on unknown facts
(in combination with known facts)

Dice

Roll the Dice

8 + 7 = 15

____ + ____ = ____

____ + ____ = ____

____ + ____ = ____

____ − ____ = ____

____ − ____ = ____

____ − ____ = ____

____ − ____ = ____

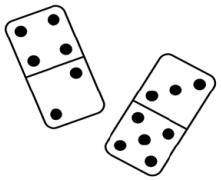
Beach Ball

4 plus 6 equals 10.

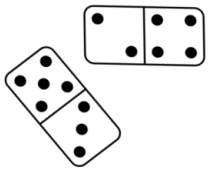
7 plus 6 equals 13.

2 plus 2 equals 4.

Dominoes



Dominoes



4 + 6 = 10

____ + ____ = ____

____ − ____ = ____

____ − ____ = ____

____ × ____ = ____

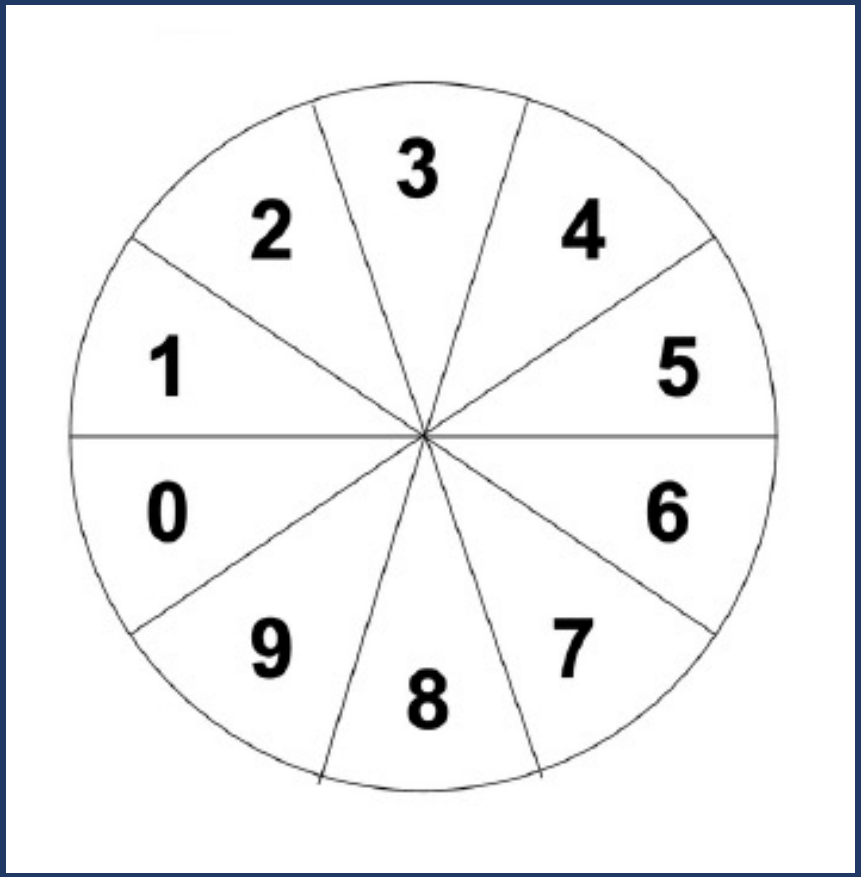
____ × ____ = ____

Spinner

2 times 4 equals 8.

6 times 9 equals 54.

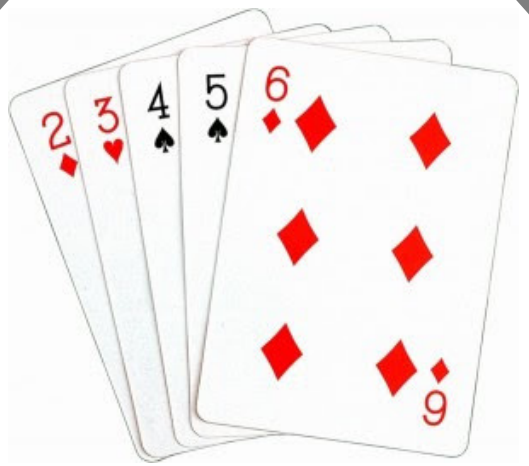
7 times 1 equals 7.



Playing Cards

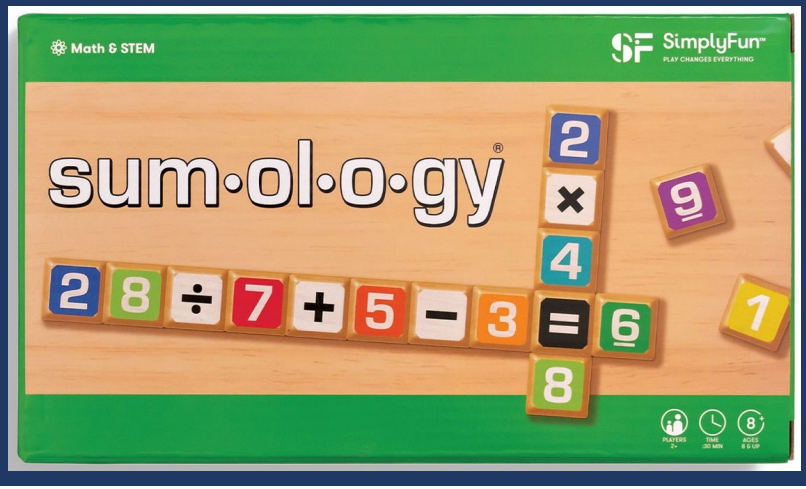
Cards 

____ + ____ = ____	____ + ____ = ____
____ + ____ = ____	____ + ____ = ____
6 − 2 = 4	____ − ____ = ____
____ − ____ = ____	____ − ____ = ____

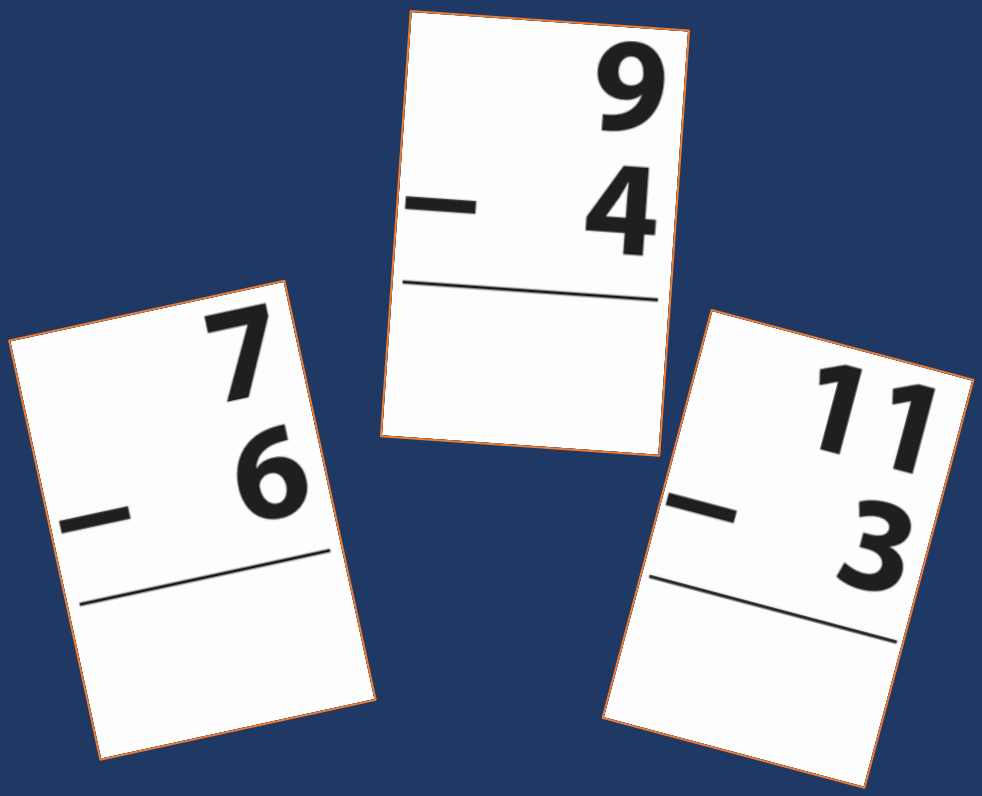


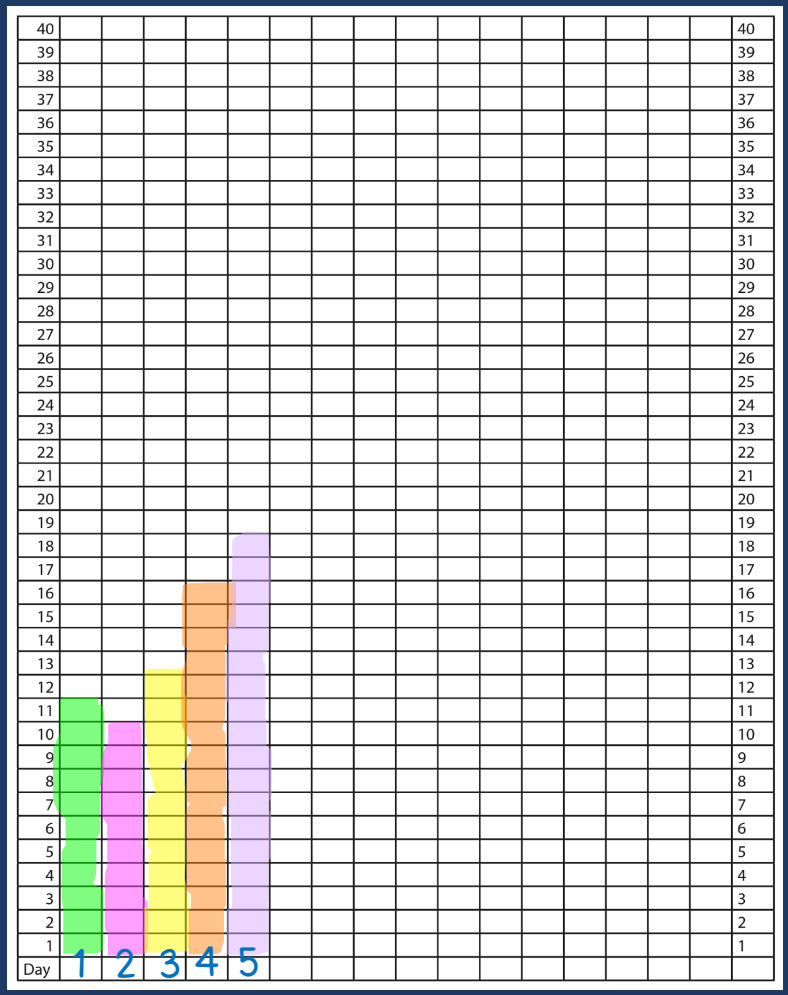
Wrap-Ups

Mobi Math



Flash Cards

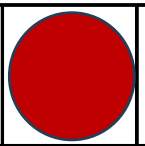
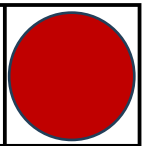
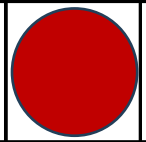
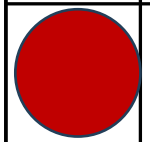




Bingo

Math Bingo

Your teacher will call out a math problem. Quickly solve the problem. If you have the answer on your bingo card, cover it with a chip. The middle space is free!
The first person to finish the pattern your teacher decides wins!
(5 in a row, 4 corners, etc.)

12		24	100	
15	0	42	16	20
8	35		6	4
	2	40	27	7
50	10	30	48	14

8 times 10 equals...

3 times 1 equals...

2 plus 3 equals...

Magic Squares

Magic Squares Board

1. Place the sum or product in the bottom right corner.
2. In the bottom row, create a fact with a sum or product of the bottom right corner.
3. In the right column, create a fact with a sum or product of the bottom right corner.
4. Create two columns with a sum or product of the bottom number.
5. Create two rows with a sum or product of the right column number.
6. Write the created facts below.

