Best Practices for Fluency and Vocabulary

January 12, 2023

Sarah R. Powell, Ph.D.

Associate Professor
The University of Texas at Austin

www.sarahpowellphd.com

srpowell@utexas.edu

@sarahpowellphd

Say hello.

Describe the mathematics you support.

When you see this icon, it's time to use the Chat Box.

Raise your Zoom hand at anytime.

Drop questions in the Chat Box at anytime.

Schedule for Today

November	Word-Problem Solving
January 12th	Fact Fluency Computational Fluency Mathematical Language
January	Elementary Check-in Data-Based Decision Making
January	Secondary Check-in Data-Based Decision Making
February	Communities of Practice
March	Communities of Practice
April	Communities of Practice

Increase the fact fluency of your students

Increase the computational fluency of your students

Increase the focus on mathematics vocabulary

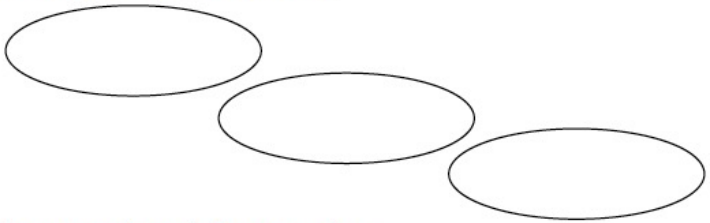
Instructional Platform

Best Practices for Fluency and Vocabulary

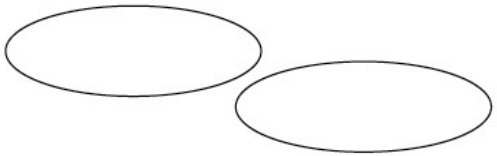
srpowell@utexas.edu @sarahpowellphd
www.sarahpowellphd.com

Instructional Platform

Instructional Delivery



Instructional Strategies



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

Multiple representations

INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving instruction

Fluency Building

Building Fluency

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.*

Addition	Subtraction
Multiplication	Division

Counting

Comparing numbers

Counting coins

Telling time

Identifying equivalent fractions

Knowing multiples

Identifying shapes

Knowing formulas

Fact Fluency

Fluency

Addition

Subtraction

Multiplication

Division

Addition

100 addition facts

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

$$\begin{array}{rl} 5 & \text{(addend)} \\ +\ 4 & \text{(addend)} \\ \hline 9 & \text{(sum)} \end{array}$$

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 have brown *eyes*:

What's a Total story to show addition?

If you don't have brown *eyes*:

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

Subtraction

100 subtraction facts

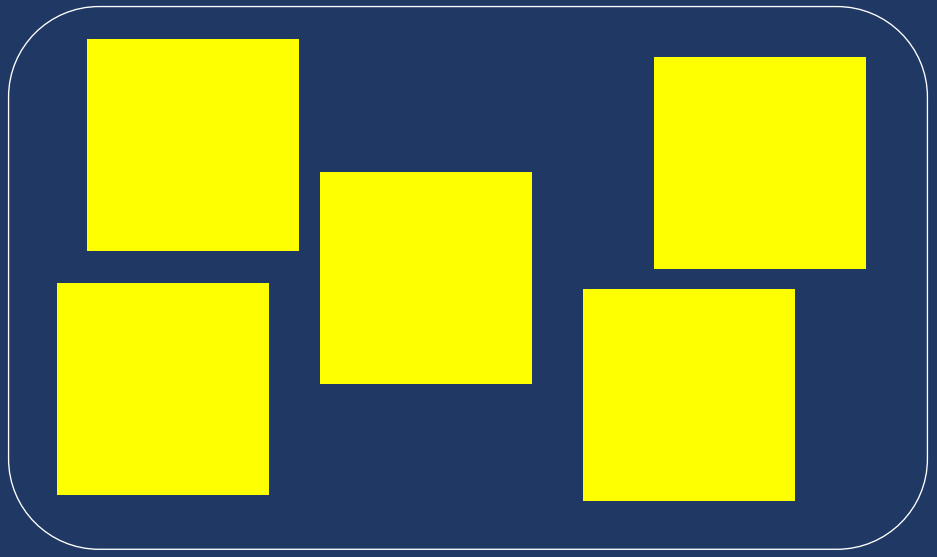
Subtrahend and difference are single-digit numbers and minuend is single- or double-digit number

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

Change

Subtraction

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

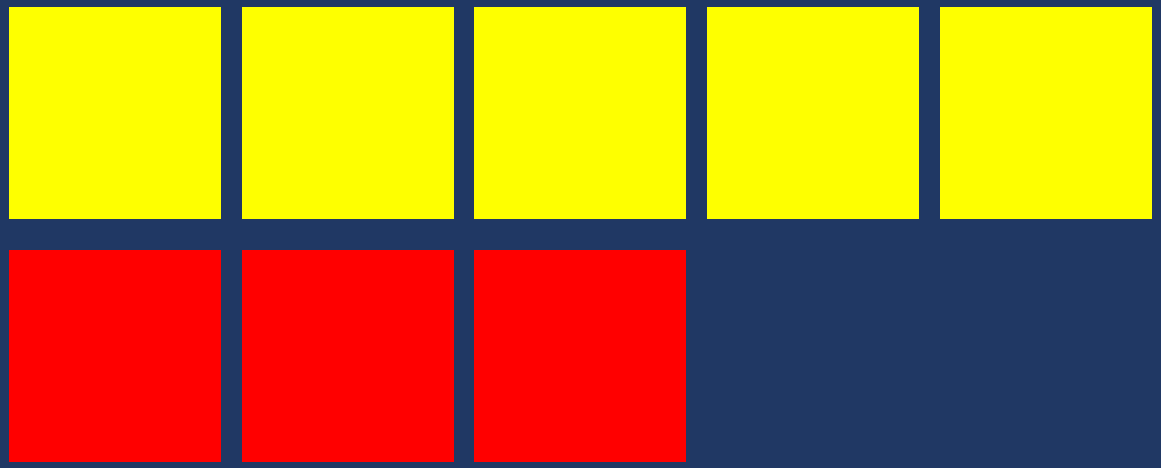


$$5 - 3 = 2$$

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

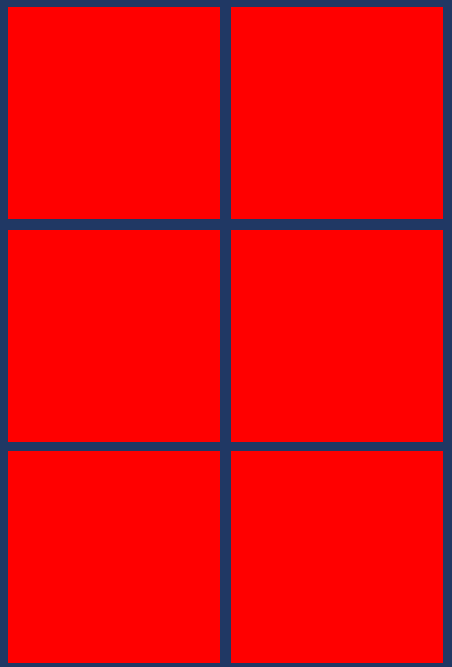
Show the groups, show the amount for each group, count product

$$3 \times 2 = 6$$

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 2 boxes of crayons. There are 12 crayons in each box. How many crayons does Rhiannon have altogether?

Comparison

Multiplication

Set multiplied by a number of times for a product

Vivienne picked 12 apples. Jessica picked 2 times as many apples as Vivienne. How many apples did Jessica pick?

$2 \times 5 = \_\_$

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

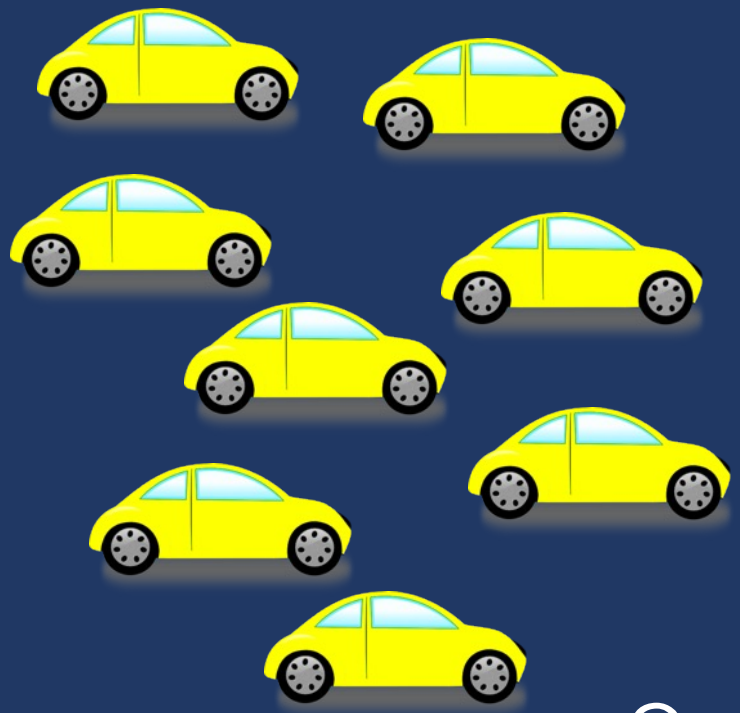
Divisor and quotient are single-digit numbers and dividend is single- or double-digit number

8	÷	4	=	2
(dividend)		(divisor)		(quotient)

Equal Groups (Partitive Division)

Division

Show the dividend, divide equally among divisor, count quotient

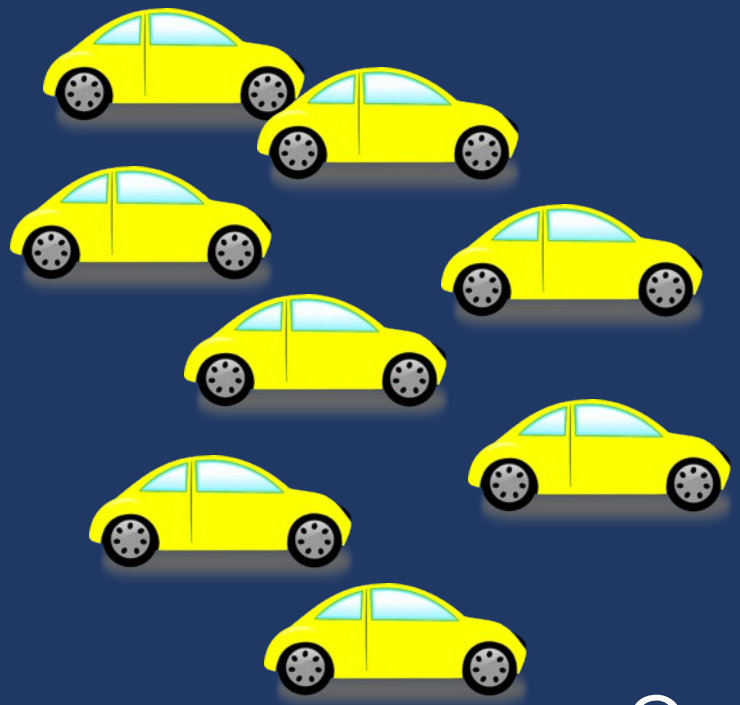


$$8 \div 2 = 4$$

Equal Groups (Quotative Division)

Division

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



$$8 \div 2 = 4$$

Equal Groups

Groups multiplied by number in each group for a product

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

Nicole has 12 apples. She put them into bags with 6 apples each. How many bags did Nicole use?

$12 \div 4 = \_\_$

Division

If you watch *Stranger Things*:

What's a Partitive story to show division?

If you watch *Ted Lasso*:

What's a Quotative story to show division?

Addition	Subtraction
Multiplication	Division

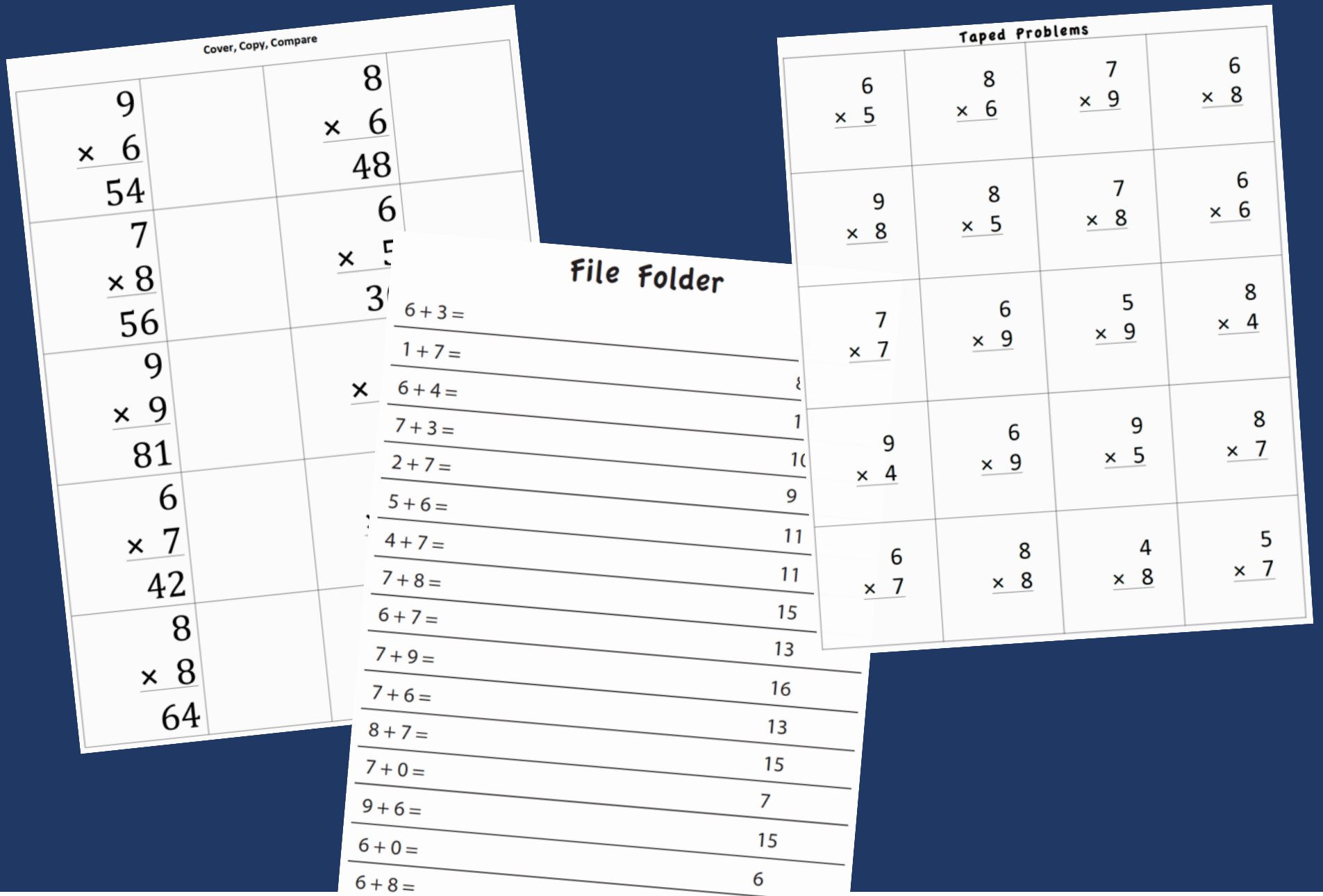
Build fluency with math facts.