0	2	2
5	4	9
5	6	11

$0 + 2 = 2$

$5 + 4 = 9$

$2 - 0 = 2$

$9 - 5 = 4$

4	5	9
2	0	2
6	5	11

7	3	10
1	0	1
8	3	11

6	1	7
3	2	5
9	3	12

4	4	8
2	2	4
6	6	12

5	1	6
4	3	7
9	4	13

5	1	6
3	4	7
8	5	13

6	3	9
2	3	5
8	6	14

1	5	6
6	2	8
7	7	14

6	2	8
3	4	7
9	6	15

4 5 2 0

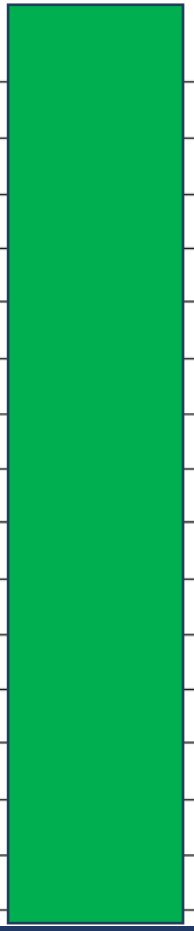
5 6 9 11 2

Cover, Copy, Compare

Cover, Copy, Compare

	9 x 6 54	8 × 6 48	
7 × 8 56		6 × 5 30	
9 × 9 81		7 × 9 63	
6 × 7 42		8 × 5 40	
8 × 8 64		7 × 7 49	

File Folder



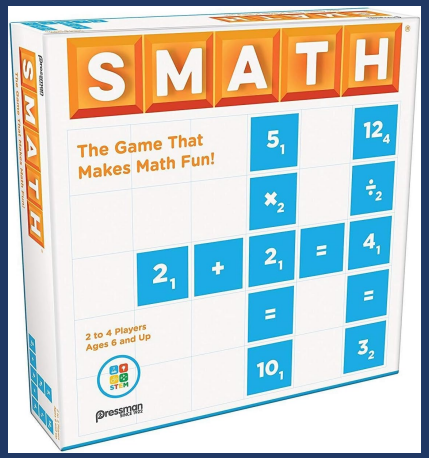
6 + 3 = 9
1 + 7 = 8
6 + 4 = 10
7 + 3 =
2 + 7 =
5 + 6 =
4 + 7 =
7 + 8 =
6 + 7 =
7 + 9 =
7 + 6 =
8 + 7 =
7 + 0 =
9 + 6 =
6 + 0 =
6 + 8 =

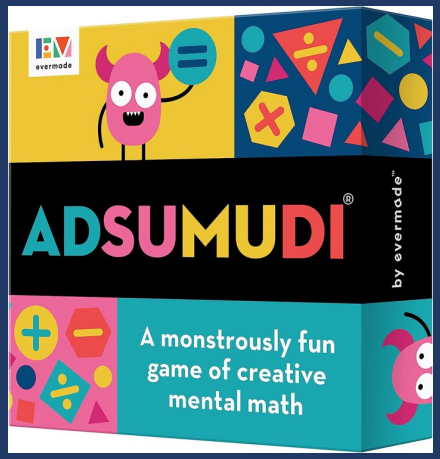
Taped Problems

Taped Problems

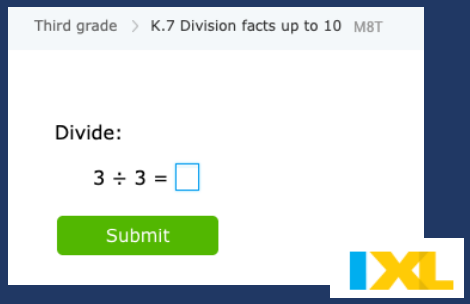
$8 \times 8 = 64$	$7 \times 7 = 49$	$8 \times 7 =$
$6 \times 5 =$	$6 \times 7 =$	$6 \times 8 =$
$5 \times 7 =$	$5 \times 5 =$	$5 \times 6 =$
$6 \times 6 =$	$8 \times 6 =$	$7 \times 6 =$
$7 \times 8 =$	$8 \times 5 =$	$7 \times 5 =$

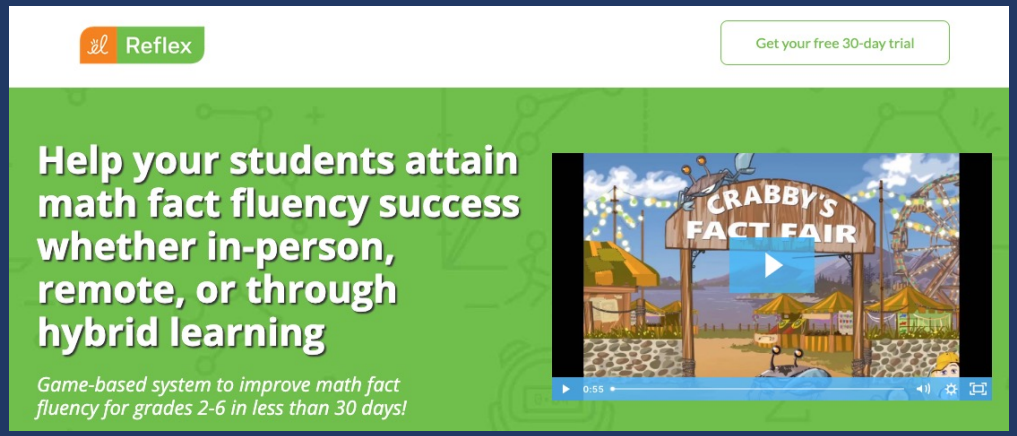
Games

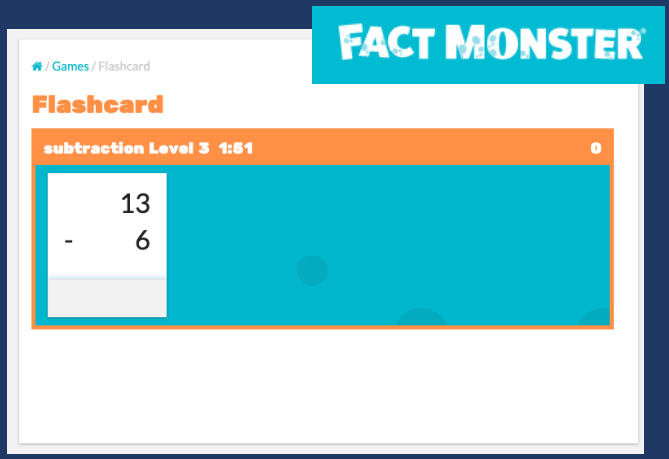




Technology







DAILY

BRIEF

Work on small sets of facts

Work on unknown facts
(in combination with known facts)

FLUENCY

Computational Fluency

Addition	Subtraction
Multiplication	Division

Addition	Subtraction
Multiplication	Division

Build fluency with whole-number computation

$$\begin{array}{r} 15 \\ +\ 28 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ \times\ 9 \\ \hline \end{array}$$

$$\begin{array}{r} 1009 \\ -\ 724 \\ \hline \end{array}$$

$$\begin{array}{r} 7250 \\ \div\ 15 \\ \hline \end{array}$$

Addition	Subtraction
Multiplication	Division

Build fluency with rational-number computation

$$\begin{array}{r} 1.4 \\ +\ 3.9 \\ \hline \end{array}$$

$$\frac{2}{3} \times \frac{3}{4}$$

$$\frac{9}{4} - \frac{3}{8}$$

$$\begin{array}{r} 7.892 \\ \div\ 0.14 \\ \hline \end{array}$$

Addition	Subtraction
Multiplication	Division

Build fluency with integer computation

$$\begin{array}{r} 1.4 \\ +\ -3.9 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times\ -12 \\ \hline \end{array}$$

$-14 - (-7) =$

$-135 \div 2 =$

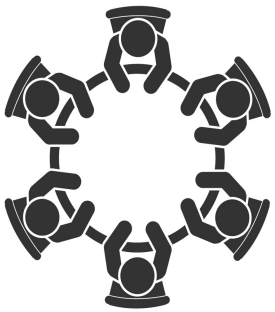
Partial Sums

A.

$$\begin{array}{r} 74 \\ +\ 18 \\ \hline 80 \\ +12 \\ \hline 92 \end{array}$$

B.

$$\begin{array}{r} 725 \\ +\ 365 \\ \hline 1{,}000 \\ 80 \\ +\ 10 \\ \hline 1{,}090 \end{array}$$



$$\begin{array}{r} 227 \\ +\ 185 \\ \hline \end{array}$$

Opposite Change

A.

$$\begin{array}{r} 74 \xrightarrow{-4} 70 \\ +\ 18 \xrightarrow{+4} +22 \\ \hline 92 \end{array}$$

B.

$$\begin{array}{r} 725 \xrightarrow{+5} 730 \\ +\ 365 \xrightarrow{-5} +360 \\ \hline 1{,}090 \end{array}$$

$$\begin{array}{r} 227 \\ +\ 185 \\ \hline \end{array}$$

Partial Differences

A.

$$\begin{array}{r} 62 \\ -\ 17 \\ \hline +50 \\ -\ 5 \\ \hline 45 \end{array}$$

B.

$$\begin{array}{r} 305 \\ -\ 96 \\ \hline +300 \\ -90 \\ -1 \\ \hline 209 \end{array}$$

$$\begin{array}{r} 232 \\ -\ 164 \\ \hline \end{array}$$

Same Change

A.

$$\begin{array}{r} 62 \xrightarrow{+3} 65 \\ -\ 17 \xrightarrow{+3} -20 \\ \hline 45 \end{array}$$

B.

$$\begin{array}{r} 305 \xrightarrow{+4} 309 \\ -\ 96 \xrightarrow{+4} -100 \\ \hline 209 \end{array}$$

$$\begin{array}{r} 232 \\ -\ 164 \\ \hline \end{array}$$

Add Up

A.

$$\begin{array}{r} 62 \\ -\ 17 \\ \hline \end{array}$$

$$\begin{array}{r} 17 \\ 20 \quad 3 \\ 60 \quad 40 \\ 62 \quad +\ 2 \\ \hline 45 \end{array}$$

B.

$$\begin{array}{r} 305 \\ -\ 96 \\ \hline \end{array}$$

$$\begin{array}{r} 96 \\ 100 \quad 4 \\ 300 \quad 200 \\ 305 \quad +\ 5 \\ \hline 209 \end{array}$$

$$\begin{array}{r} 232 \\ -\ 164 \\ \hline \end{array}$$

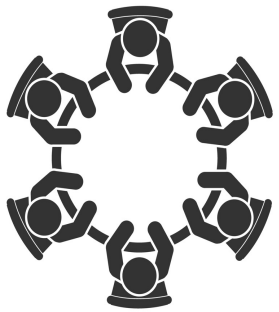
Partial Products

A.

$$\begin{array}{r} 24 \\ \times\ 43 \\ \hline 800 \\ 160 \\ 60 \\ +\ 12 \\ \hline 1{,}032 \end{array}$$

B.

$$\begin{array}{r} 132 \\ \times\ 53 \\ \hline 5000 \\ 1500 \\ 100 \\ 300 \\ 90 \\ +\ 6 \\ \hline 6996 \end{array}$$



$$\begin{array}{r} 13 \\ \times\ 47 \\ \hline \end{array}$$

Area (Array)

A.

$$\begin{array}{r} 24 \\ \times\ 43 \\ \hline \end{array}$$

	20	4	
	800	160	40
	60	12	3

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 800 \\ 160 \\ 60 \\ +\ 12 \\ \hline 1{,}032 \end{array}$$

B.

$$\begin{array}{r} 132 \\ \times\ 53 \\ \hline \end{array}$$

	100	30	2	
	5000	1500	100	50
	300	90	6	3

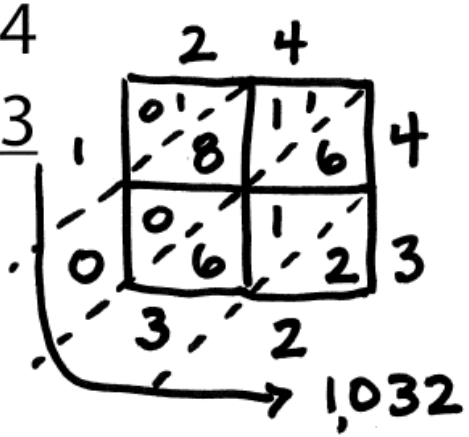
$$\begin{array}{r} 5000 \\ 1500 \\ 100 \\ 300 \\ 90 \\ +\ 6 \\ \hline 6996 \end{array}$$

$$\begin{array}{r} 13 \\ \times\ 47 \\ \hline \end{array}$$

Lattice

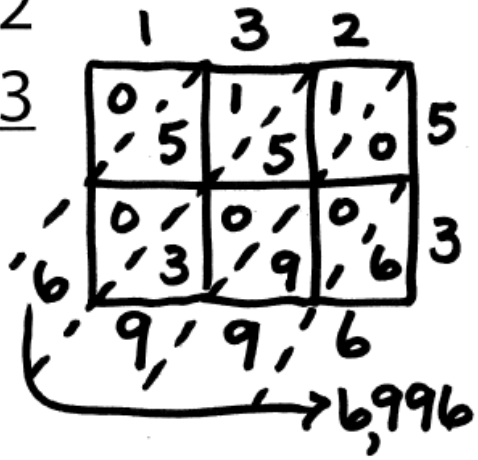
A.

$$\begin{array}{r} 24 \\ \times\ 43 \\ \hline \end{array}$$



B.

$$\begin{array}{r} 132 \\ \times\ 53 \\ \hline \end{array}$$



$$\begin{array}{r} 13 \\ \times\ 47 \\ \hline \end{array}$$

Partial Quotients

A.

$$
\begin{array}{r|l}
12\overline{)158} & \\
-120 & 10 \\
\hline
38 & \\
-36 & +3 \\
\hline
2 & 13\ \text{R}2
\end{array}
$$

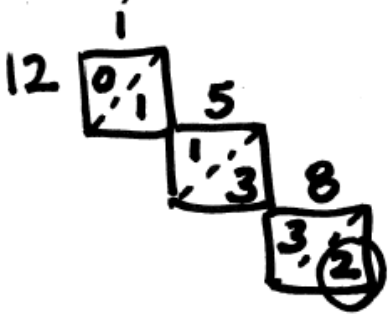
B.

$$
\begin{array}{r|l}
34\overline{)970} & \\
-680 & 20 \\
\hline
290 & \\
-170 & 5 \\
\hline
120 & \\
102 & +3 \\
\hline
18 & 28\ \text{R}18
\end{array}
$$

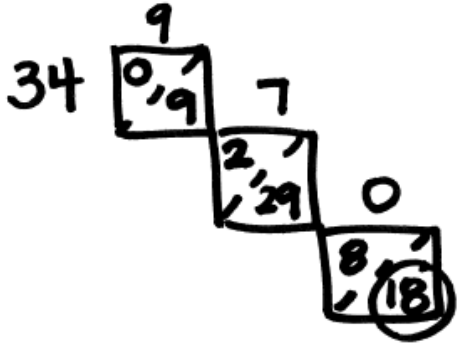
$$
\begin{array}{r}
804 \\
\div\ 12 \\
\hline
\end{array}
$$

Lattice

A. $12\overline{)158}$ = 13 R2



B. $34\overline{)970}$ = 28 R 18



804 ÷ 12

FLUENCY

What are your strengths?