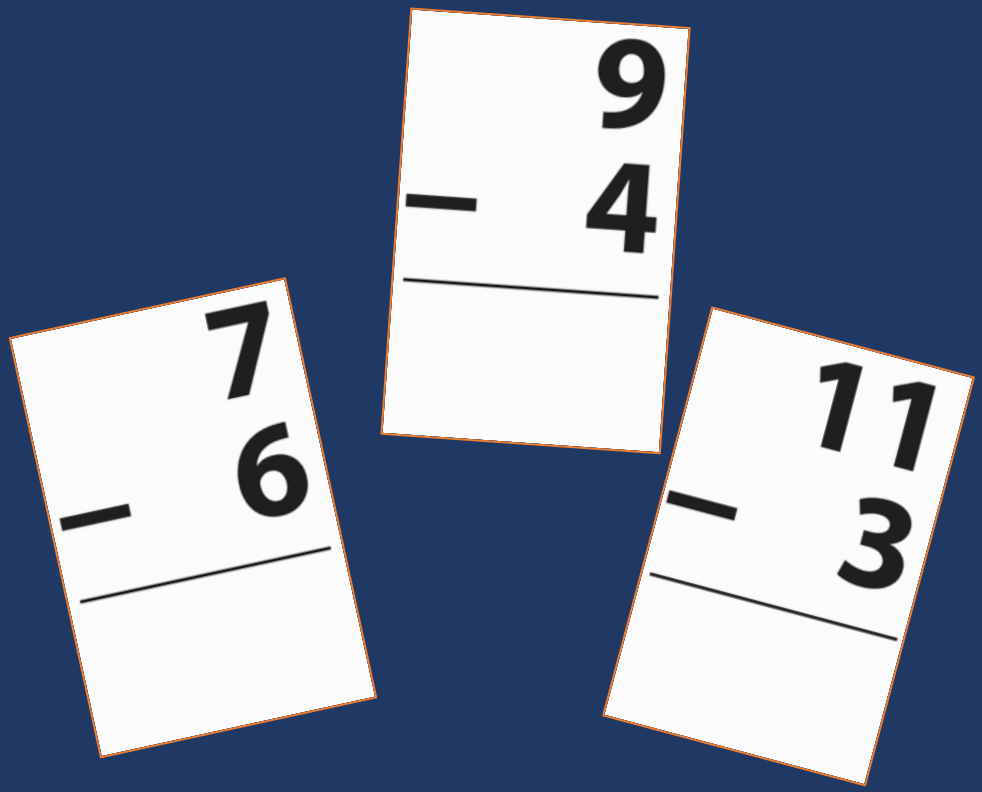
- Addition: single-digit addends
- Subtraction: single-digit subtrahend
- Multiplication: single-digit factors
- Division: single-digit divisor

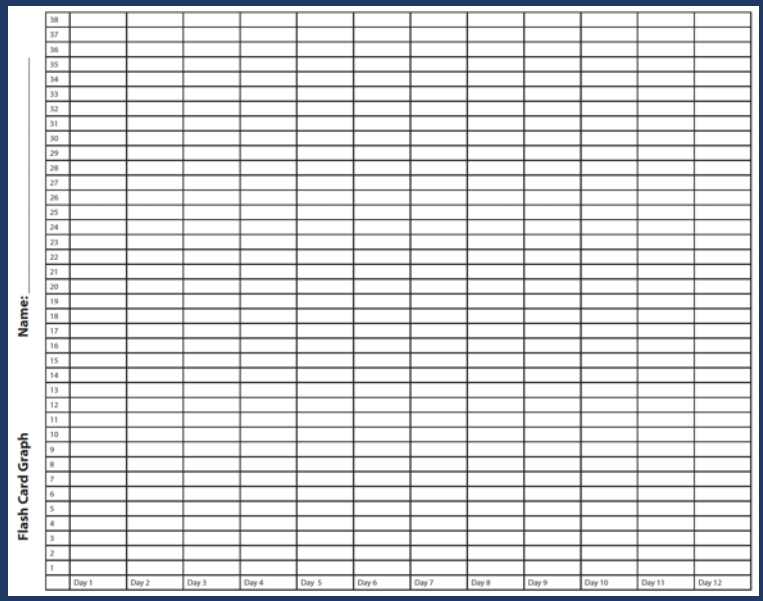
$$\begin{array}{r} 5 \\ +\ 8 \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ -\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 6 \\ \times\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 56 \\ \div\ 8 \\ \hline \end{array}$$

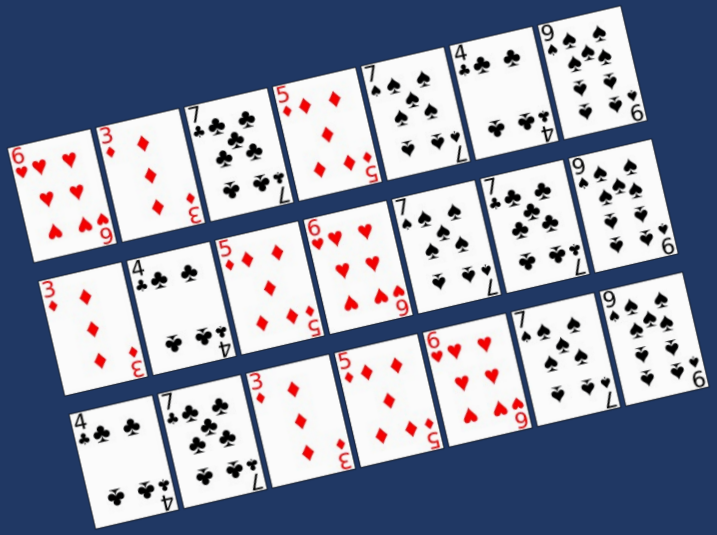
Fact Fluency Building Strategies

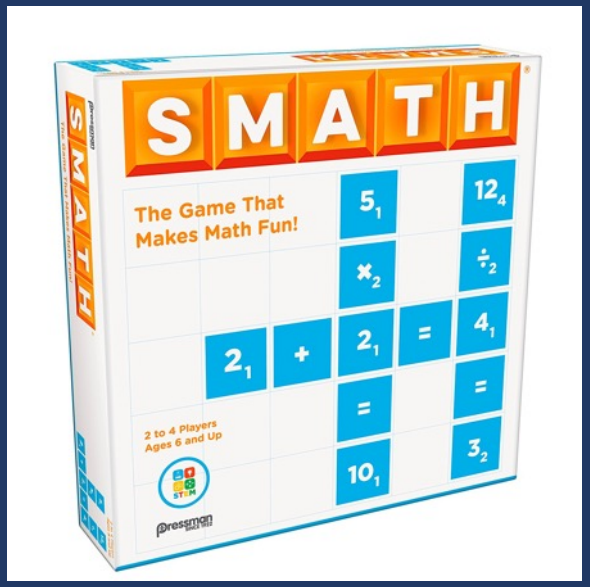
Computational Fluency Building Strategies

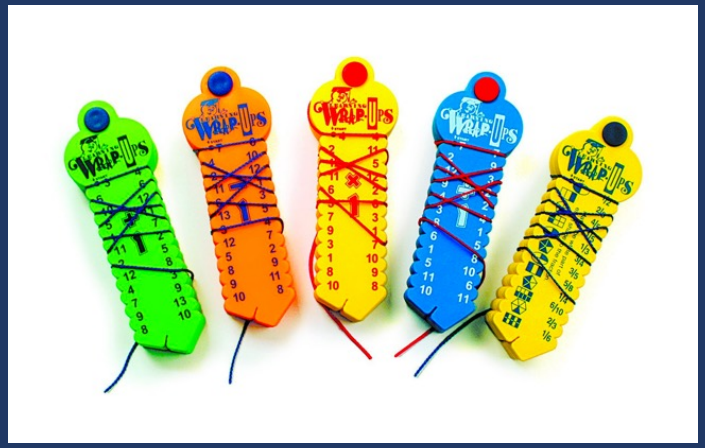


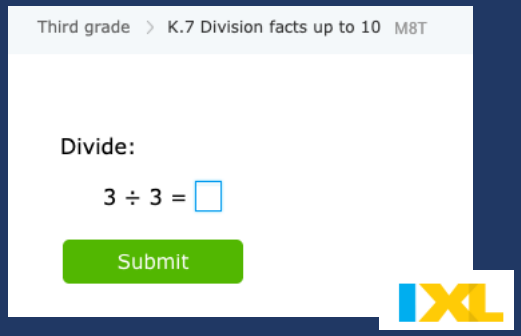


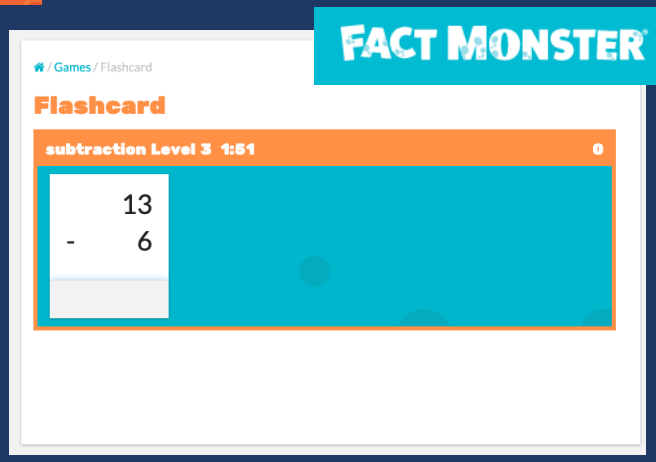












DAILY and BRIEF

Addition	Subtraction
Multiplication	Division

What fact fluency is important for your students?

What are five ways to help students build fact fluency?

Computational Fluency

Addition and Subtraction Computation

227 + 185 =	232 – 164 =

Traditional

A.

$$\begin{array}{r} {\scriptstyle 1} \\ 74 \\ +\ 18 \\ \hline 92 \end{array}$$

B.

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 725 \\ +\ 365 \\ \hline 1{,}090 \end{array}$$

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

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.

$$74 \xrightarrow{-4} 70$$
$$+\ 18 \xrightarrow{+4} +22$$
$$92$$

B.

$$725 \xrightarrow{+5} 730$$
$$+\ 365 \xrightarrow{-5} +360$$
$$1{,}090$$

$$227$$
$$+\ 185$$

Addition and Subtraction Computation

227 + 185 =	232 – 164 =

Traditional

A.

$$\begin{array}{r} 5 \\ \not{6}\,{}^{1}2 \\ -\ 17 \\ \hline 45 \end{array}$$

B.

$$\begin{array}{r} 2\,9 \\ \not{3}\,{}^{1}\not{0}\,{}^{1}5 \\ -\ 96 \\ \hline 209 \end{array}$$

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

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.

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

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

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

Multiplication and Division Computation

13 x 7 =	135 ÷ 5 =
13 x 47 =	804 ÷ 12 =

Traditional

A.

$$\begin{array}{r} {\scriptstyle 1} \\ 24 \\ \times\ 43 \\ \hline {\scriptstyle 1\,1}72 \\ +960 \\ \hline 1{,}032 \end{array}$$

B.

$$\begin{array}{r} {\scriptstyle 1\,1} \\ 132 \\ \times\ 53 \\ \hline 396 \\ +6600 \\ \hline 6{,}996 \end{array}$$

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

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

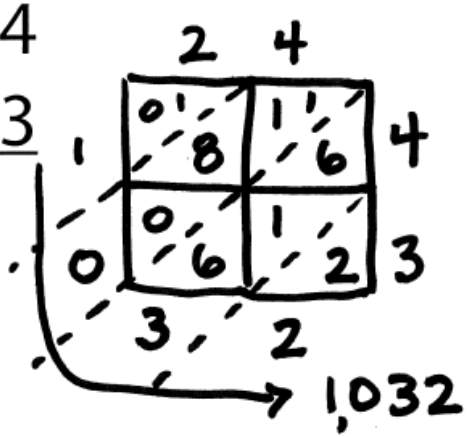
$$\begin{array}{r} 5000 \\ 1500 \\ 100 \\ 300 \\ 90 \\ +\ 6 \\ \hline 6996 \end{array}$$

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

Lattice

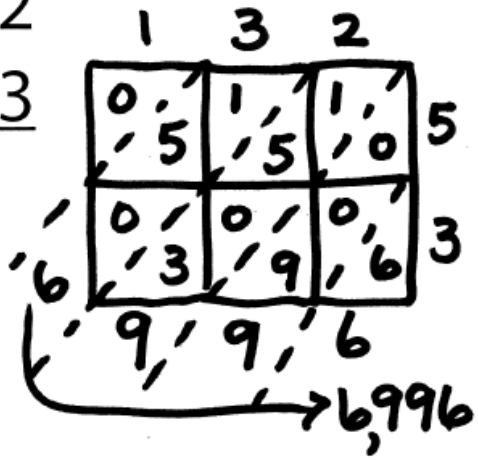
A.

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



B.

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



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

Multiplication and Division Computation

13 x 7 =	135 ÷ 5 =
13 x 47 =	804 ÷ 12 =

Traditional

A.
$$\begin{array}{r} 13 \text{ R2} \\ 12\overline{)158} \\ -12\downarrow \\ \hline 38 \\ -36 \\ \hline 2 \end{array}$$

B.
$$\begin{array}{r} 28 \text{ R18} \\ 34\overline{)\cancel{89}\,170} \\ -68\downarrow \\ \hline 2\cancel{8}\,10 \\ -272 \\ \hline 18 \end{array}$$

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

Partial Quotients

A.

$$
\begin{array}{r|l}
12\overline{)158} & \\
-120 & 10 \\
\hline
38 & \\
-36 & +3 \\
\hline
2 & 13\ R2
\end{array}
$$

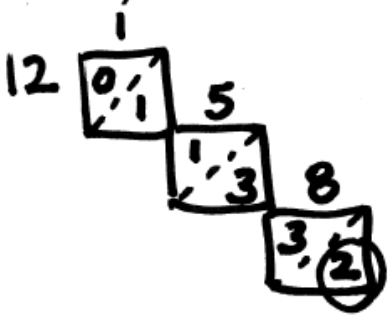
B.

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

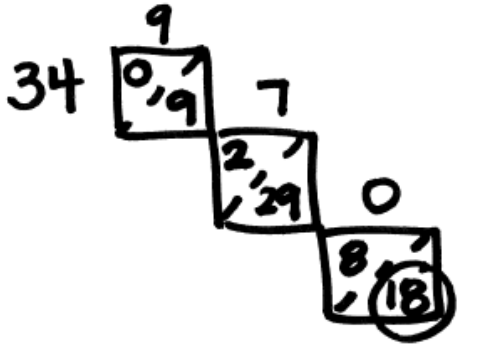
$$
\begin{array}{r}
804 \\
\div\ \ 12 \\
\hline
\end{array}
$$

Lattice

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



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



$$804 \div 12$$

Division as Fractions

A. $12\overline{)158}$

$\frac{100}{12}$ $8\frac{4}{12}$

$\frac{50}{12}$ $4\frac{2}{12}$

$\frac{8}{12} + \frac{8}{12} = 12\frac{14}{12} = 13\frac{2}{12}$

B. $34\overline{)970}$

$\frac{900}{34}$ $26\frac{16}{34}$

$\frac{70}{34}$ $+2\ \frac{2}{34}$

$\frac{0}{34}$ $= 28\frac{18}{34}$

$804 \div 12$

Fact Fluency Building Strategies

Computational Fluency Building Strategies

Addition	Subtraction
Multiplication	Division

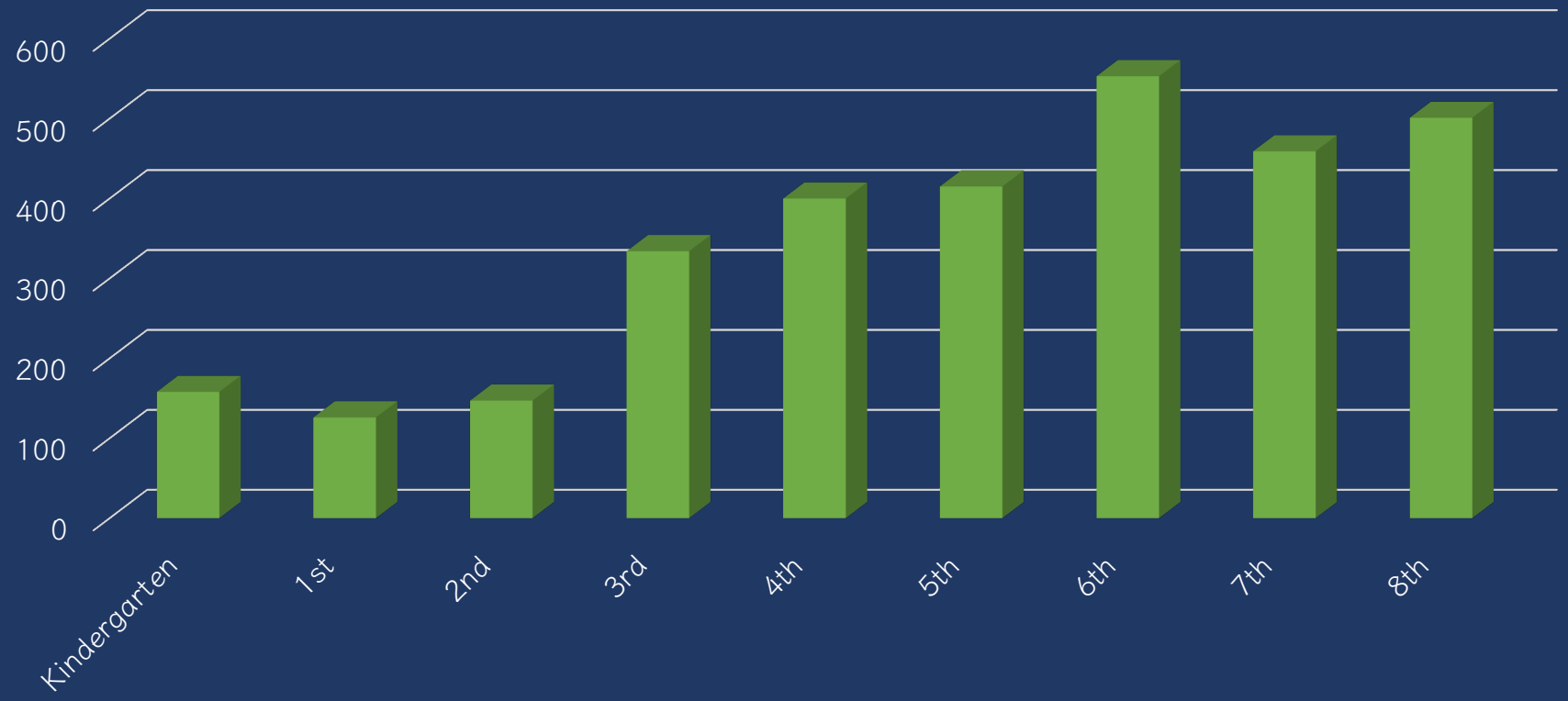
What computational fluency is important for your students?

What are your plans for creating practice time for students to practice computational fluency?

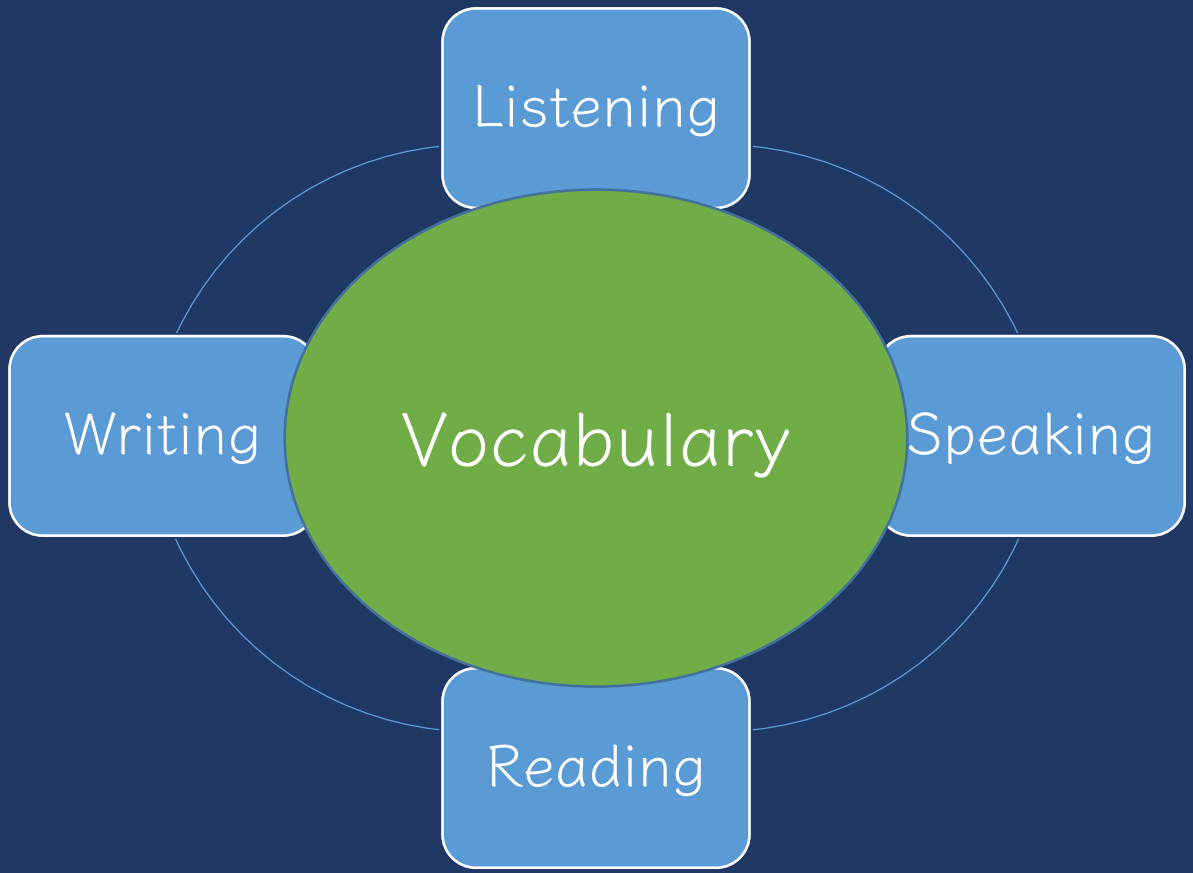
Mathematical Language

Mathematical Language

Instead of that...	Say this...



Powell, Bos, & Lin (2019)



1. Some math terms are shared with English but have different meanings

base

right

degree

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings
   (but a more precise math meaning)

difference

even

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings
   (but a more precise math meaning)

3. Some math terms are only used in math

trapezoid

numerator

parallelogram

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings
   (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

round

square

second

base

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

divide vs. Continental Divide

variable vs. variably cloudy

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

eight vs. ate

sum vs. some

rows vs. rose

base vs. bass

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

7. Some math terms are related but have distinct meanings

factor vs. multiple

hundreds vs. hundredths

numerators vs. denominator

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

7. Some math terms are related but have distinct meanings

8. An English math term may translate into another language with different meanings

mesa vs. tabla

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

7. Some math terms are related but have distinct meanings

8. An English math term may translate into another language with different meanings

9. English spelling and usage may have irregularities

four vs. forty

Rubenstein & Thompson (2002)

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

7. Some math terms are related but have distinct meanings

8. An English math term may translate into another language with different meanings

9. English spelling and usage may have irregularities

10. Some math concepts are verbalized in more than one way

skip count vs. multiples

one-fourth vs. one quarter

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

7. Some math terms are related but have distinct meanings

8. An English math term may translate into another language with different meanings

9. English spelling and usage may have irregularities

rhombus vs. diamond

10. Some math concepts are verbalized in more than one way

vertex vs. corner

11. Informal terms may be used for formal math terms

1. Some math terms are shared with English but have different meanings

2. Some math words are shared with English with similar meanings (but a more precise math meaning)

3. Some math terms are only used in math

4. Some math terms have more than one meaning

5. Some math terms are similar to other content-area terms with different meanings

6. Some math terms are homographs

7. Some math terms are related but have distinct meanings

8. An English math term may translate into another language with different meanings

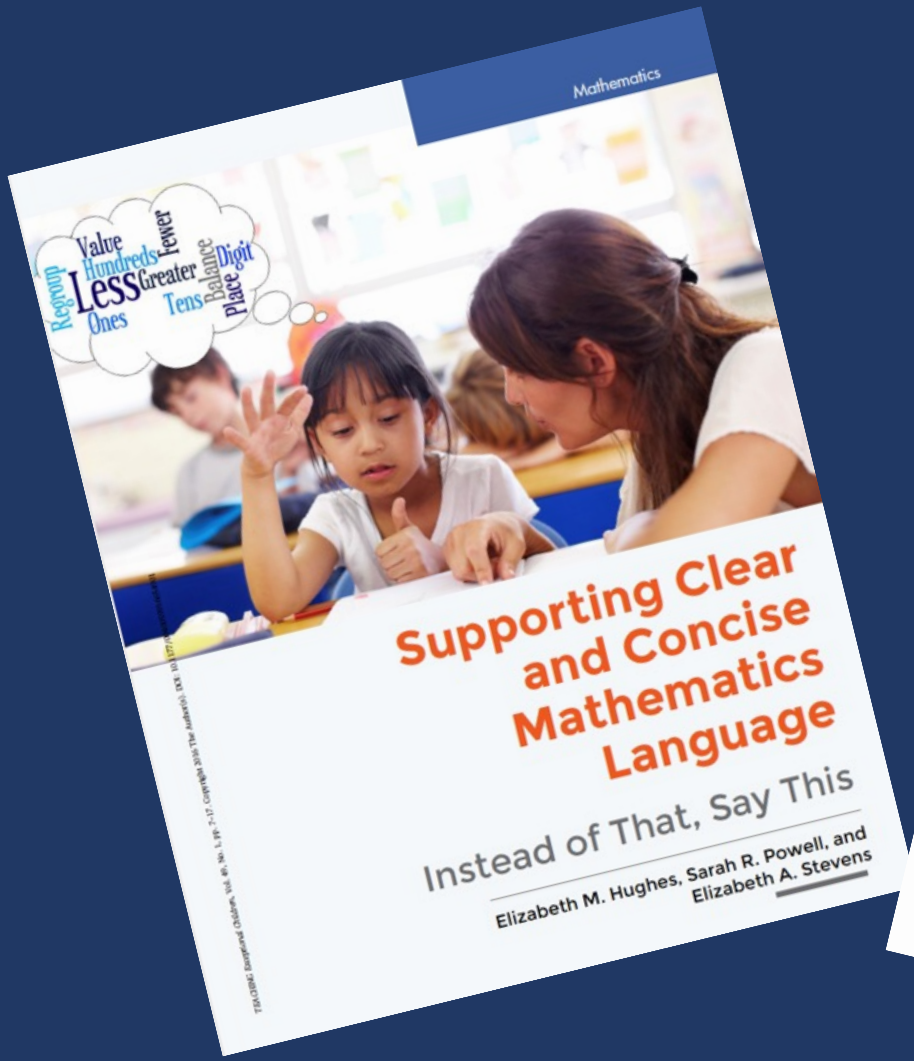
9. English spelling and usage may have irregularities