What are your opportunities for growth?

What are your plans for next Monday?
Next month?
Next year?

WORD PROBLEMS

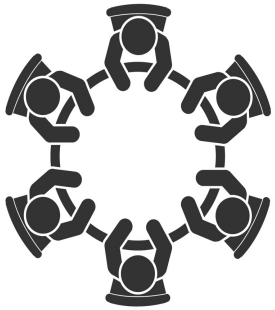
Research and Information

What are your strengths with fluency?

What are your opportunities for growth?

What are your plans for next Monday?
Next month?
Next year?

SCOPE AND SEQUENCE



Where does FLUENCY fit within your scope and sequence? What are your plans for your teachers?

Students require modeling and practice on how to use the language of mathematics.

Students should use hands-on tools, virtual manipulatives, drawings, and other visuals to understand mathematics concepts and procedures.

Teachers should use systematic and explicit instruction to help students develop a strong foundation for specific mathematics skills.

Teachers should use fluency building activities to build counting fluency and fluency with the operations.

Students should learn how to set up and solve word problems by combining an attack strategy with a focus on word-problem schemas.

Word Problems

Instructional Platform

INSTRUCTIONAL DELIVERY

Vocabulary

Representations

Model and Practice

INSTRUCTIONAL STRATEGIES

Fluency

Word Problems

FLUENCY

What are your strengths?

What are your opportunities for growth?

What are your plans for next Monday?
Next month?
Next year?

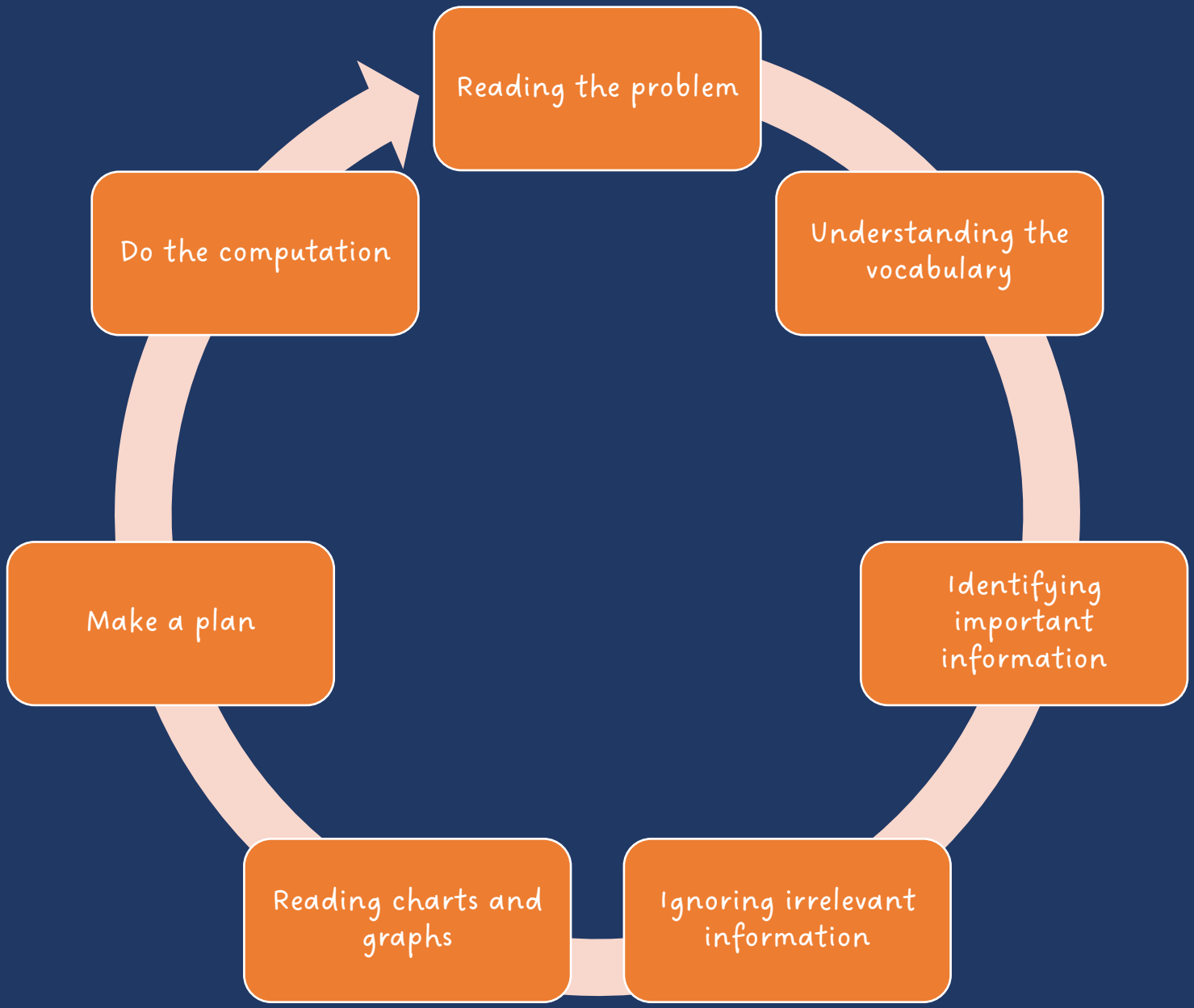
WORD PROBLEMS

Research and Information

Key words tied to operations is an ineffective word-problem strategy.
(Karp et al., 2019; Powell et al., 2022)

Using a meta-cognitive strategy improves word-problem performance.
(Freeman-Green et al., 2015; Krawec et al., 2012; Montague et al., 2011; Swanson et al., 2014)

A focus on schemas improves word-problem performance.
(Alghamdi et al., 2020; Cook et al., 2020; Flores et al., 2016; Fuchs et al., 2021; Griffin et al., 2019; Jitendra et al., 2013; Lein et al., 2020; Peltier et al., 2020; Powell et al., 2022; Xin & Xhang, 2009; Zheng et al., 2013)

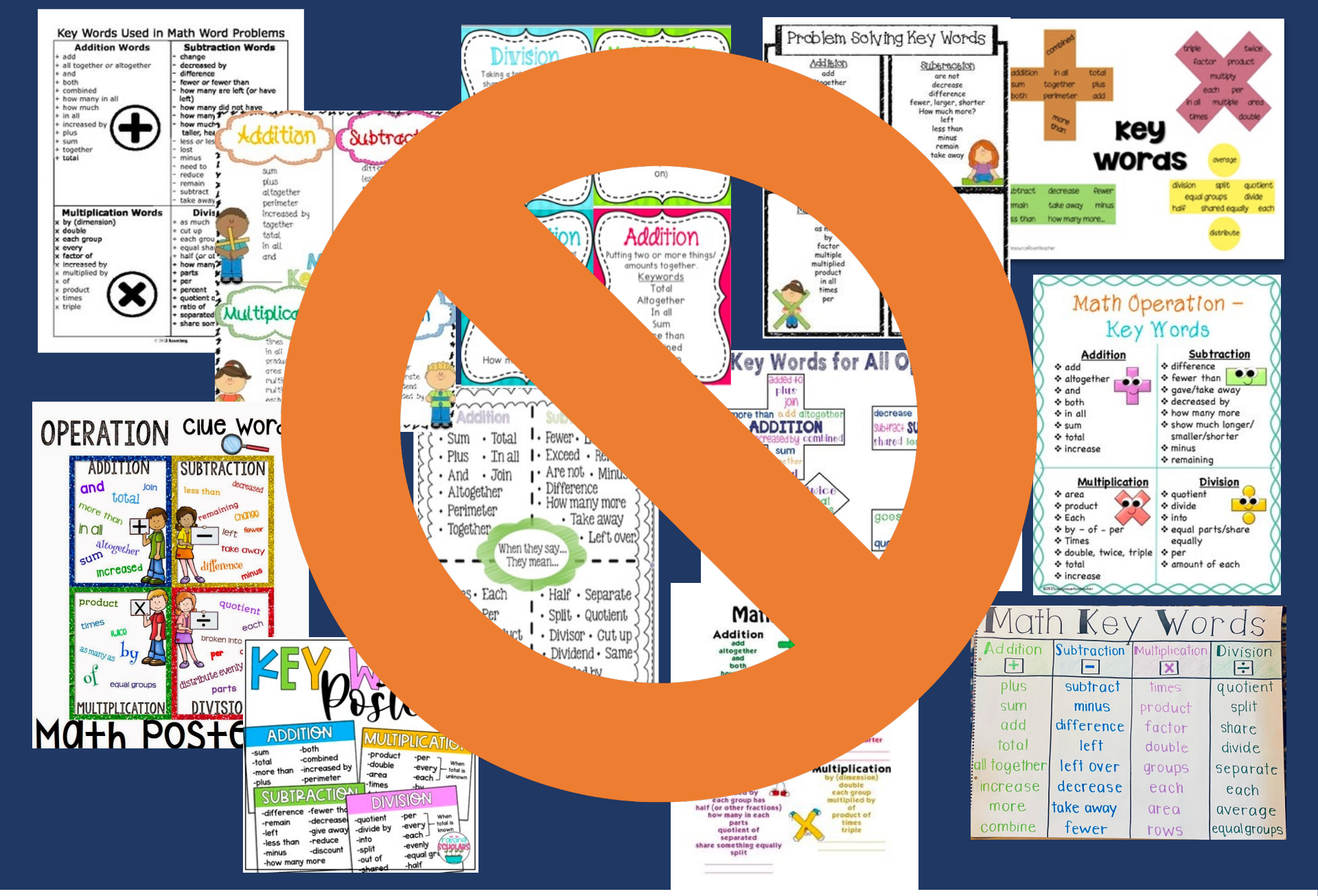


Ineffective Strategies

1. Keywords tied to operations

Carmelita had 8 pencils **fewer** than Jenny. If Jenny had 18 pencils, how many pencils did Carmelita have?

Carmelita had 8 pencils **fewer** than Jenny. If Carmelita had 18 pencils, how many pencils did Jenny have?



Description of Single-Step Word Problems (n = 132)

Schema	Occurrence of schema		Any keyword		Schema-specific keywords[a]		Multiple keywords[a]		Keyword(s) led to correct solution[a]	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Total	27	20.5	26	96.3	23	88.5	5	19.2	21	80.8
Difference	17	12.9	17	100.0	14	82.4	2	11.8	12	70.6
Change	11	8.3	7	63.6	5	71.4	5	71.4	2	28.6
Equal groups	29	22.0	26	89.7	22	84.6	18	69.2	8	30.8
Comparison	10	7.6	9	90.0	9	100.0	4	44.4	5	55.6
Ratios or proportions	29	22.0	23	79.3	9	39.1	9	39.1	6	26.1
Product of measures	9	6.8	9	100.0	8	88.9	1	11.1	5	55.6

[a]When a problem featured a keyword.

Description of Multi-Step Word Problems (n = 84)

Schema	Occurrence of schema[a] *n*	Occurrence of schema[a] %	Any keyword *n*	Any keyword %	Keyword(s) led to correct solution[b] *n*	Keyword(s) led to correct solution[b] %
Total	40	47.6	39	97.5	3	7.7
Difference	11	13.1	11	100.0	1	9.1
Change	21	23.8	19	95.0	1	5.3
Equal groups	49	58.3	48	98.0	1	2.1
Comparison	7	8.3	7	100.0	0	0.0
Ratios or proportions	22	25.0	16	76.2	1	6.3
Product of measures	7	8.3	7	100.0	2	28.6

[a]Sum across schemas does not equal 100 because each word problem featured more than one schema.

[b]When a problem featured a keyword.