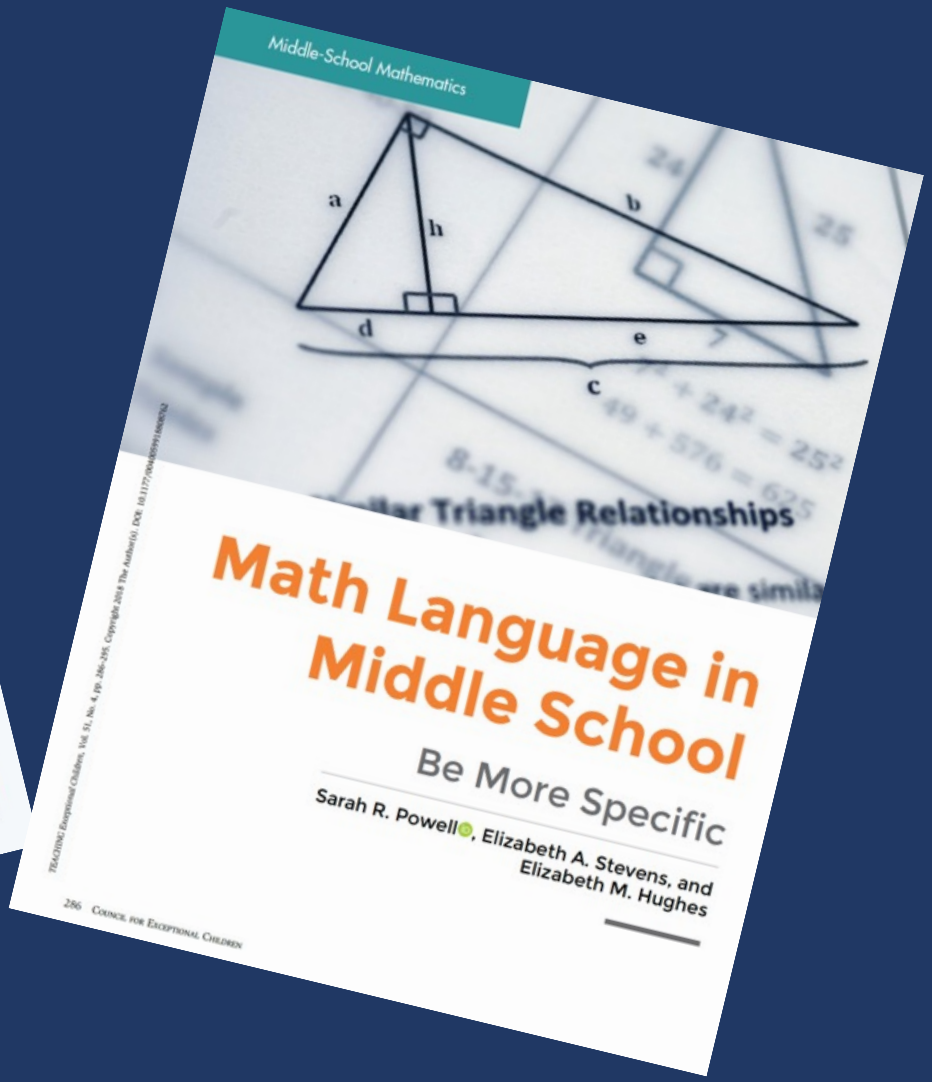
10. Some math concepts are verbalized in more than one way

11. Informal terms may be used for formal math terms

Use formal math language

Use terms precisely





What number is in the tens place?

What digit is in the tens place?
What is the value of the digit in the tens place?

135

Why this is important...

- A number refers to the entire amount.
- The 3 in the tens place value is not a number, but rather a digit in the number 135.
- Reinforces conceptual understanding of place value.
- Emphasizes that 3 is part of the number 135 with a value of 30.

The alligator eats the bigger number

is less than
OR
is greater than

Why this is important...

- Students must learn how to read and write the inequality symbols.
- Students must learn to read equations correctly from left to right because < and > are two distinct symbols.

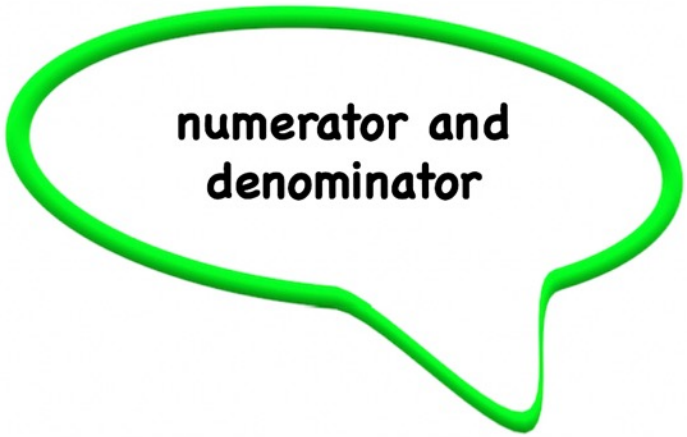
carry OR borrow

regroup OR trade OR exchange

$$\begin{array}{r} 167 \\ +\ 294 \\ \hline \end{array}$$

Why this is important...

- "Carry" or "borrow" is procedural.
- The other terms reinforce the conceptual understanding or regrouping ones into tens, tens into hundreds, and so on (i.e., the total amount does not change) *or* ungrouping hundreds into tens, tens into ones, and so on.



Why this is important...

- Identifying that there are two separate (whole) numbers suggests that whole number properties can be applied to fractions.
- Emphasizing that a fraction is ONE number with ONE magnitude on a number line that is communicated with a numerator and denominator is important.

reduce the fraction

rename OR
find equivalent OR
simplify

Why this is important...

- Reducing suggests that the quantity or magnitude of the new number will be less than the original number.

Four point seven
Four point oh seven

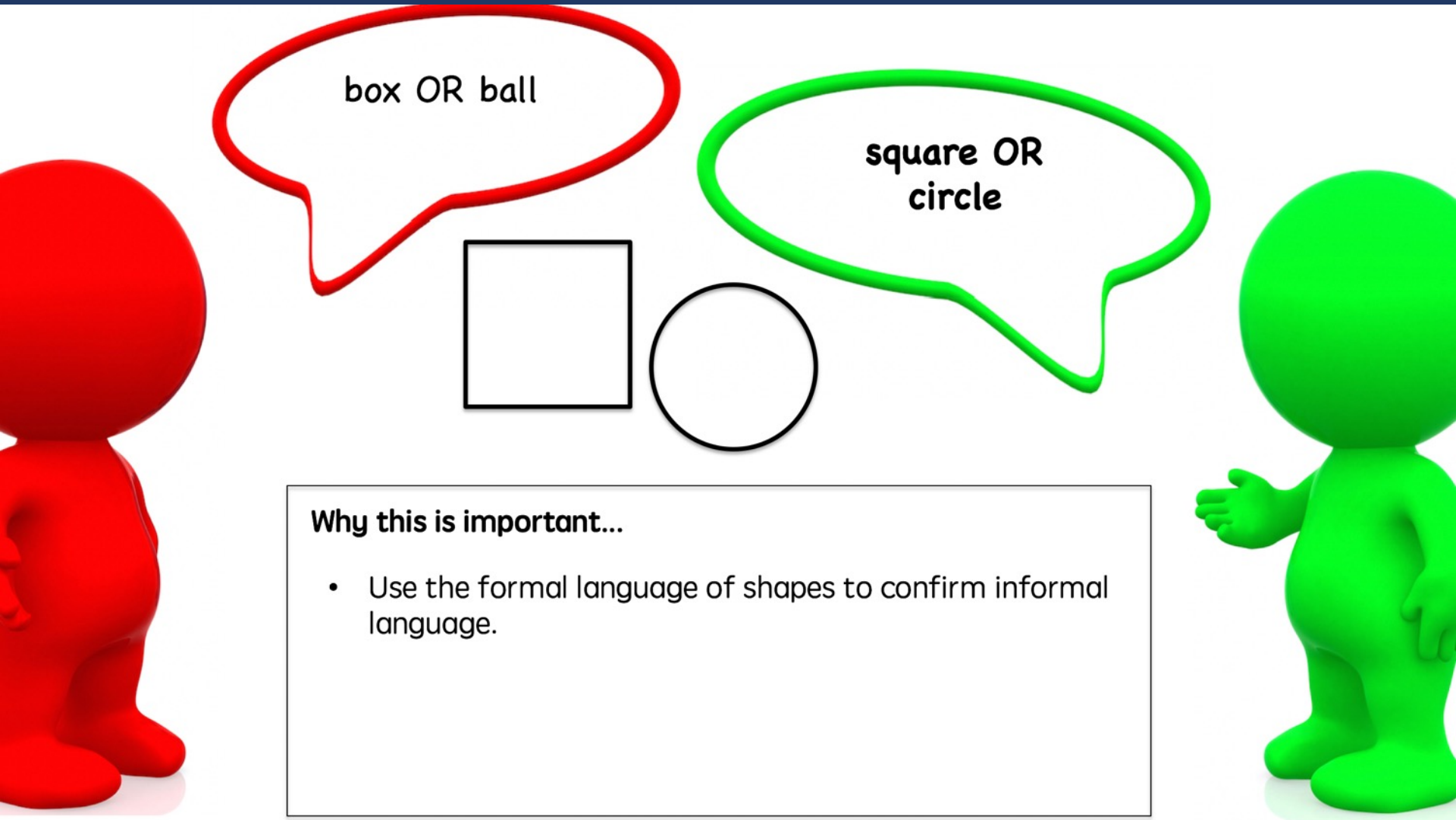
Four and seven tenths
Four and seven hundredths

4.7

4.07

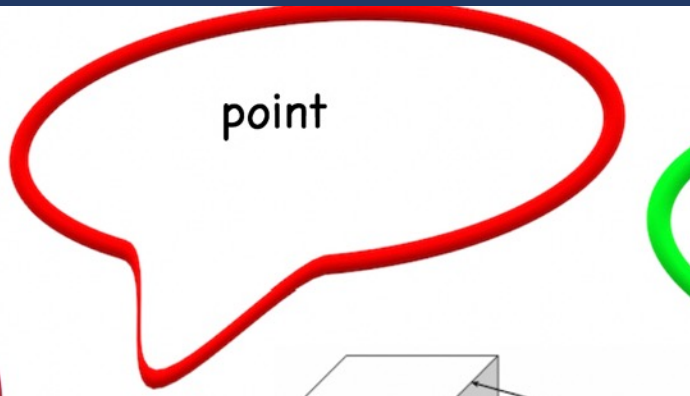
Why this is important...

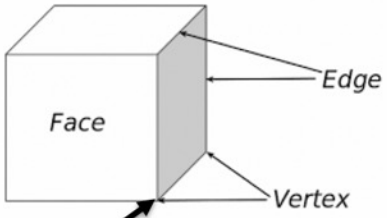
- Accurately shares the magnitude of the decimal.
- Emphasizes place value.



Why this is important...

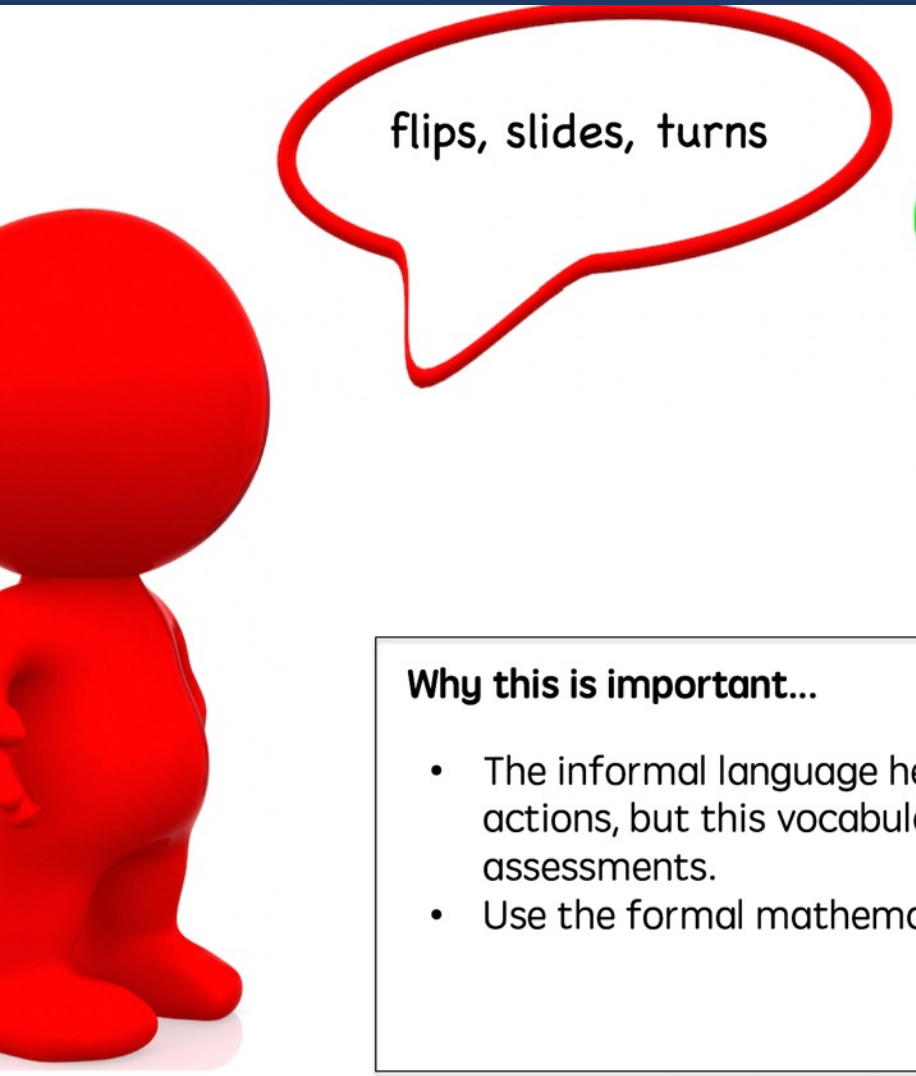
- Use the formal language of shapes to confirm informal language.

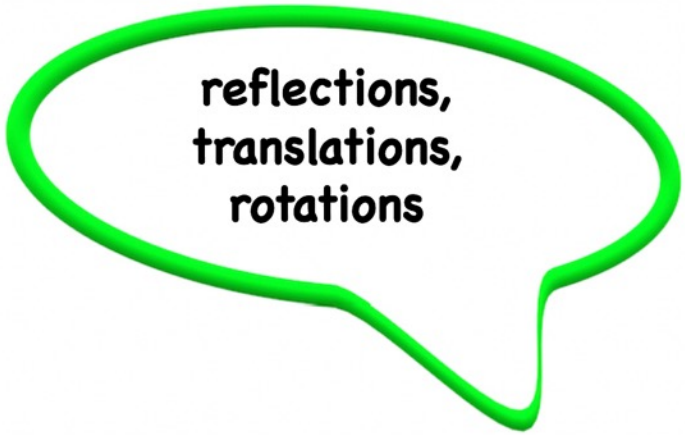




Why this is important...

- This is the endpoint where two or more line segments or rays meet.





Why this is important...

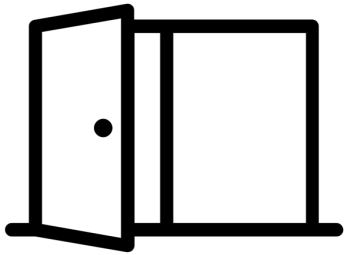
- The informal language helps children remember the actions, but this vocabulary is not used on assessments.
- Use the formal mathematical terms.

Why this is important...

- The informal language describes the length of clock hands but not the meaning.
- Help students understand the hours and minutes.

Mathematical Language

Instead of that...	Say this...



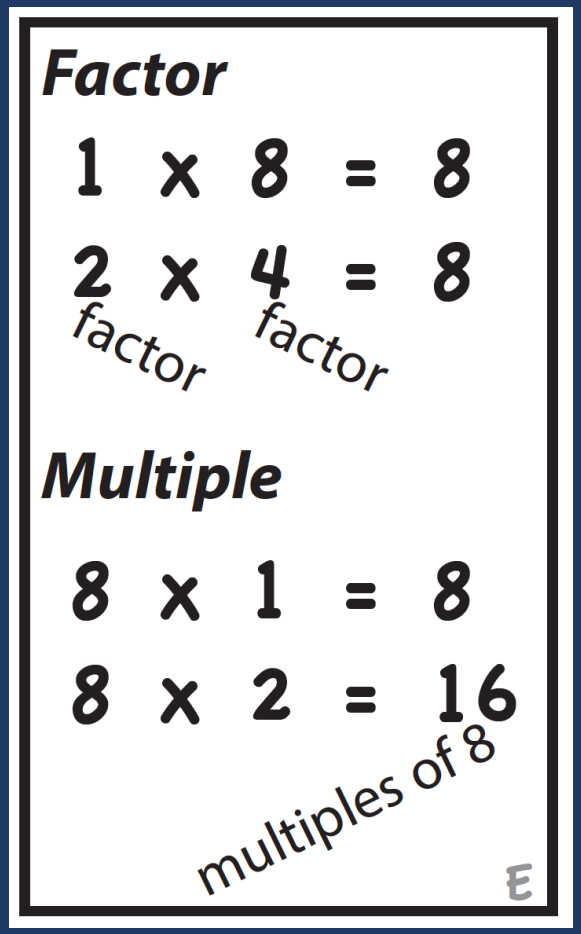
Identify examples of "Instead of ____, say ____."

Use formal math language

Use terms precisely

Use Terms With Precision

Strategies for Teaching Mathematics Language



Improper fraction

$$\frac{8}{5}$$

Proportion

$$\frac{2}{5} = \frac{8}{20}$$

Mixed number

$$1\frac{3}{5}$$

Ratio

4:3

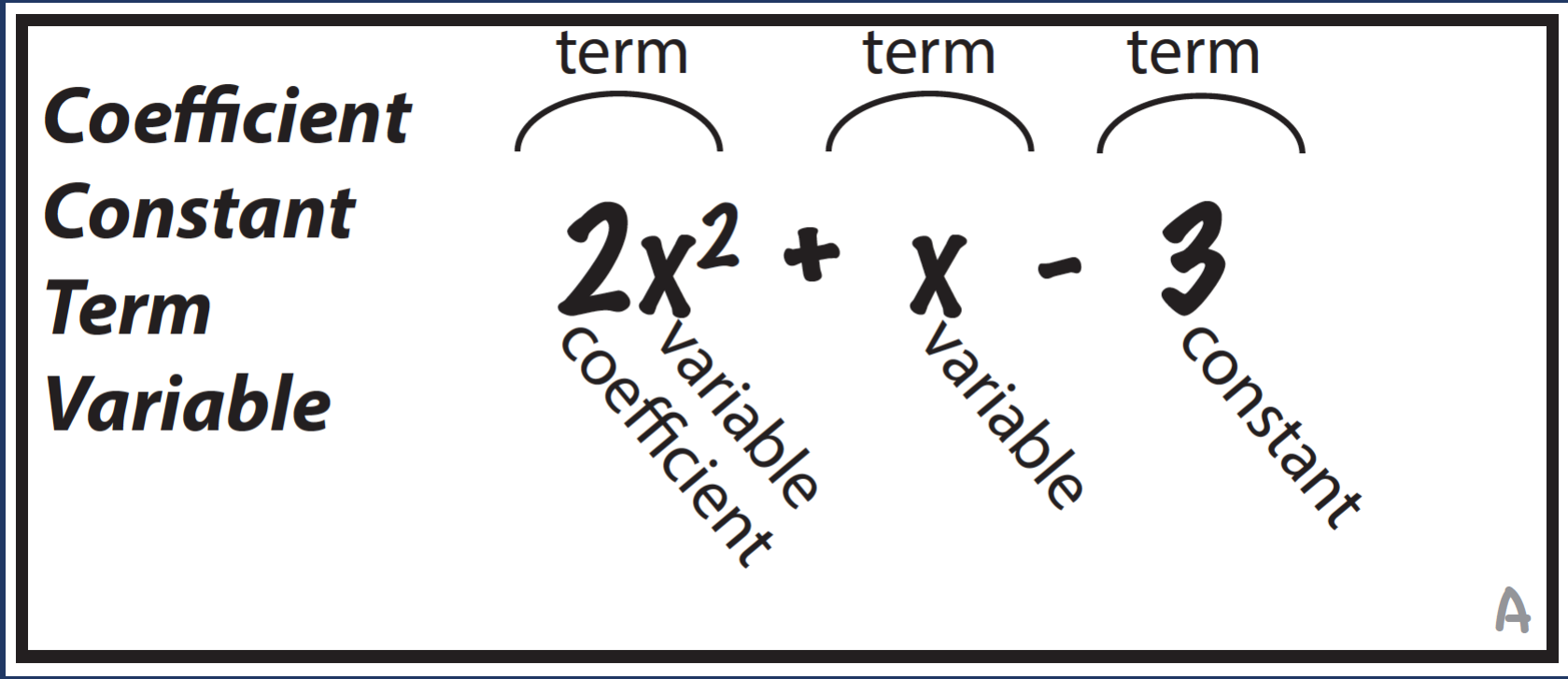
Proper fraction

$$\frac{2}{9}$$

Unit fraction

$$\frac{1}{6}$$

D

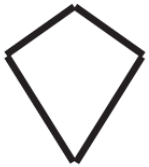


Equation	$9x - 4 = 7x$
Expression	$9x - 4$
Formula	$a^2 + b^2 = c^2$
Function	$f(x)$
Inequality	$9x - 4 > 6x$