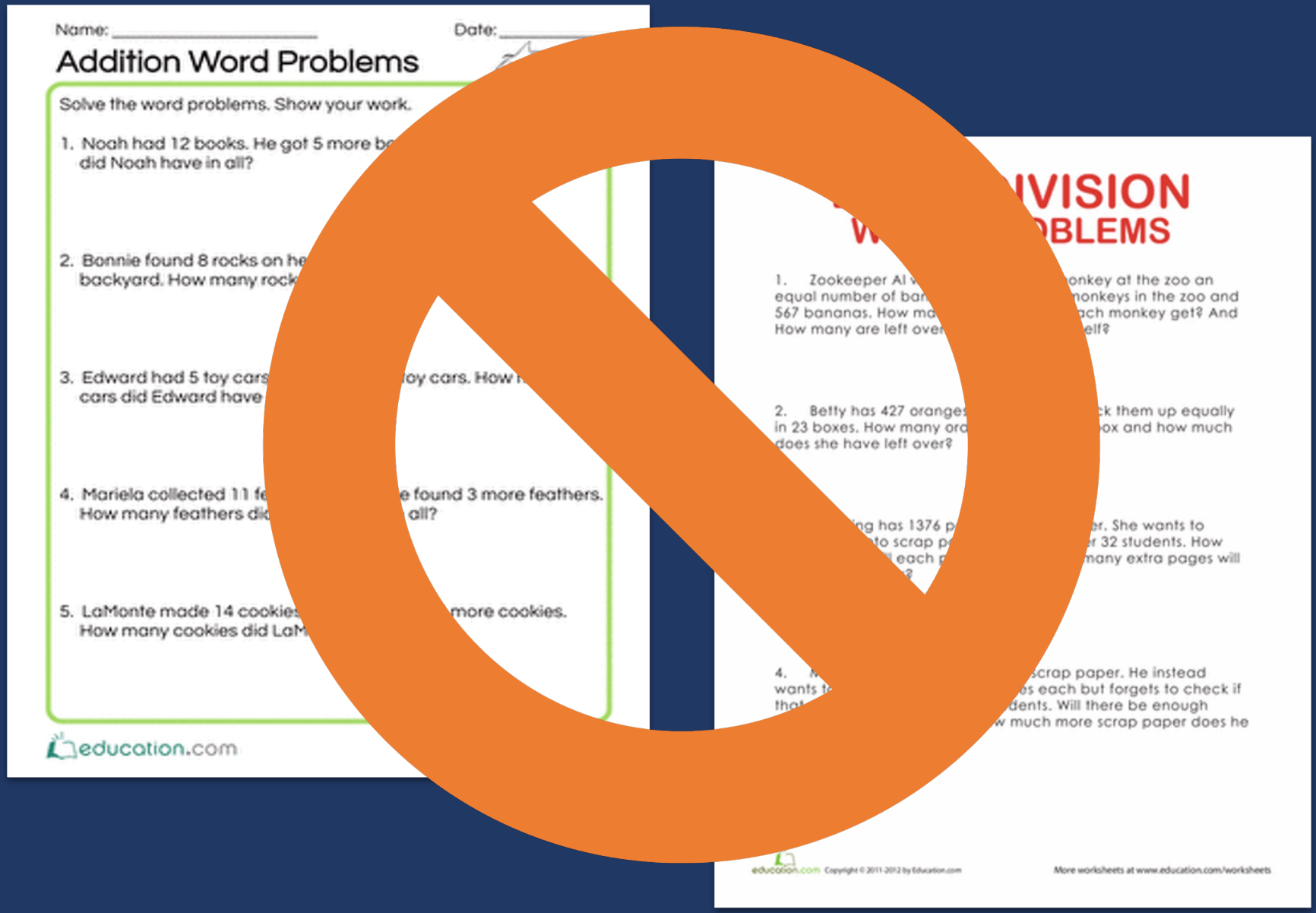
Keywords are important to identify and understand

Keywords are the mathematical vocabulary that help an students understand what the story is about and what they need to do

Talk about keywords ("What does *more than* tell you about?")

But, *do not* tie a keyword to a specific operation!

2. Presenting problems by operation



WORD PROBLEMS

Attack Strategies

SOLVE

- Study the problem
- Organize the information
- Line up a plan
- Verify the plan
- Examine the answer

R-CUBES

- Read the problem
- Circle key numbers
- Underline the question
- Box action words
- Evaluate steps
- Solve and check

UPS Check

- Understand
- Plan
- Solve
- Check

Effective Strategies

Teach an attack strategy

Teach about schemas

RIDE

Read the problem.

Identify the relevant information.

Determine the operation and unit for the answer.

Enter the correct numbers and calculate, then check the answer.

RICE

Read and record the problem.
Illustrate your thinking.
Compute.
Explain your thinking.

RIDGES

Read the problem.
I know statement.
Draw a picture.
Goal statement.
Equation development.
Solve the equation.

SUPER

Slowly read the story problem twice.
Underline the question and circle the numbers you need.
Picture it. Draw the scenario to show what is happening.
Explain the problem with a number sentence.
Rewrite the answer in a sentence.

STAR

Stop and read the problem carefully.
Think about your plan and the strategy you will use.
Act. Follow your plan and solve
the problem.
Review your answer.

SHINES

Slowly and carefully read the problem.
Highlight or underline key information.
Identify the question by drawing a circle around it.
Now solve the problem. Show your work.
Examine your work for precision, accuracy, and clarity.
Share your answer by writing a sentence.

SOLVE

Study the problem.
Organize the information.
Line up the plan.
Verify the plan.
Examine the answer.

R-CUBES

Read the problem.
Circle key numbers.
Underline the question.
Box action words.
Evaluate steps.
Solve and check.

UPS✓

UNDERSTAND
Read and explain.

PLAN
How will you solve the problem?

SOLVE
Set up and do the math!

✓CHECK
Does your answer make sense?

Created by: Sarah Powell (srpowell@austin.utexas.edu)

Share your favorite attack strategy.

Teach an attack strategy

Teach about schemas

Total

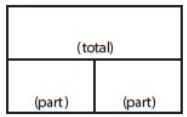
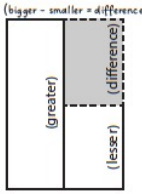
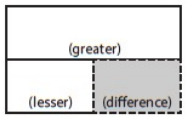
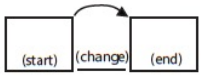
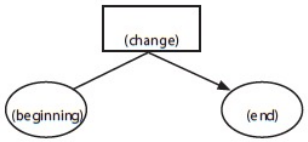
Difference

Change

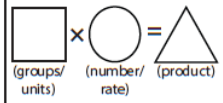
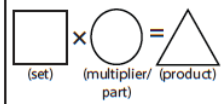
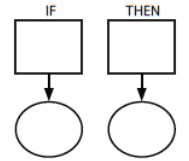
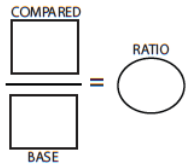
Equal Groups

Comparison

Ratios/Proportions

Schema and Definition	Equations and Graphic Organizers	Examples			Variations
Total (Combine; Part-part-whole) Parts combined for a sum	P1 + P2 = T (part + part = total)  	Sum unknown: Lyle has 11 red apples and 18 green apples. How many apples does Lyle have altogether?	Part unknown: Lyle has 29 red and green apples. If 11 of the apples are red, how many green apples does Lyle have?		More than two parts: Lyle has 34 apples. Of the apples, 11 are red, 18 are green, and the rest are yellow. How many yellow apples does Lyle have?
Difference (Compare) Sets compared for a difference	B − s = D (bigger − smaller = difference)  G − L = D (greater − less = difference)  	Difference unknown: Sasha wrote 85 words in her essay, and Tabitha wrote 110 words. How many fewer words did Sasha write than Tabitha?	Bigger/greater unknown: Tabitha wrote 25 more words than Sasha. If Sasha wrote 85 words, how many words did Tabitha write?	Smaller/lesser unknown: Tabitha wrote 110 words in her essay. Sasha wrote 25 words fewer than Tabitha. How many words did Sasha write?	(None)
Change (Join; Separate) An amount that increases or decreases	ST +/− C = E (start +/− change = end)   	End (increase) unknown: Jorge had $52. Then, he earned $16 babysitting. How much money does Jorge have now? End (decrease) unknown: Jorge had $52. Then, he spent $29 at the ballpark. How much money does Jorge have now?	Change (increase) unknown: Jorge had $52. Then, he earned some money babysitting. Now, Jorge has $68. How much did Jorge earn babysitting? Change (decrease) unknown: Jorge had $52 but spent some money when he went to the ballpark. Now, Jorge has $23. How much did Jorge spend at the ballpark?	Start (increase) unknown: Jorge has some money, and then he earned $16 for babysitting. Now, Jorge has $68. How much money did he have to start with? Start (decrease) unknown: Jorge had some money. Then, he spent $29 at the ballpark and has $23 left. How much money did Jorge have before going to the ballpark?	Multiple changes: Jorge had $78. He stopped and bought a pair of shoes for $42 and then he spent $12 at the grocery. How much money does Jorge have now?

Powell & Fuchs (2018).
Material collected from: Griffin & Jitendra, 2009; Fuchs et al., 2014; Fuchs, Seethaler, et al., 2008; Fuchs et al., 2010; Jitendra, 2002; Kintsch & Greeno, 1985; Van de Walle, Karp, & Bay-Williams, 2013.

Schema and Definition	Graphic Organizers	Examples			Variations
Equal Groups (Vary) A number of equal sets or units	GR x N = P  	Product unknown: Maria bought 5 cartons of eggs with 12 eggs in each carton. How many eggs did Maria buy?	Groups unknown: Maria bought 60 eggs. The eggs were sold in cartons with 12 eggs each. How many cartons of eggs did Maria buy?	Number unknown: Maria bought 5 cartons of eggs for a total of 60 eggs. How many eggs were in each carton?	With rate: Maria bought 5 cartons of eggs. Each carton cost $2.95. How much did Maria spend on eggs?
Comparison One set as a multiple or part of another set	S x T = P  	Product unknown: Malik picked 7 flowers. Danica picked 3 times as many flowers. How many flowers did Danica pick?	Set unknown: Danica picked 3 times as many flowers as Malik. If Danica picked 21 flowers, how many flowers did Malik pick?	Times unknown: Malik picked 7 flowers. Danica picked 21 flowers. How many times more flowers did Danica pick?	With fraction: Malik picked 25 red and yellow flowers. If 1/5 of the flowers were yellow, how many were red?
Ratios/ Proportions (Percentages; Unit Rate) Relationships among quantities Ratio	  	Subject unknown: Sally typed 56 words in 2 minutes. How many words could Sally type in 7 minutes? Base unknown: Justin baked cookies and brownies. The ratio of cookies to brownies was 3:5. If he baked 15 cookies, how many brownies did he bake?	Object unknown: Sally typed 56 words in 2 minutes. How many minutes would it take Sally to type 192 words? Compared unknown: Justin baked cookies and brownies. The ratio of cookies to brownies was 3:5. If he baked 25 brownies, how many cookies did he bake?	Ratio unknown: Justin baked 15 cookies and 25 brownies. What's the ratio of cookies to brownies?	With percentage: Watson received an 80% on his science quiz. If the test had 40 questions, how many questions did Watson answer correctly? With unit rate: Paula bought 5 boxes of markers. She spent $9.75. What is the price of one box of markers?

Material collected from: Jitendra, DiPipi, & Perron-Jones, 2002; Jitendra & Star, 2011; Jitendra et al., 2009; Van de Walle et al., 2013; Xin, Jitendra, & Deatline-Buchman, 2005; Xin & Zhang, 2009.

Total

Difference

Change

Additive Schemas

Total

Part-part-whole
Combine

Parts put together into a **total**

Mandy saw 3 canoes and 8 kayaks. How many boats did Mandy see?

Total

Mandy saw 11 boats. If 3 of the boats were canoes, how many were kayaks?

Part

Mandy saw 11 boats. 8 of the boats were kayaks, how many were canoes?

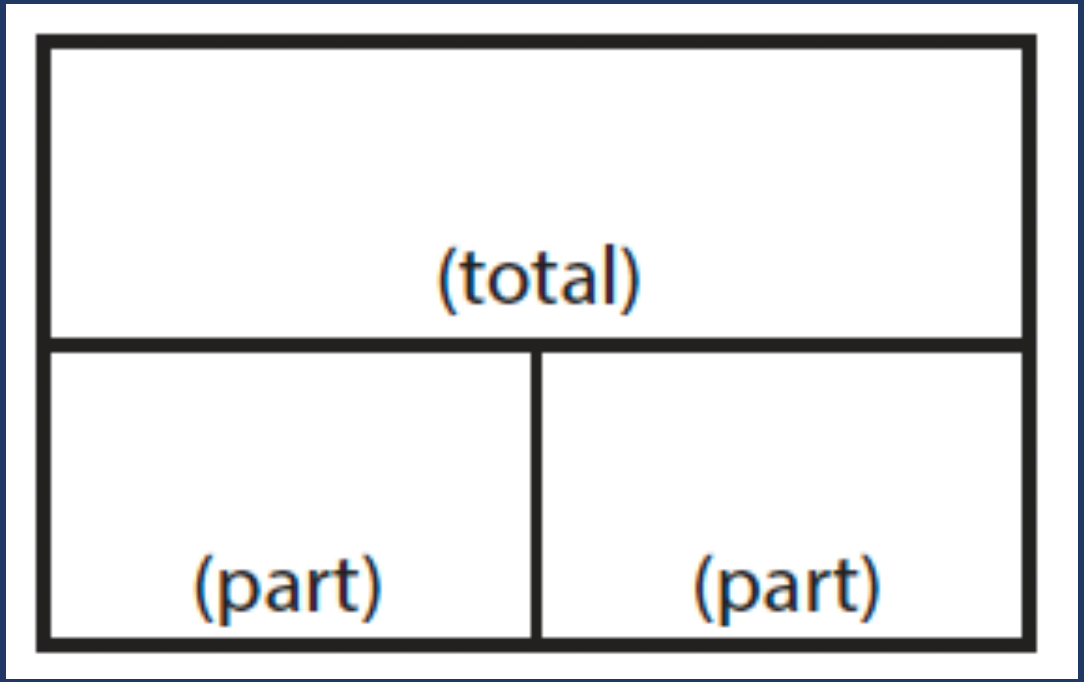
Part

Total

"Are parts put together for a total?"

Total

P1 + P2 = T



Fuchs et al. (2008); Griffin & Jitendra (2009)

Difference

Compare

Greater and **lesser** amounts compared for a **difference**

L'Tanya has 10 pencils. Vickie has 4 pencils. How many more pencils does L'Tanya have?

L'Tanya has 6 more pencils than Vickie. If Vickie has 4 pencils, how many does L'Tanya have?

Vickie has 6 fewer pencils than L'Tanya. L'Tanya has 10 pencils. How many pencils does Vickie have?

Difference

Greater amount

Lesser amount

Total

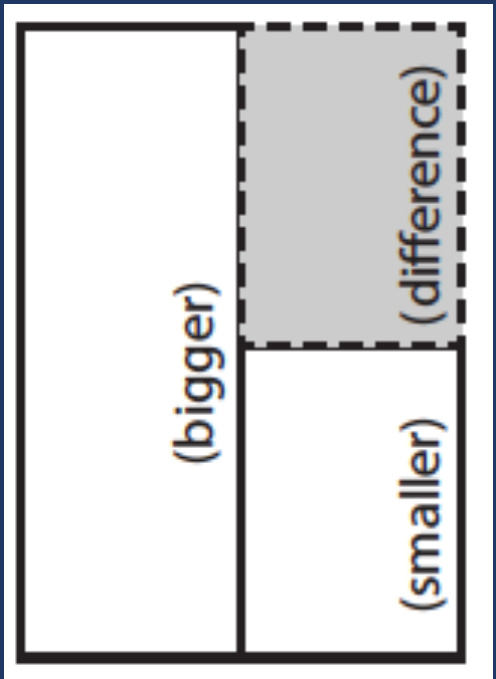
"Are parts put together for a total?"

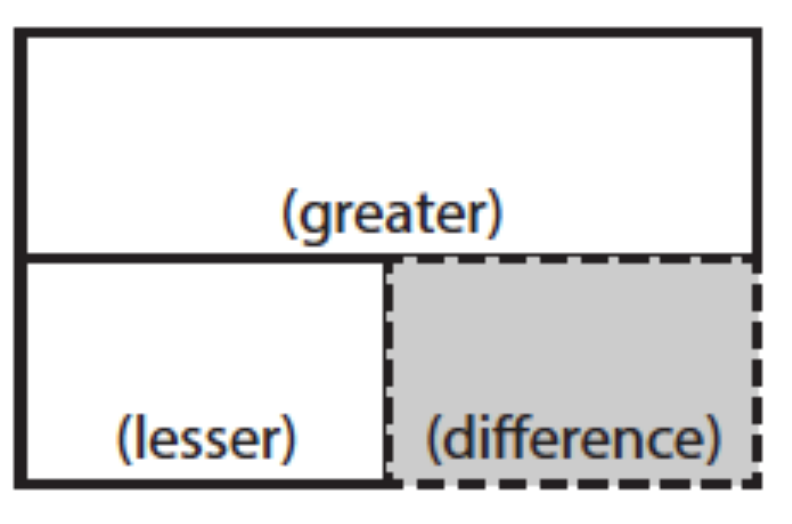
Difference

"Are amounts compared for a difference?"

Difference

G − L = D





Fuchs et al. (2008); Griffin & Jitendra (2009)

Change

Join

An amount that **increases** or decreases

Annette had 6 notebooks. Then, she bought 3 notebooks. How many notebooks does Annette have now?

End amount

Annette had 6 notebooks. Then, she bought a few more notebooks. Now, Annette has 9 notebooks. How many notebooks did she buy?

Change amount

Annette had some notebooks. Then, she bought 3 notebooks. Now, Annette has 9 notebooks. How many notebooks did she have to start with?

Start amount

Change

Separate

An amount that increases or **decreases**

Jenny baked 9 cookies. Then, she ate 3 of the cookies. How many cookies does Jenny have now?

End amount

Jenny baked 9 cookies. Then, she ate some of the cookies. Now, she has 6 cookies. How many cookies did Jenny eat?

Change amount

Jenny baked some cookies. She ate 3 of the cookies and has 6 cookies left. How many cookies did Jenny bake?

Start amount

Total

"Are parts put together for a total?"

Difference

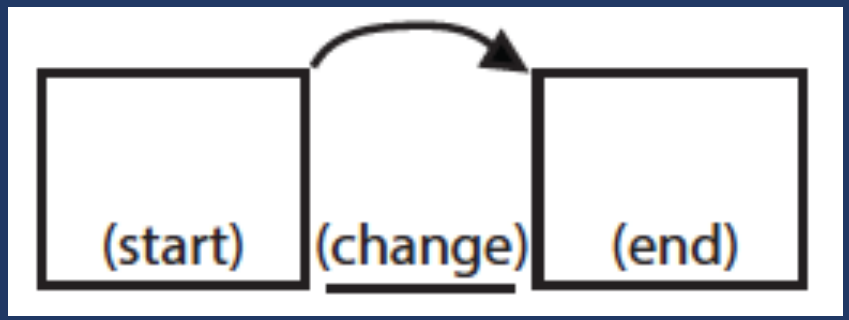
"Are amounts compared for a difference?"

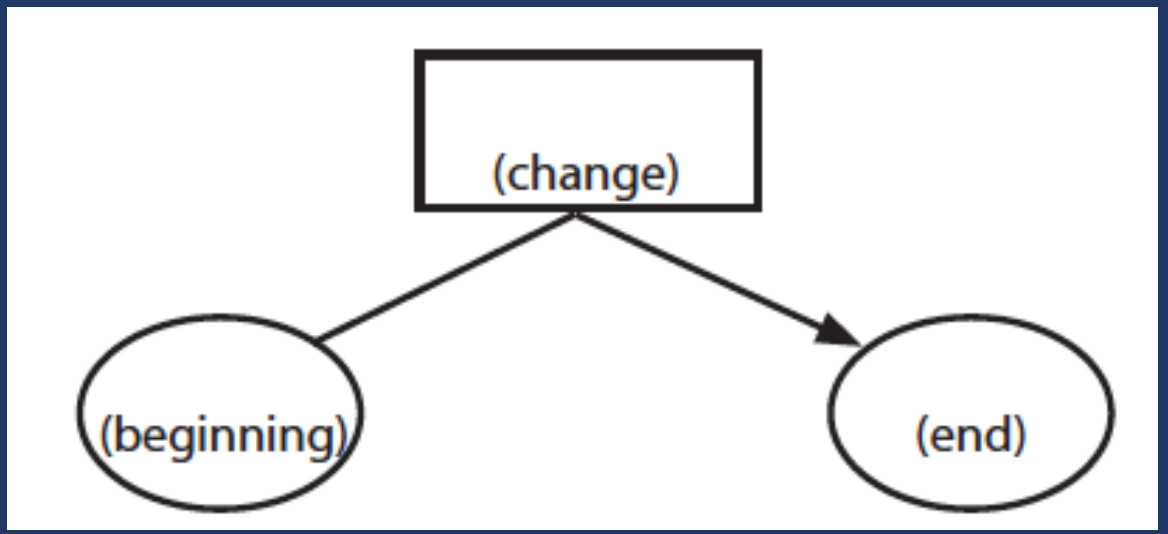
Change

"Does an amount increase or decrease?"

Change

ST +/− C = E





Fuchs et al. (2008); Griffin & Jitendra (2009)

Total

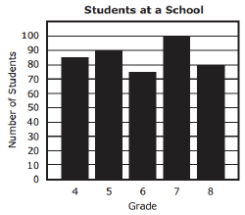
Difference

Change

WORD PROBLEMS

Additive Word Problems

A.
The bar graph shows the number of students in each grade at a school. How many more students are in grade 7 than are in grade 4?



B.
A package of bread has a mass of 623 grams. One slice of bread is removed from the package. The slice of bread has a mass of 55 grams. What is the mass, in grams, of the package of bread after the slice of bread is removed?

C.
A student measures the mass of 2 jars of sand. The total mass of the 2 jars of sand is 963 grams. Which two jars of sand have a total mass of 963 grams?

D.
A photographer has a picture album that holds 100 pictures. The photographer fills 57/100 of the album with pictures of trees. She fills 30/100 of the album with pictures of animals. What fraction of the album is filled with either pictures of trees or animals?

Total

Difference

Change

Equal Groups

Comparison

Ratios/Proportions

Multiplicative Schemas

Equal Groups

Comparison

Ratios/Proportions

Equal Groups

Array
Vary

Groups multiplied by **number in each group** for a **product**

Evan has 2 boxes. There are 6 muffins in each box. How many muffins does Evan have?

Product

Evan has 12 muffins. They want to place them equally into 2 boxes. How many muffins will Evan place in each box?

Number in each group

Evan has 12 muffins. They put them into boxes with 6 muffins each. How many boxes did Evan use?

Groups

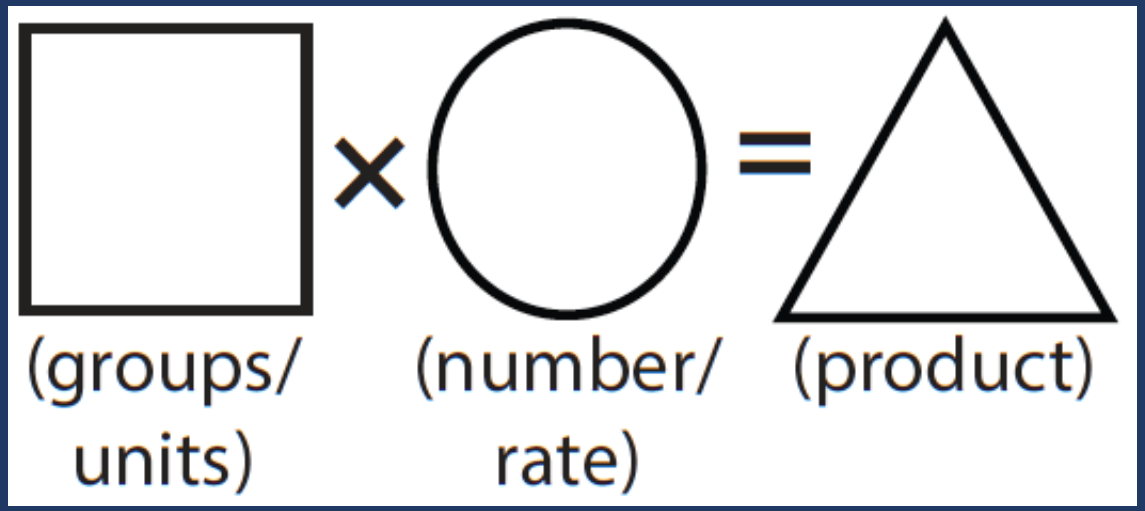
Equal Groups

"Are there groups with an equal number in each group?"

Equal Groups

GR × N = P

GR × E = P



Comparison

Set multiplied by a number of times for a product

Joan ran 6 minutes. L'Tanya ran 4 times longer than Joan. How many minutes did L'Tanya run?