C

Quadrilaterals

Kite



Rhombus

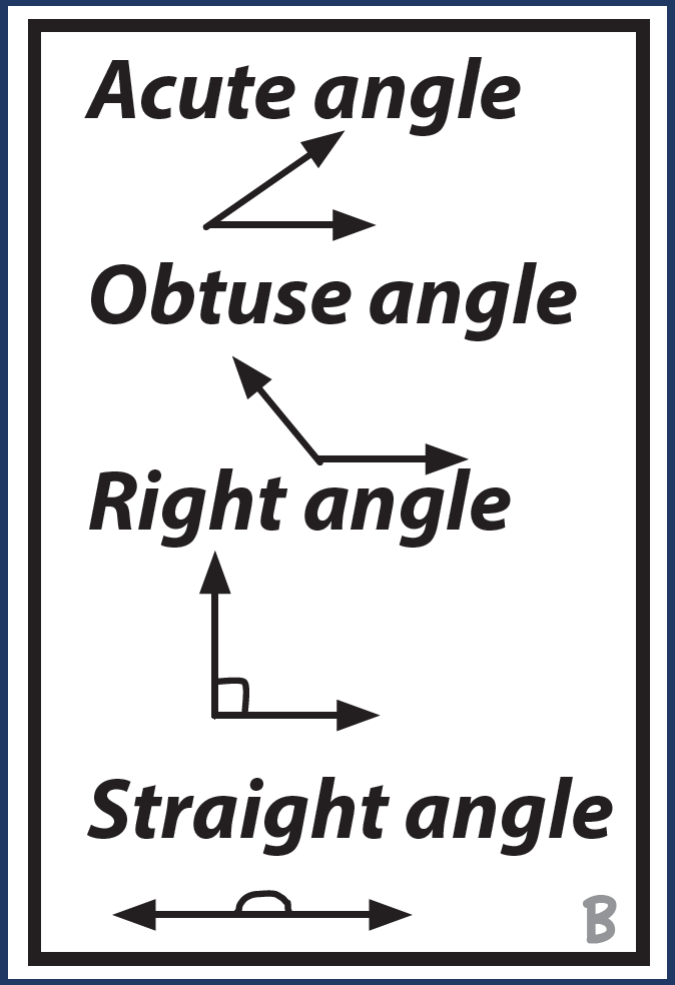
Parallelogram

Square

Rectangle

Trapezoid

A



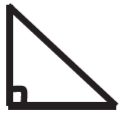
Acute triangle

Equilateral triangle

Obtuse triangle

Isosceles triangle

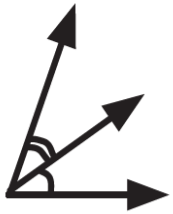
Right triangle



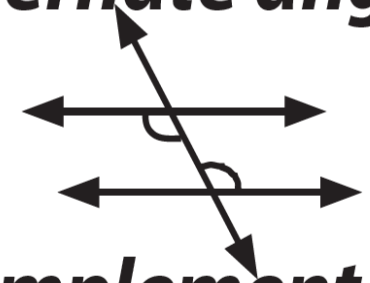
Scalene triangle

C

Adjacent angles

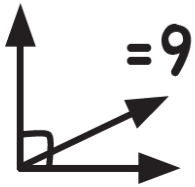


Alternate angles

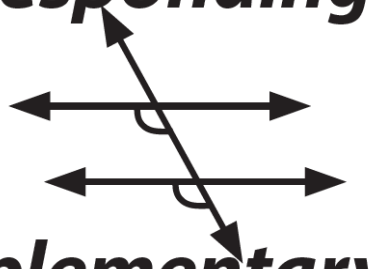


Complementary angles

=90°



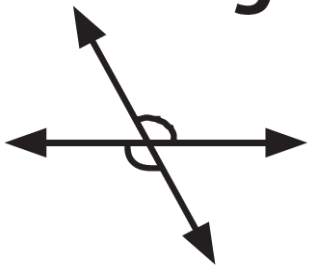
Corresponding angles



Supplementary angles

=180°

Vertical angles

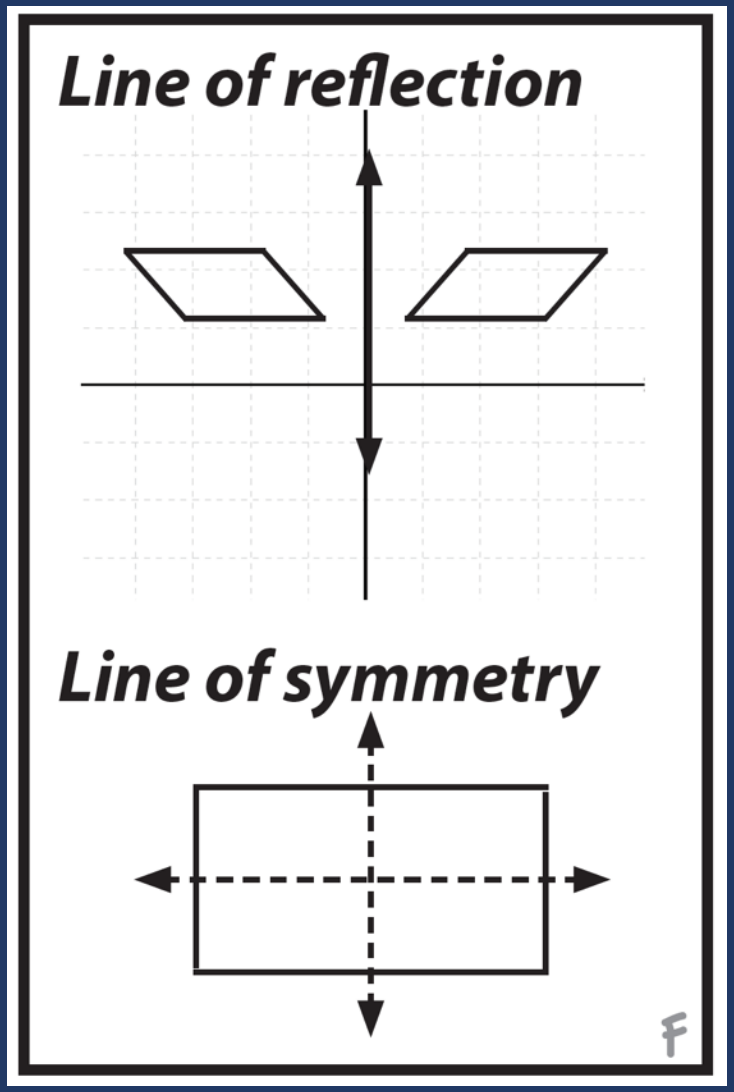


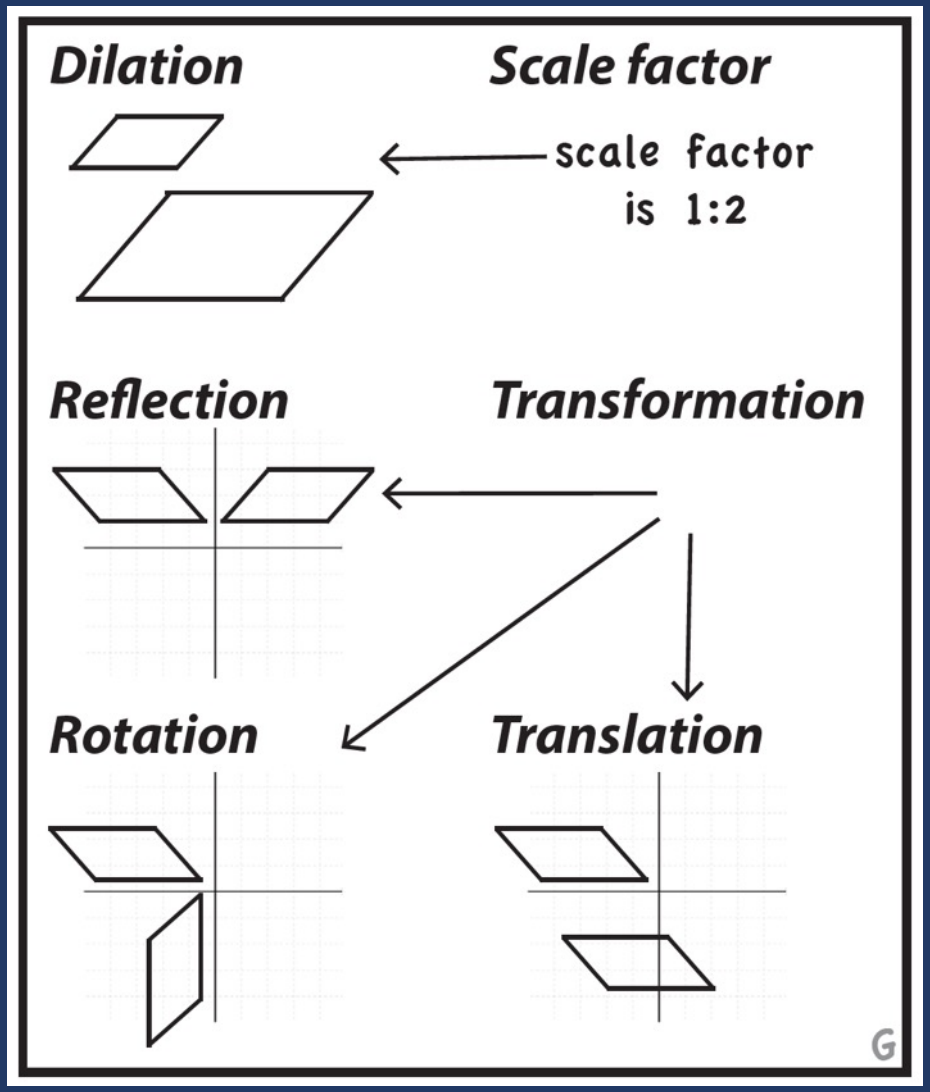
D

Congruent figures

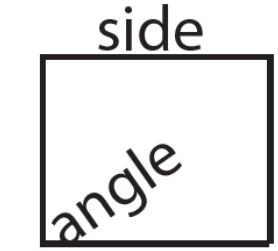
Similar figures

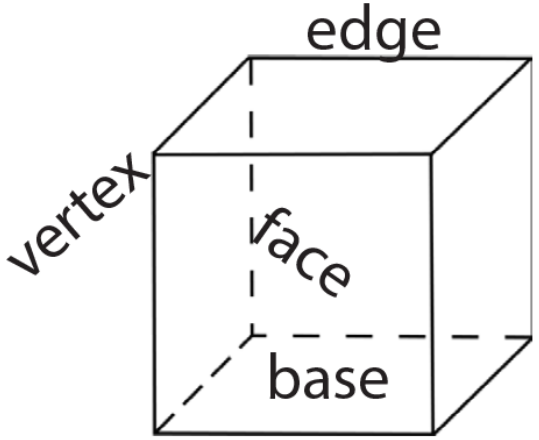
E

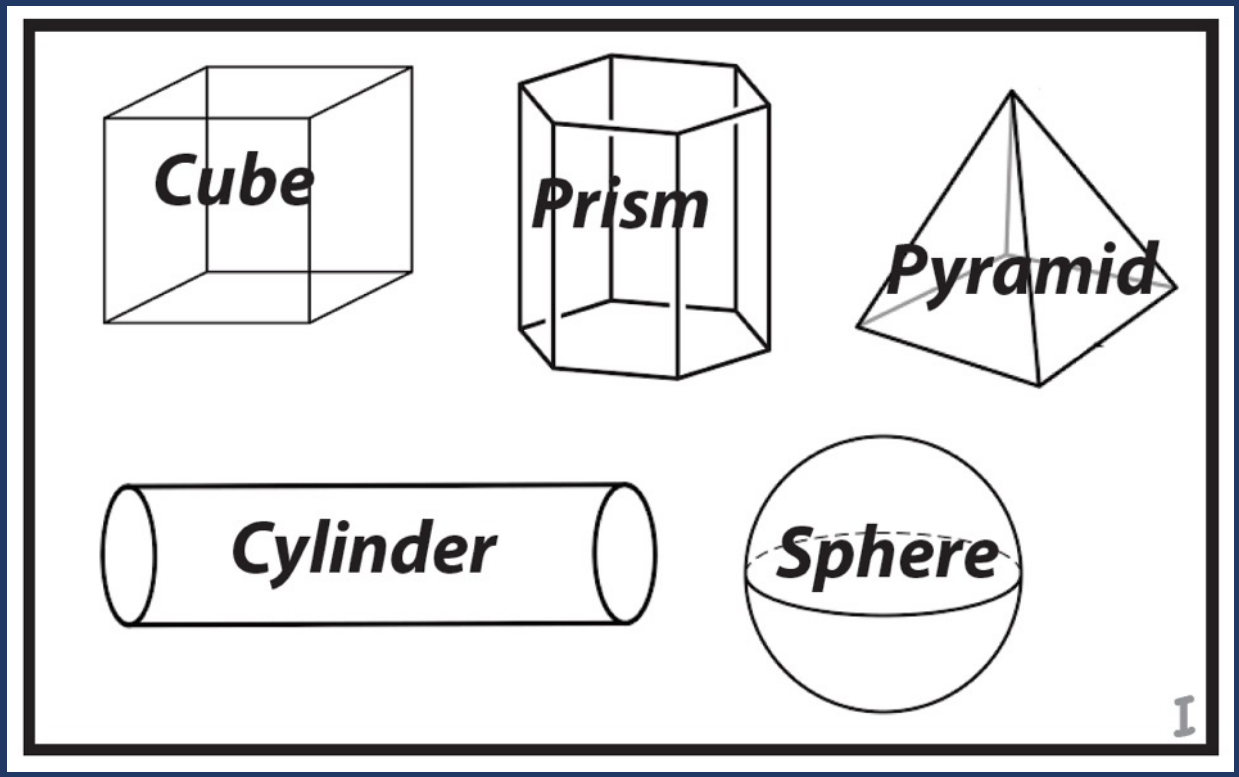




Angle
Base
Edge
Face
Side
Vertex







Coordinate plane

Ordered pair

Quadrants

x

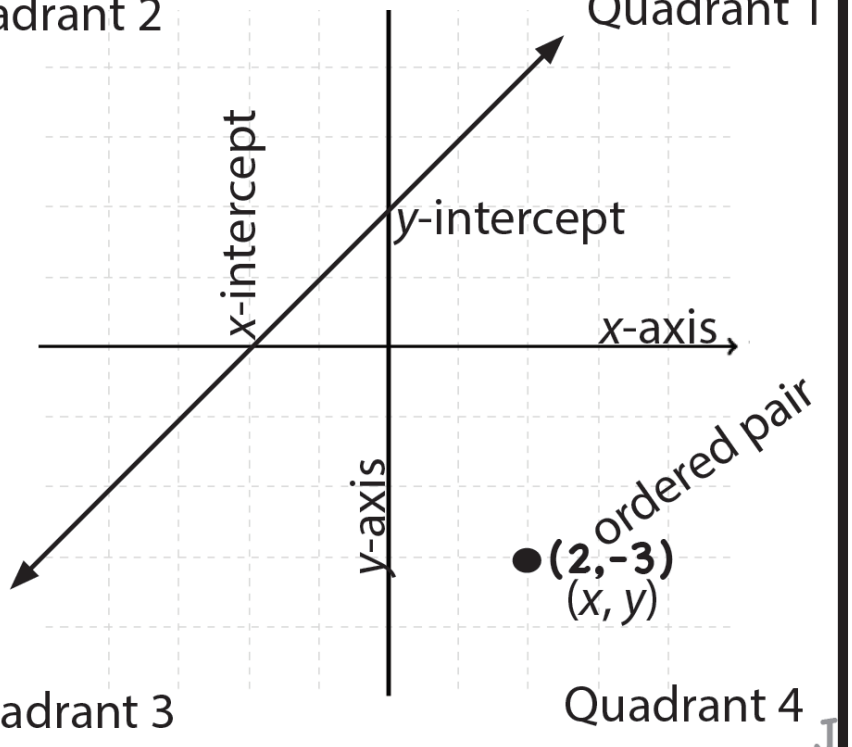
x-axis

x-intercept

y

y-axis

y-intercept



Use Terms With Precision

Strategies for Teaching Mathematics Language

Discuss terms you want your students to use with precision.