Set

Number of times

Product

Equal Groups

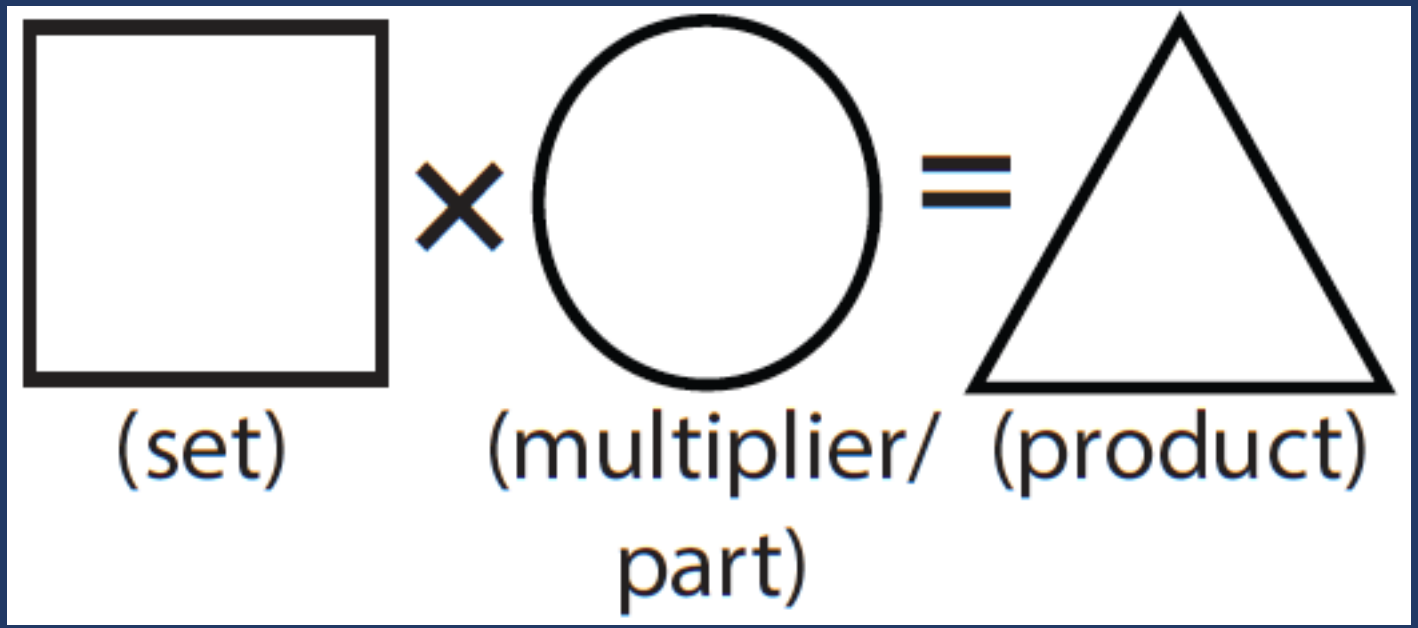
"Are there groups with an equal number in each group?"

Comparison

"Is a set compared a number of times?"

Comparison

S × T = P



Ratio/Proportion

Description of relationships among quantities

Melissa baked cookies and brownies. The ratio of cookies to brownies was 3:5. If she baked 25 brownies, how many cookies did she bake?

Emma typed 56 words in 2 minutes. At this rate, how many words could Emma type in 7 minutes?

Equal Groups

"Are there groups with an equal number in each group?"

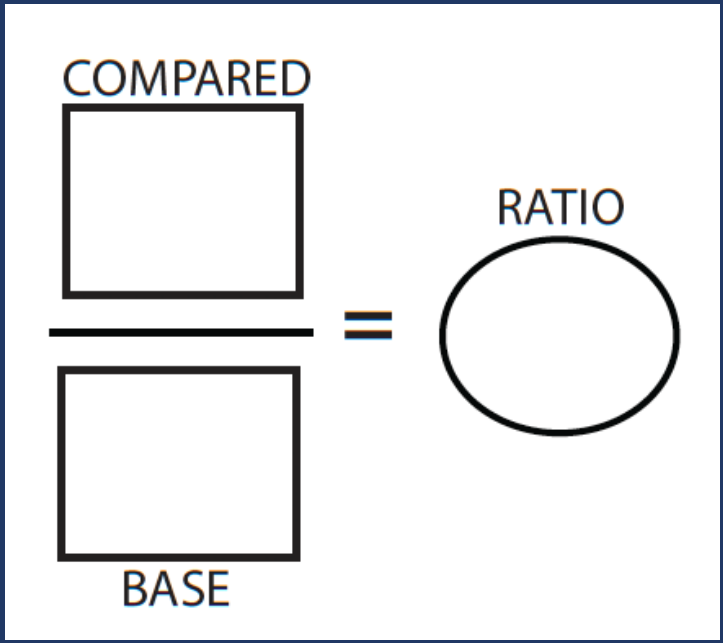
Comparison

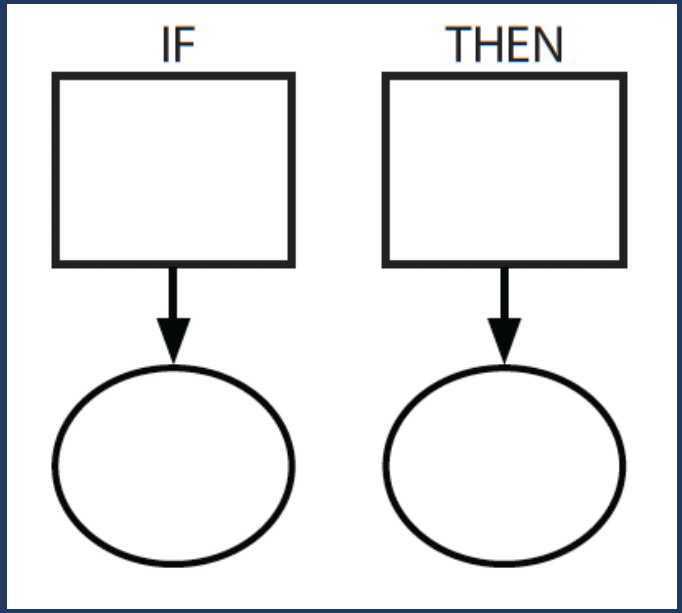
"Is a set compared a number of times?"

Ratio/Proportion

"Are there relationships among quantities - if this, then this?"

Ratio/Proportion





Xin et al. (2005)

WORD PROBLEMS

Multiplicative Word Problems

E.
There are 8 people. They each have 4 oranges. Which expression shows how many oranges the people have altogether?

A. 8 + 4
B. 8 – 4
C. 8 × 4
D. 8 ÷ 4

F.
A farmer plants 4 rows of trees. Each row has an equal number of trees. There are 1,580 trees on the farm. What is the number of trees in each row?

G.
A store has two lamps for sale. Lamp A costs $9. Lamp B costs 6 times more than Lamp A. How much is Lamp B ?

H.
There are 3,726 students spending the summer at a camp. The students are divided equally into 9 groups. How many students are in each group?

Equal Groups

Comparison

Ratio/ Proportion

Total

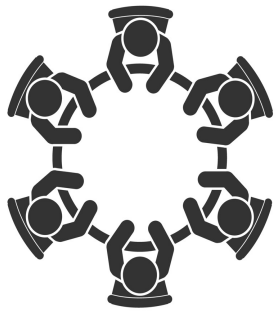
Difference

Change

Equal Groups

Comparison

Ratio/ Proportion



Identify 1 of each schema.

WORD PROBLEMS

Total

Difference

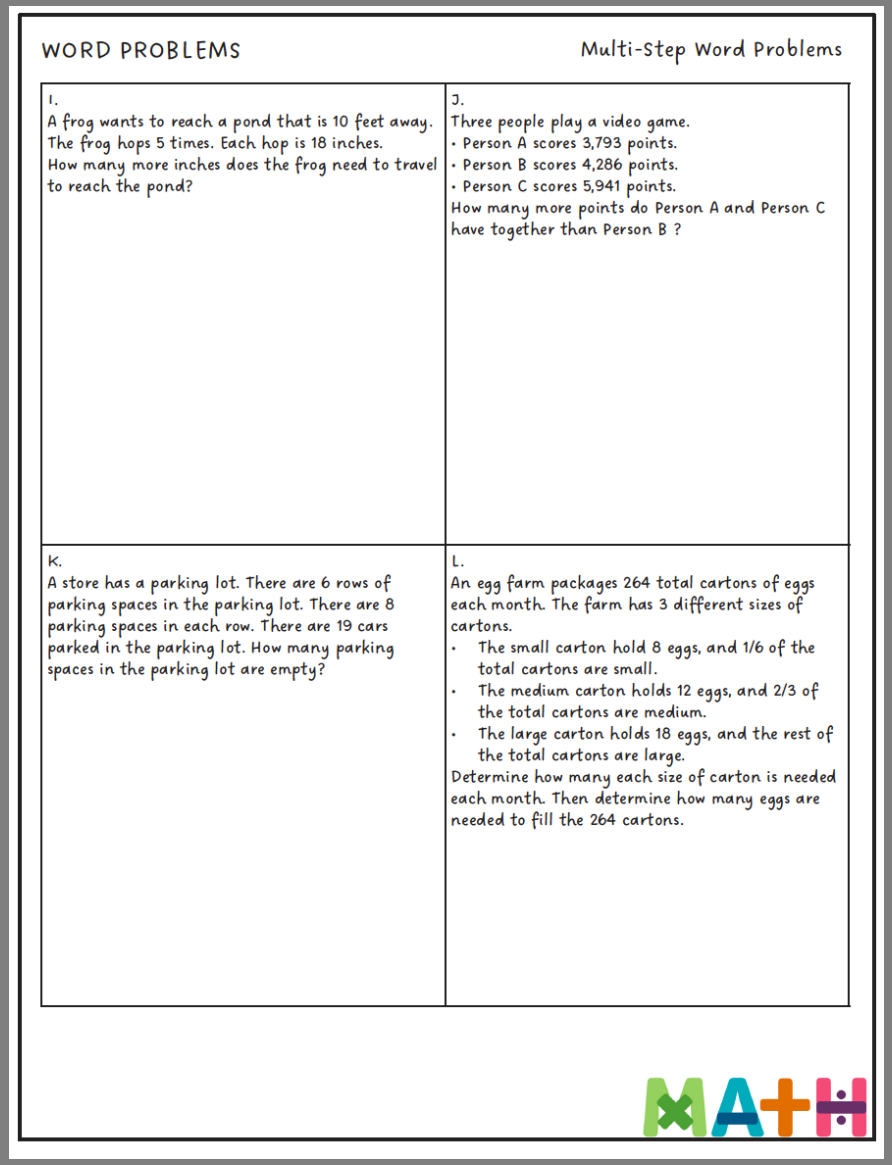
Change

Equal Groups

Comparison

Ratios and Proportions

Multi-Step Problems



WORD PROBLEMS — Multi-Step Word Problems

I.
A frog wants to reach a pond that is 10 feet away. The frog hops 5 times. Each hop is 18 inches. How many more inches does the frog need to travel to reach the pond?

J.
Three people play a video game.
- Person A scores 3,793 points.
- Person B scores 4,286 points.
- Person C scores 5,941 points.

How many more points do Person A and Person C have together than Person B ?

K.
A store has a parking lot. There are 6 rows of parking spaces in the parking lot. There are 8 parking spaces in each row. There are 19 cars parked in the parking lot. How many parking spaces in the parking lot are empty?

L.
An egg farm packages 264 total cartons of eggs each month. The farm has 3 different sizes of cartons.
- The small carton hold 8 eggs, and 1/6 of the total cartons are small.
- The medium carton holds 12 eggs, and 2/3 of the total cartons are medium.
- The large carton holds 18 eggs, and the rest of the total cartons are large.

Determine how many each size of carton is needed each month. Then determine how many eggs are needed to fill the 264 cartons.

Total

Difference

Change

Equal Groups

Comparison

Ratio/
Proportion

Find or write your own. Have a partner solve.

WORD PROBLEMS

Multi-Step Word Problems

M.

N.

MATH

MATH

Directive Problems

UPS✓

UNDERSTAND
Read and explain.

PLAN
How will you solve the problem?

SOLVE
Set up and do the math!

✓CHECK
Does your answer make sense?

Created by: Sarah Powell (srpowell@austin.utexas.edu)

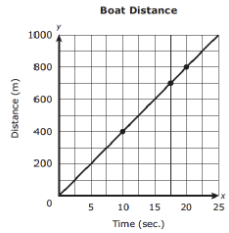
WORD PROBLEMS — Directive Word Problems

O.
What fraction, when added to 3/8, would make one whole?

P.
Three shapes are listed in the table. Place a check mark to show what is true for each shape. Select one or more than one box per row.

Shape	Is a Quadrilateral	Has More Than 5 Sides
rectangle	☐	☐
hexagon	☐	☐
square	☐	☐

Q.
Which coordinate pairs represent points on the graph? Select the two coordinate pairs.



R.
A fish tank is in the shape of a right rectangular prism. The fish tank has a length of 6 feet, a width of 2 feet, and a height of 3 feet. What is the volume, in cubic feet, of the fish tank?

WORD PROBLEMS

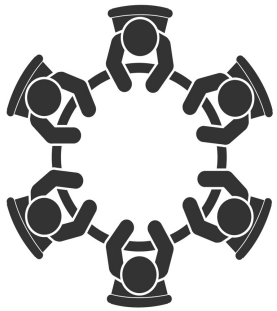
What are your strengths?

What are your opportunities for growth?

What are your plans for next Monday?
Next month?
Next year?

INSTRUCTIONAL PLATFORM

Instructional Platform



What are your strengths with problem solving?

What are your opportunities for growth?

What are your plans for next Monday?

Next month?

Next year?

Students require modeling and practice on how to use the language of mathematics.

Students should use hands-on tools, virtual manipulatives, drawings, and other visuals to understand mathematics concepts and procedures.

Teachers should use systematic and explicit instruction to help students develop a strong foundation for specific mathematics skills.

Teachers should use fluency building activities to build counting fluency and fluency with the operations.

Students should learn how to set up and solve word problems by combining an attack strategy with a focus on word-problem schemas.

Instructional Platform

INSTRUCTIONAL DELIVERY

Vocabulary

Representations

Model and Practice

INSTRUCTIONAL STRATEGIES

Fluency

Word Problems

WORD PROBLEMS

What are your strengths?

What are your opportunities for growth?

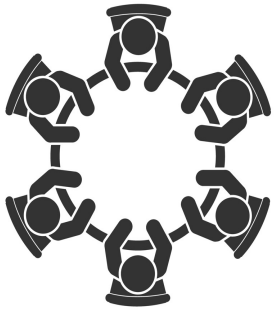
What are your plans for next Monday?
Next month?
Next year?

INSTRUCTIONAL PLATFORM

Instructional Platform

What's YOUR instructional platform? What are your plans for your teachers?

SCOPE AND SEQUENCE



Where does WORD-PROBLEM SOLVING fit within your scope and sequence? What are your plans for your teachers?

Resources

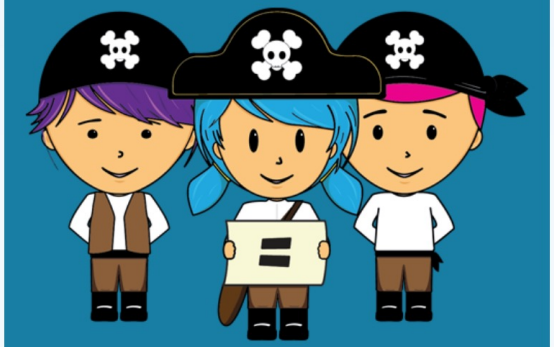
Pirate Math Equation Quest

About | Research | Individual | Small Group | STAAR | Videos

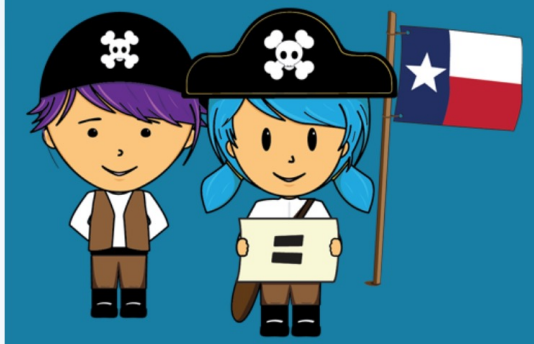
Welcome to Pirate Math Equation Quest!

Individual Word-Problem Intervention

Small-Group Word-Problem Intervention



Small-Group Word-Problem Intervention for STAAR



https://intensiveintervention.org

National Center on
INTENSIVE INTERVENTION
at American Institutes for Research

Search

Intensive Intervention | Tools Charts | Implementation Support | Intervention Materials | Information For...

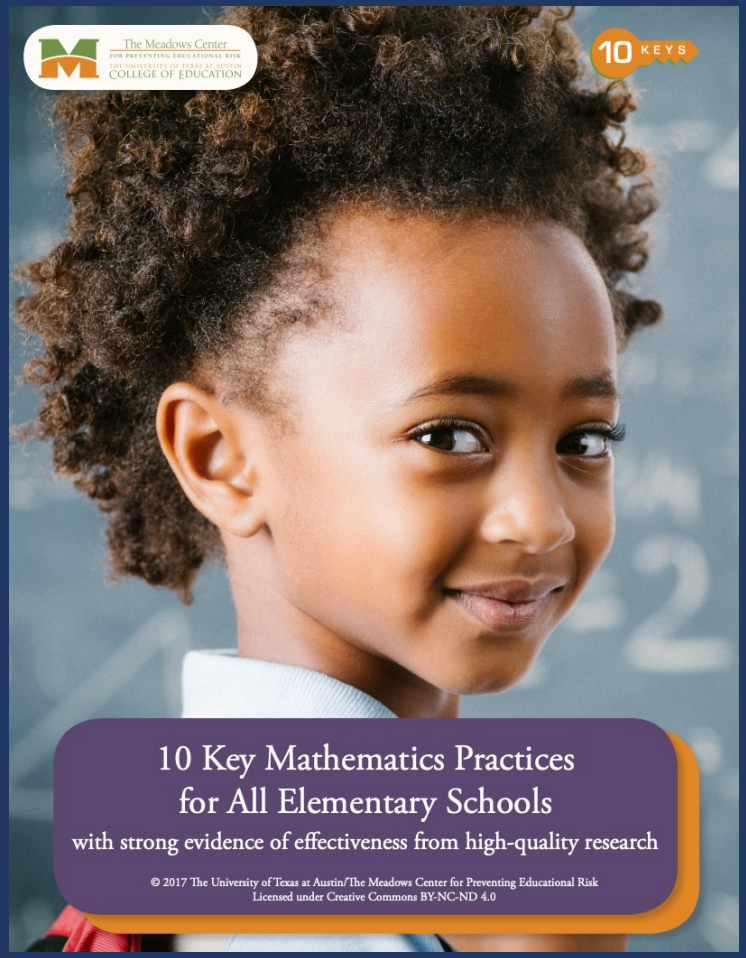
Intensive Intervention in Mathematics Course Content

NCII, through a collaboration with the University of Connecticut, developed a set of course content focused on developing educators' skills in designing and delivering intensive mathematics instruction. This content is designed to support faculty and professional development providers with instructing pre-service and in-service educators who are developing and/or refining their implementation of intensive mathematics intervention.

Intensive instruction was recently identified as a high-leverage practice in special education, and DBI is a research based approach to delivering intensive instruction across content areas (NCII, 2013). This course provides learners with an opportunity to extend their understanding of intensive instruction through in-depth exposure to DBI in mathematics, complete with exemplars from actual classroom teachers.

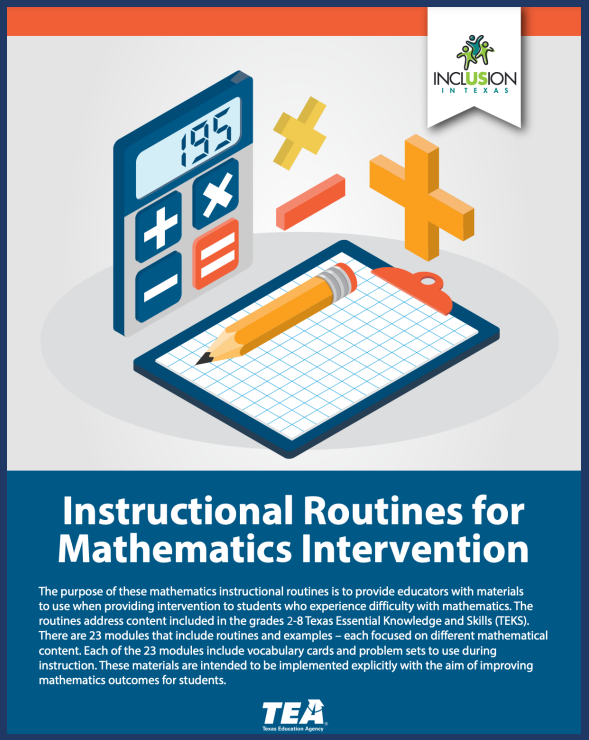
NCII, through a collaboration with the University of Connecticut and the National Center on Leadership in Intensive Intervention and with support from the CEEDAR Center, developed course content focused on enhancing educators' skills in intensive mathematics intervention. The course includes eight modules that can support faculty and professional development providers with instructing pre-service and in-service educators who are learning to implement intensive mathematics intervention through data-based individualization (DBI). The content in this course complements concepts covered in the Features of Explicit Instruction Course and so we suggest that users complete both courses.

MODULE 5: INTENSIVE MATHEMATICS INTERVENTION: INSTRUCTIONAL STRATEGIES



https://meadowscenter.org/resource/10-key-mathematics-practices-for-all-elementary-schools-with-strong-evidence-of-effectiveness-from-high-quality-research/

https://meadowscenter.org/resource/10-key-math-practices-for-all-middle-and-high-schools-with-strong-evidence-of-effectiveness-from-high-quality-research/



Module 9:
Subtraction of Rational Numbers

Problem Sets

A. Proper fractions with like denominators and sums <1 (20)
B. Improper fractions with like denominators and sums >1 (10)
C. Mixed numbers with like denominators and sums >1 (10)
D. Proper fractions with unlike denominator and sums <1 (20)
E. Improper fractions with unlike denominator and sums >1 (10)
F. Mixed numbers with unlike denominator and sums >1 (10)

G. Decimals with tenths; no regrouping (20)
H. Decimals with tenths; regrouping (20)
I. Decimals with hundredths; no regrouping (20)
J. Decimals with hundredths; regrouping (20)
K. Decimals with tenths and hundredths; mix of regrouping (20)

numerator

The term in a fraction that tells how many parts of a fraction.

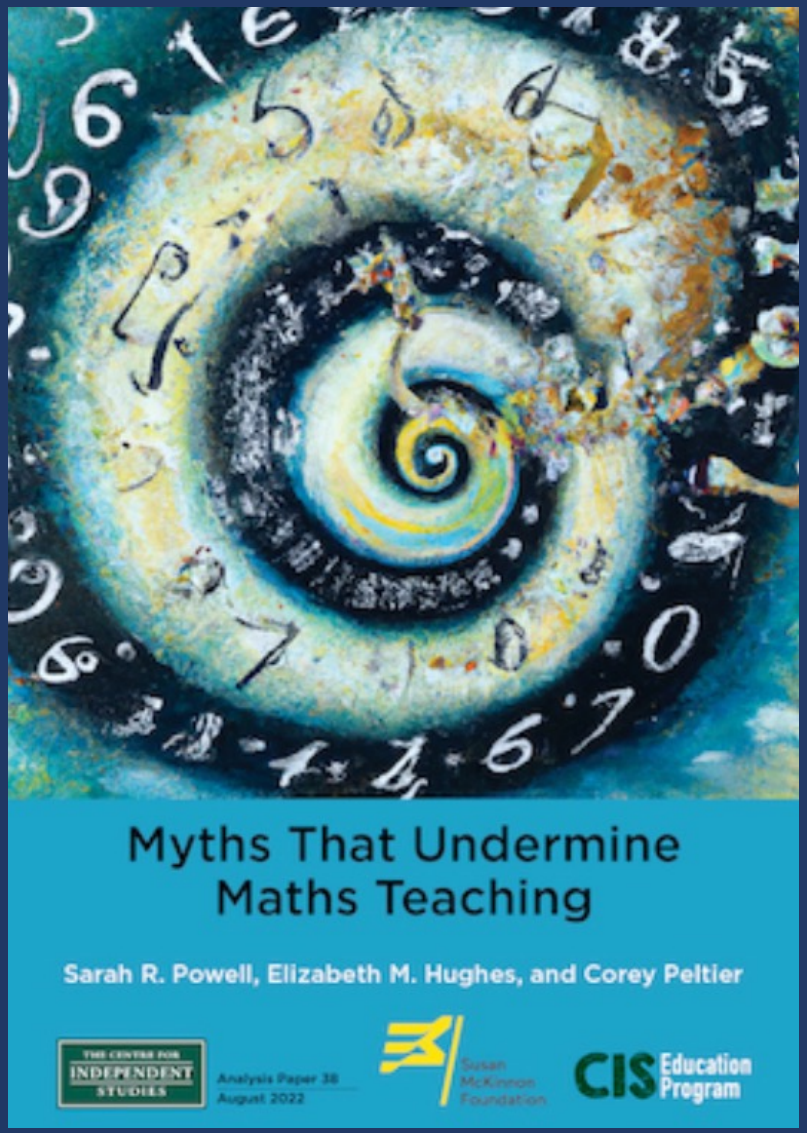
2 / 3 $\frac{2}{3}$ **In these fractions, 2 is the numerator.**

ones

The digit representing 1.