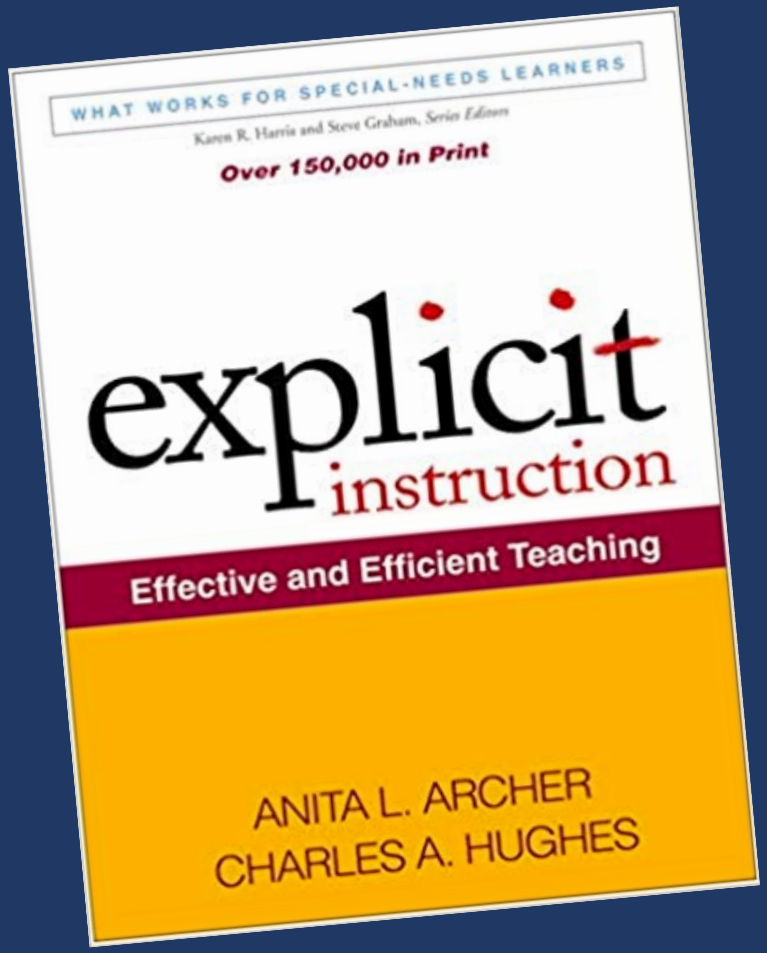
Use formal math language

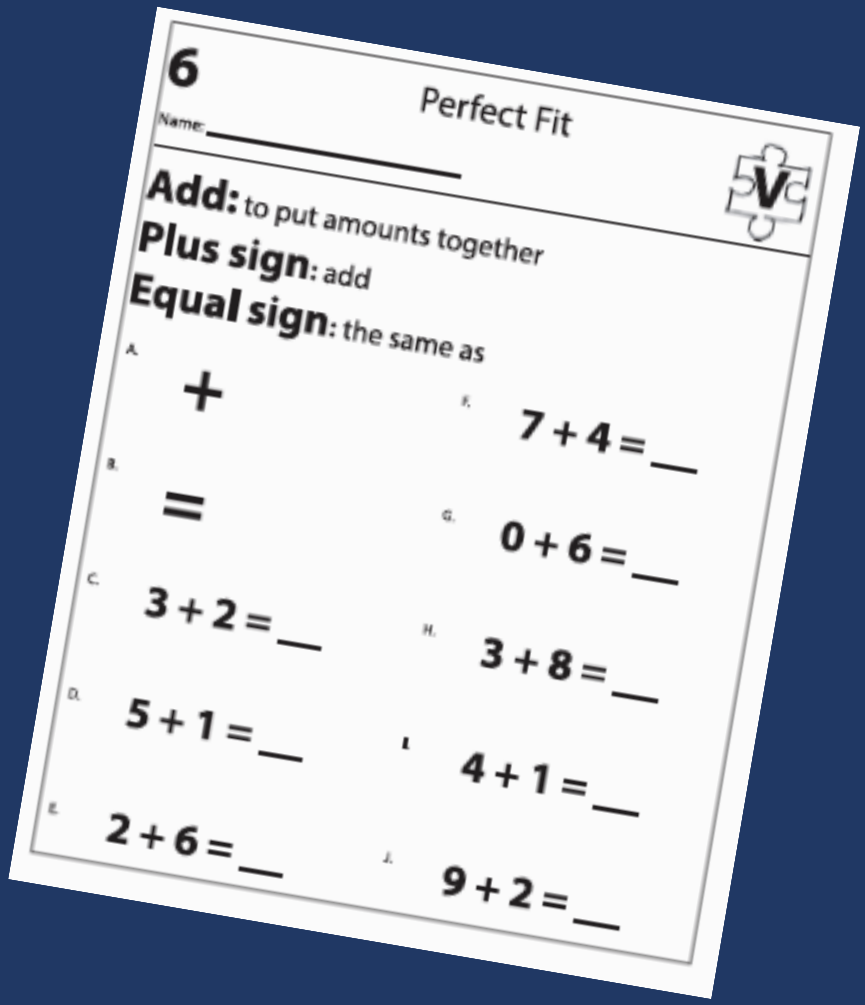
Use terms precisely

Use Terms With Precision

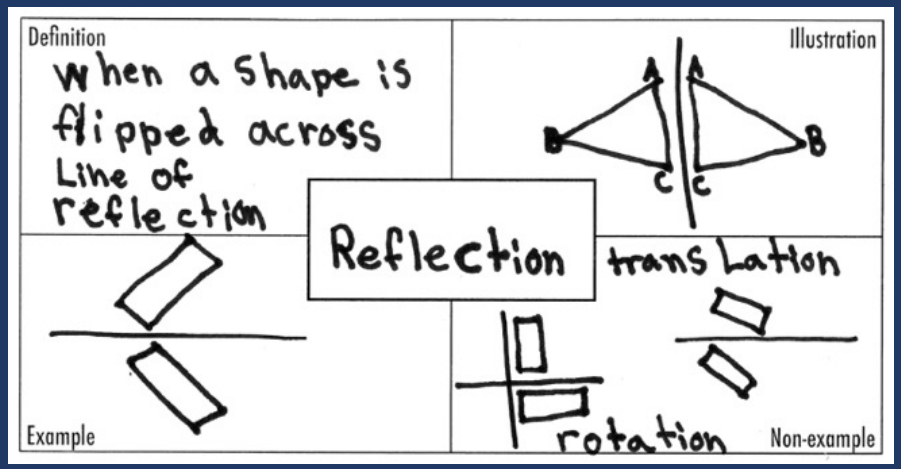
Strategies for Teaching Mathematics Language

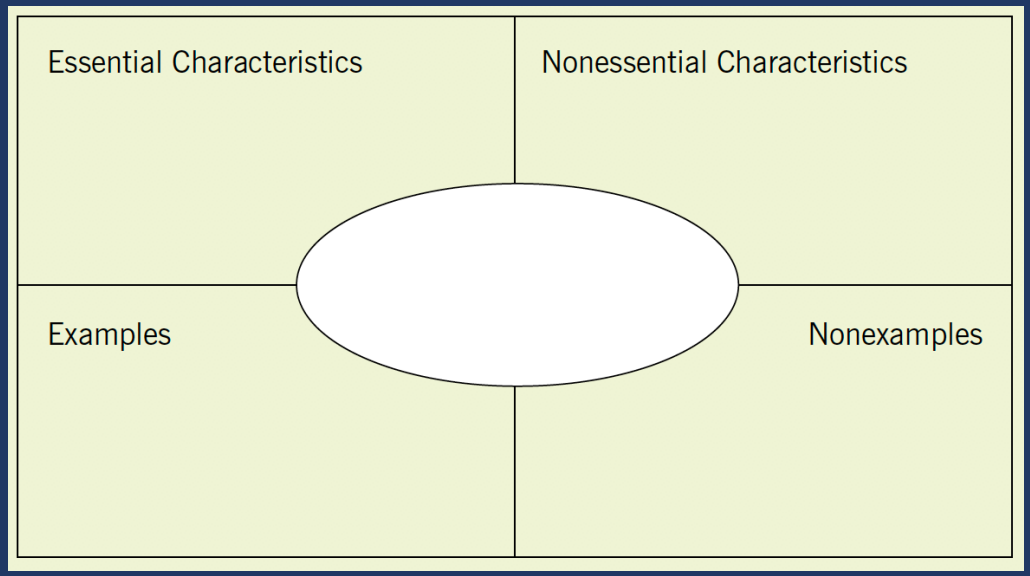
1. Use explicit instruction





2. Use graphic organizers





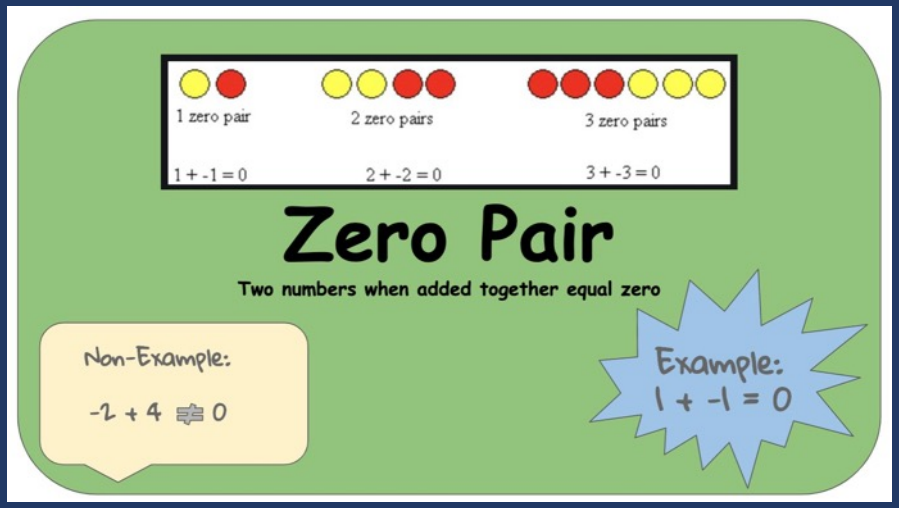
Dunston & Tyminski (2013)

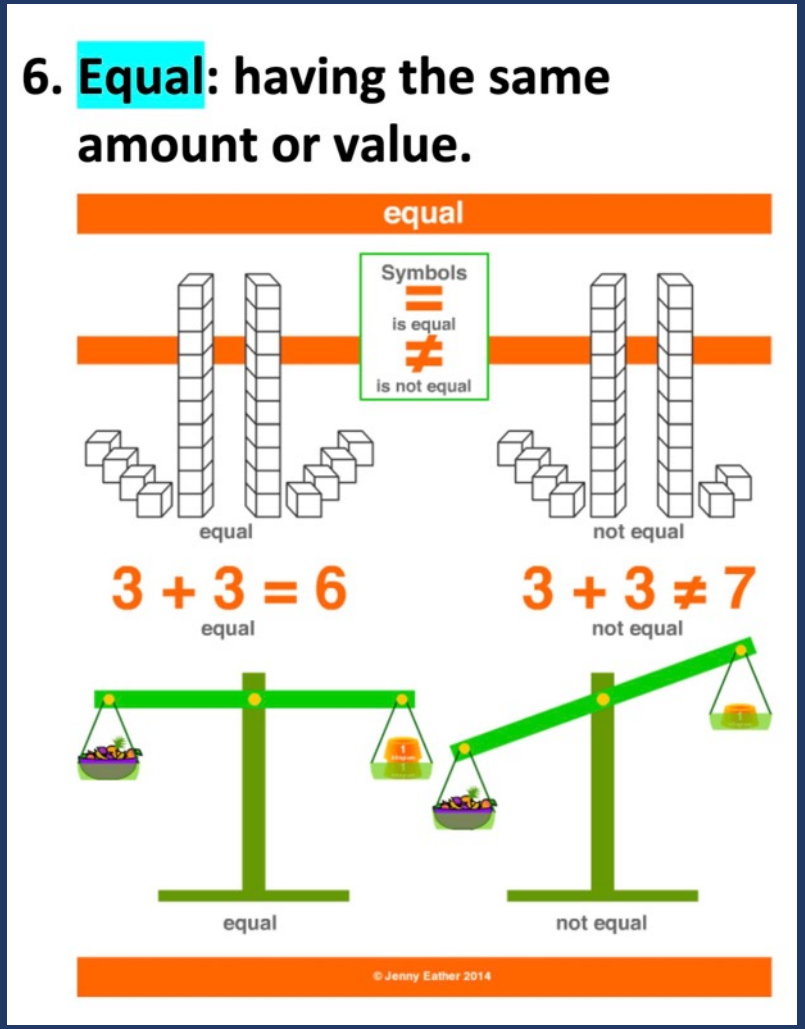
2. Use graphic organizers

Word	Lightbulb Word
Definition	Picture

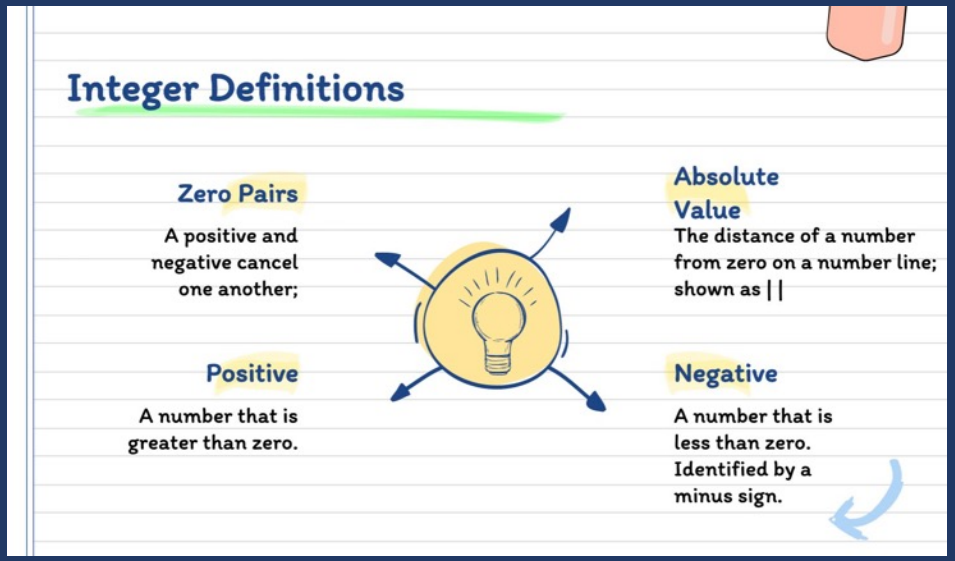
Dunston & Tyminski (2013)

3. Have students create vocabulary cards





4. Have students create glossaries



Numerator: how many parts of the whole

- Ex. $\frac{4}{10}$

Odd number: a number not divided evenly by 2

- Ex. 1, 3, 5, 7, 9....

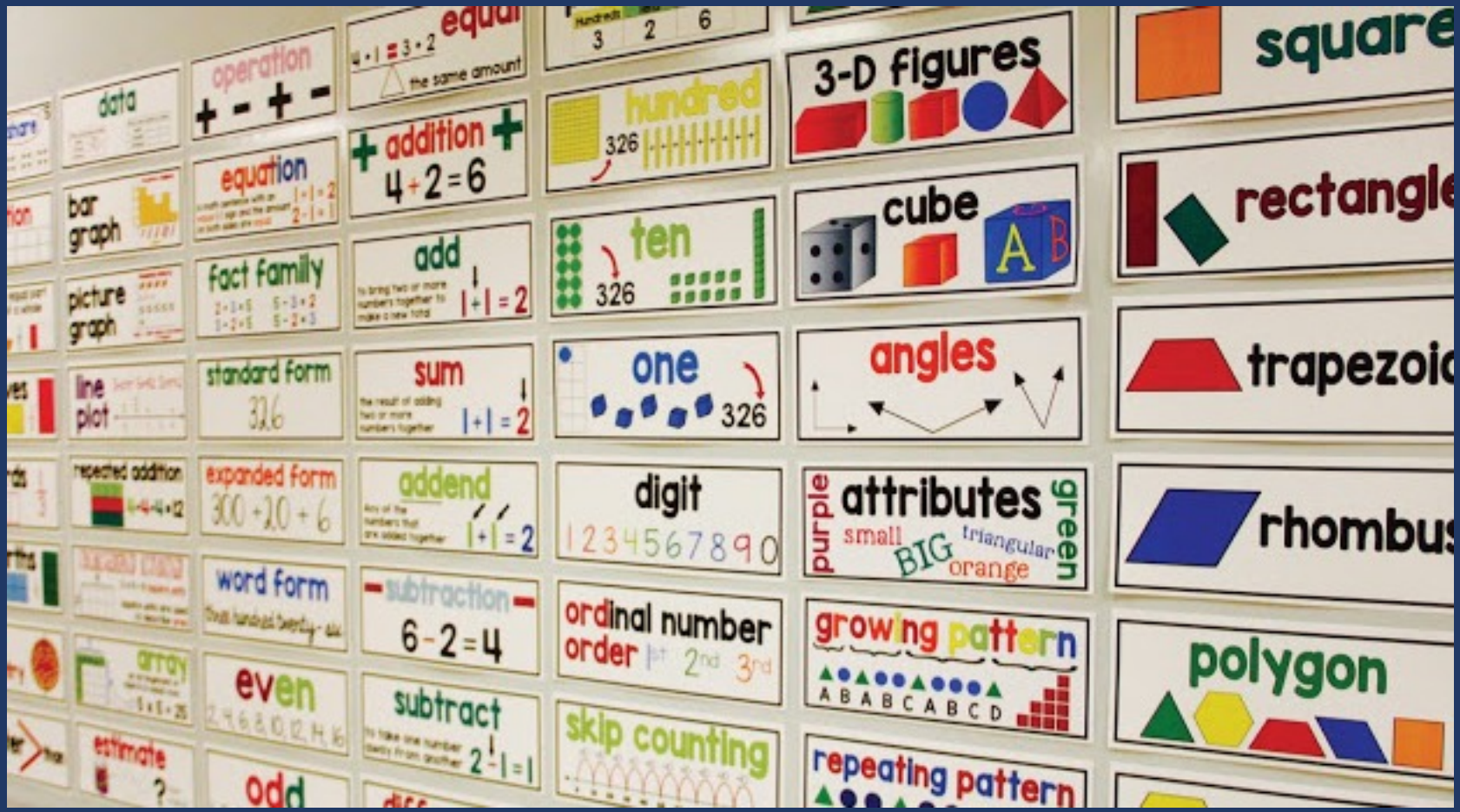
Percent: a specific number in comparison to 100