In the number 4.23, 4 is in the ones place.

https://spedsupportstage.tea.texas.gov/resource-library/instructional-routines-mathematics-intervention



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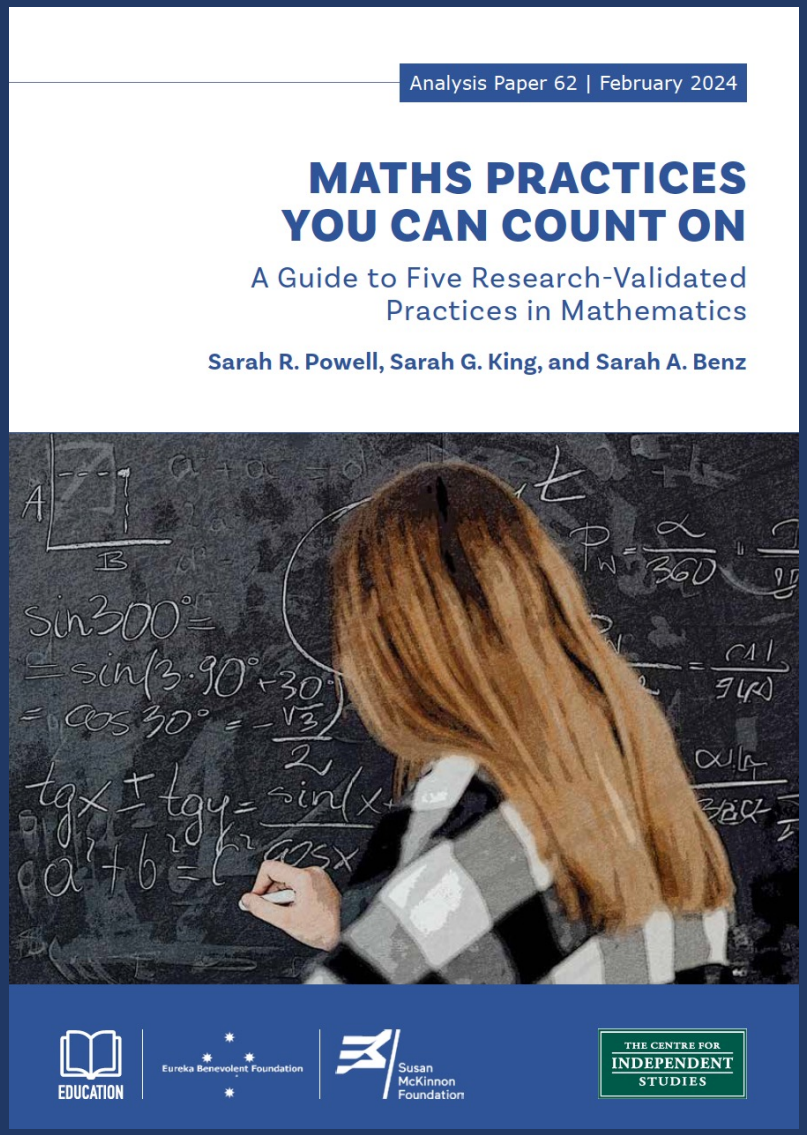

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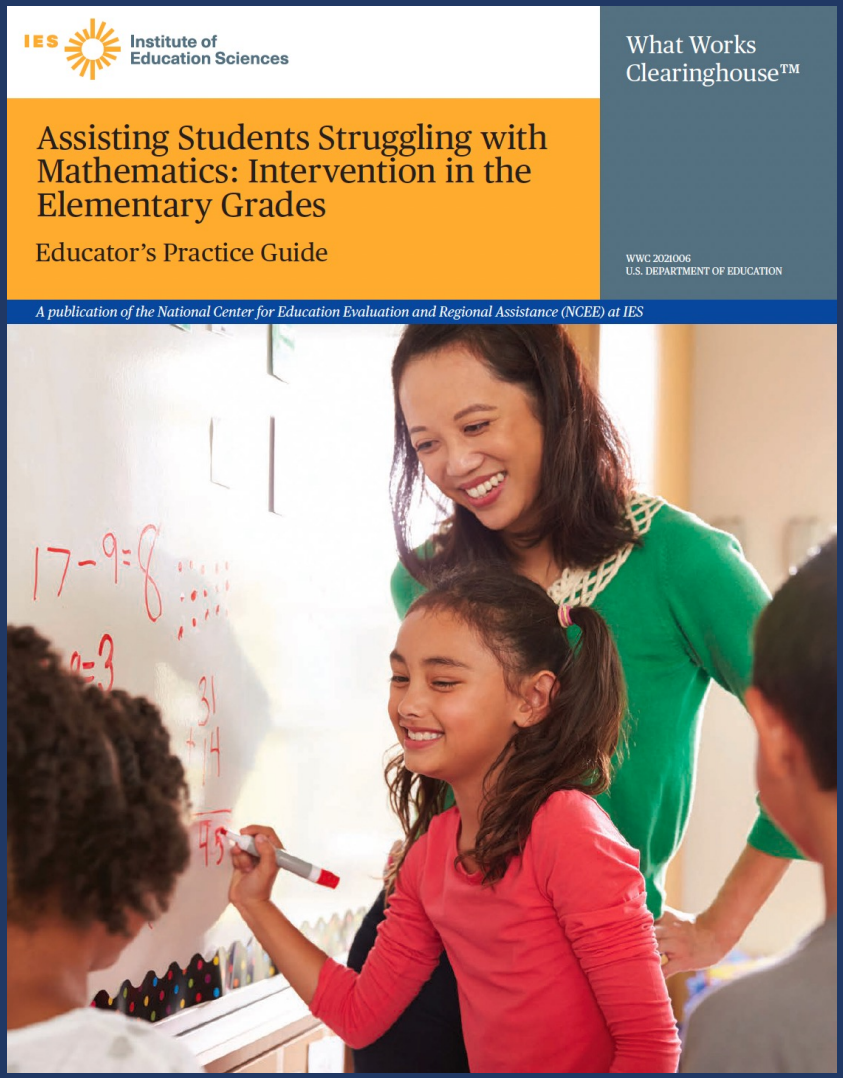
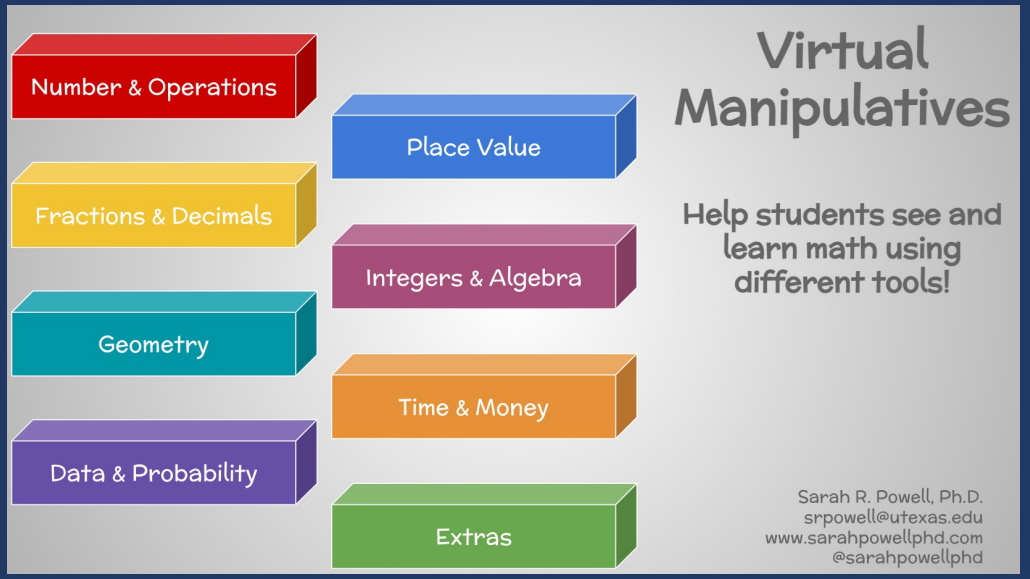
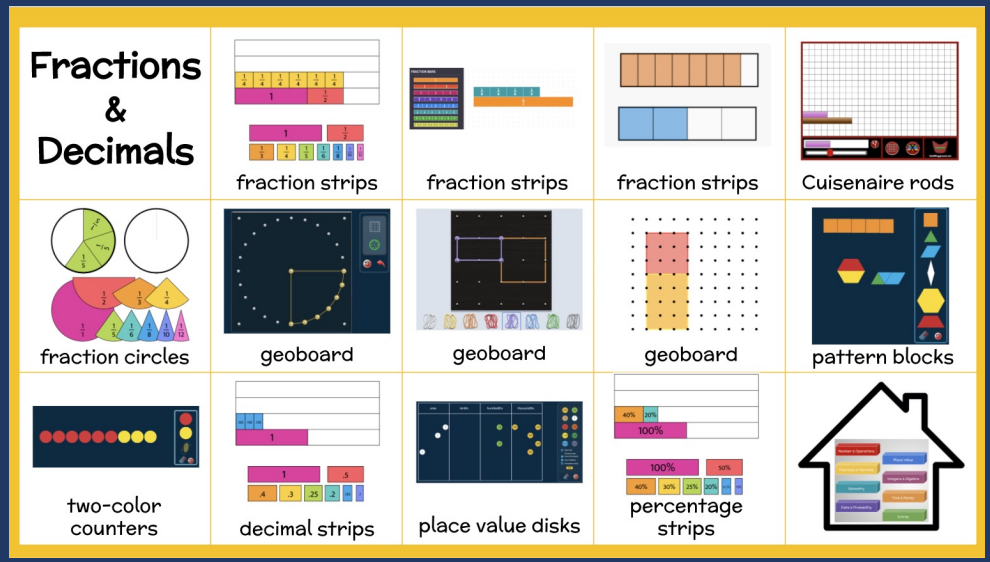
https://ies.ed.gov/ncee/wwc/PracticeGuide/26



bit.ly/srpowell





Resources

Instructional Platform

Explicit Instruction

Language

Multiple Representations

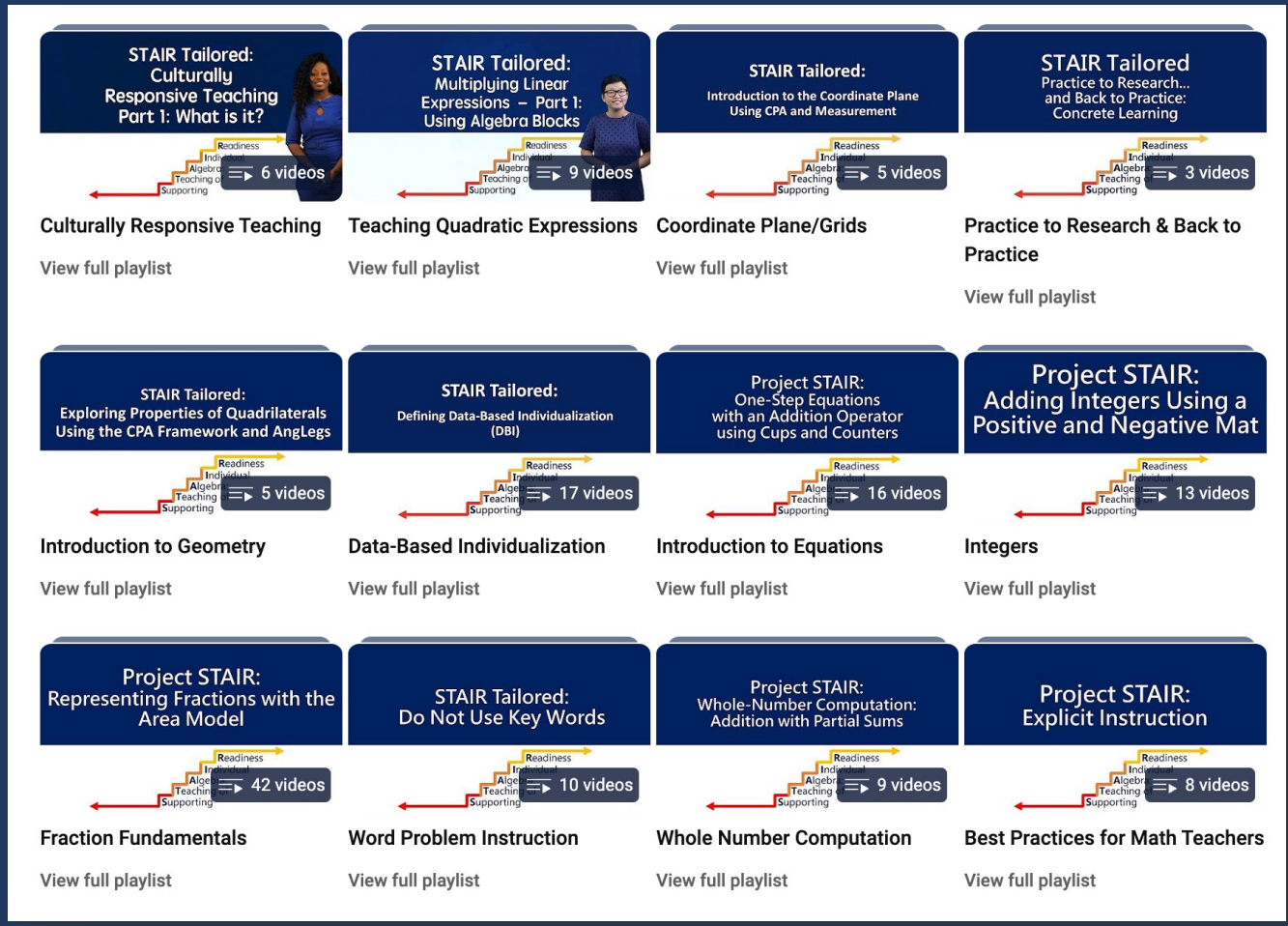
Fluency

Problem Solving

Additional Resources

Coaching

https://www.mathspiral.com



https://www.youtube.com/channel/UCE2puwDtUSNXFON1OhmYmvA

Elementary Math Leads Survey

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