- 74%

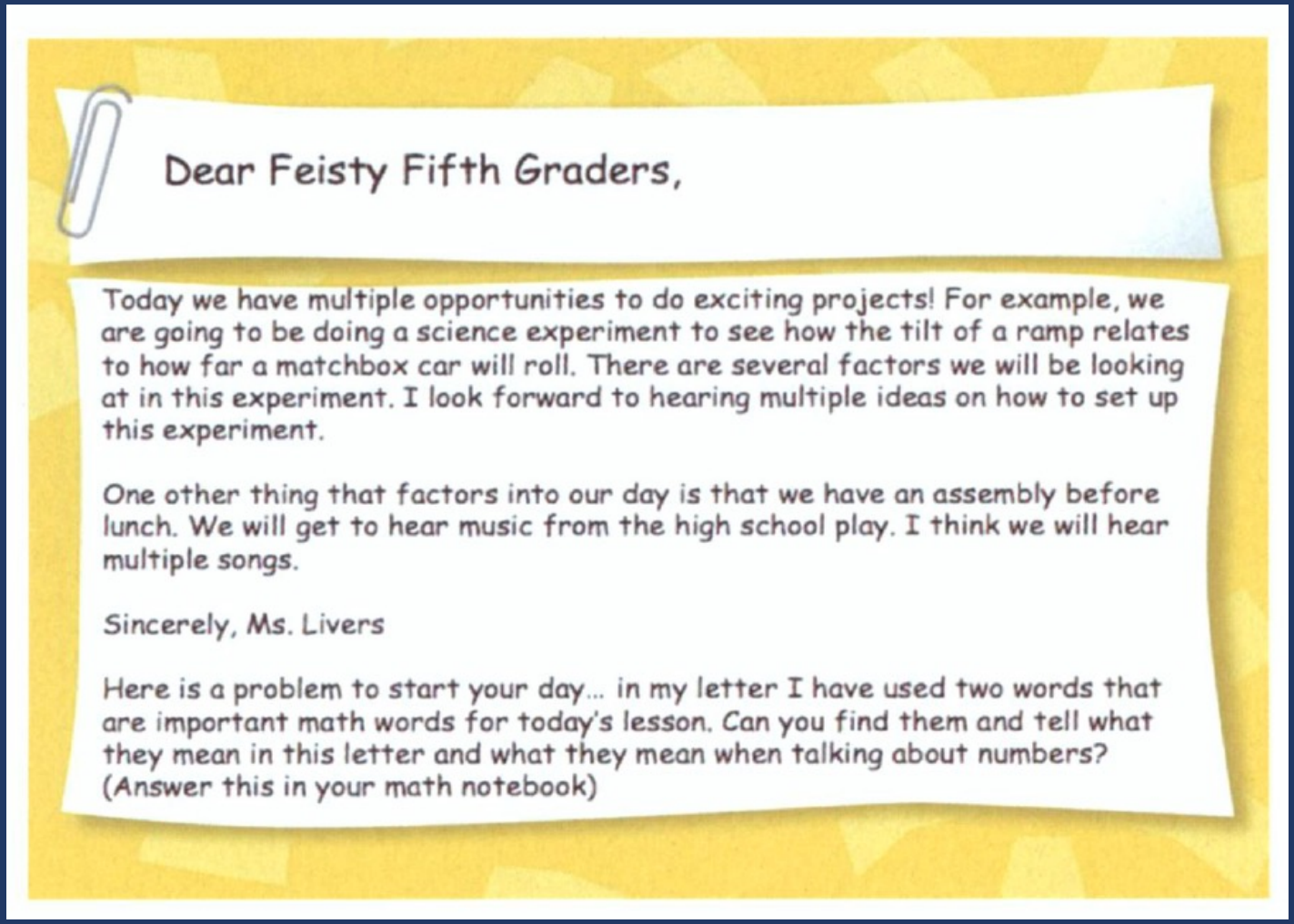
Polygon: any enclosed shape that is made up of 3 or more straight lines

- Ex. 

5. Create a word wall



6. Preview vocabulary



Dear Feisty Fifth Graders,

Today we have multiple opportunities to do exciting projects! For example, we are going to be doing a science experiment to see how the tilt of a ramp relates to how far a matchbox car will roll. There are several factors we will be looking at in this experiment. I look forward to hearing multiple ideas on how to set up this experiment.

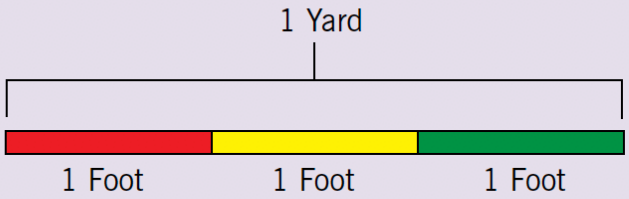
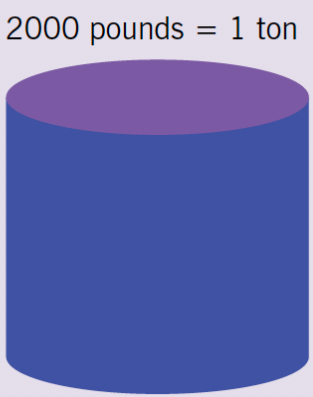
One other thing that factors into our day is that we have an assembly before lunch. We will get to hear music from the high school play. I think we will hear multiple songs.

Sincerely, Ms. Livers

Here is a problem to start your day... in my letter I have used two words that are important math words for today's lesson. Can you find them and tell what they mean in this letter and what they mean when talking about numbers? (Answer this in your math notebook)

Bay-Williams & Livers (2009)

7. Cluster vocabulary

	Length	Weight
Meaning	How long something is	How heavy something is
Visual		

Livers & Bay-Williams (2014)

7. Cluster vocabulary

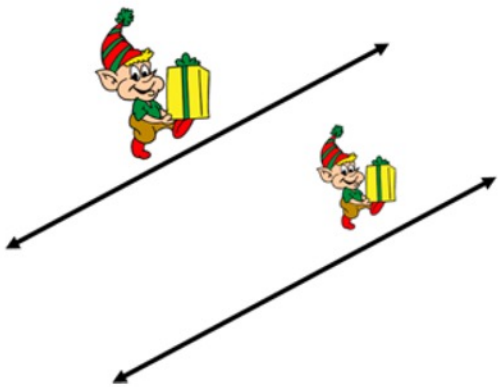
Rating	Word	Definition	Synonym(s)	Example	Sample Problem
2	expression	a mathematical phrase combining operations, numbers and/or variables.	phrase algebraic expression	6 6n 6+n (no equal sign)	Lucia earns $8 per hour for babysitting and gets a $5 tip. Write an expression to represent the amount she would earn if she worked for x hours.
2	variable	a quantity that can change or take many values. (refers to the letter or symbol representing the quantity)	unknown	x D y T	The variable x represents the number of hours Charlie works in a week. Write an expression to represent his earnings if he earns $9 per hour.
1	product	the result when two or more numbers are multiplied	total answer	3 x 2 = (6) ↑ product	The product of 6 and a number is 24. What is the number?
3	quotient	the result of a division (refers to the number of times the divisor divides the dividend)	answer	18 ÷ 2 = (9) (9) ← quotient 2⟌18	Estimate the quotient when 365 is divided by 12.

Marin (2018)

8. Use mnemonics

Parallel Lines (Pair of Elves)

Lines that are the same distance apart and will never intersect



The Pair of Elves are the same distance apart and will never intersect.

The Pair of Elves are on Parallel Lines

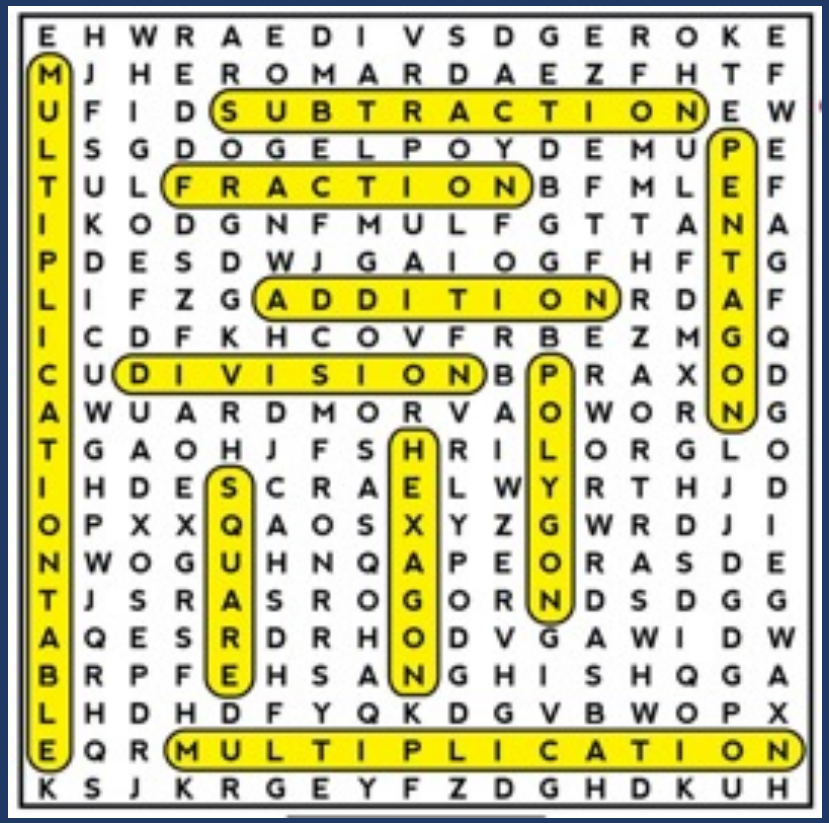
Ray (Run Away)

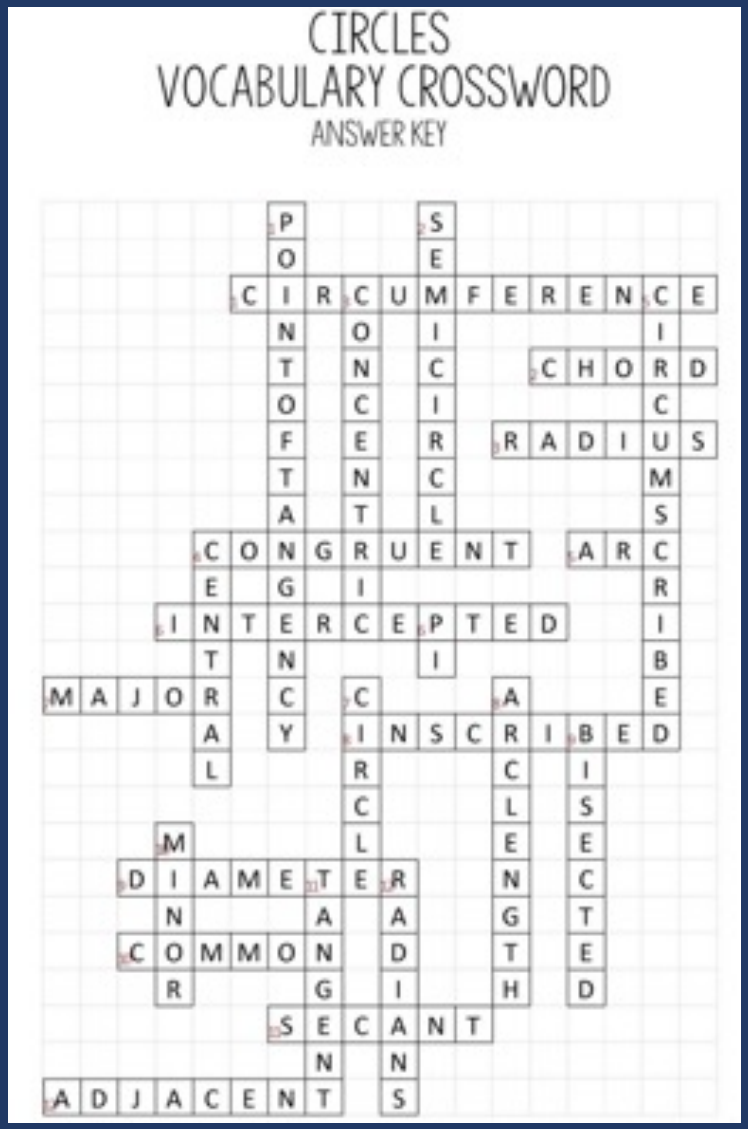
A line that has a starting point but no endpoint

Start here!! Run away and never stop running Ray.

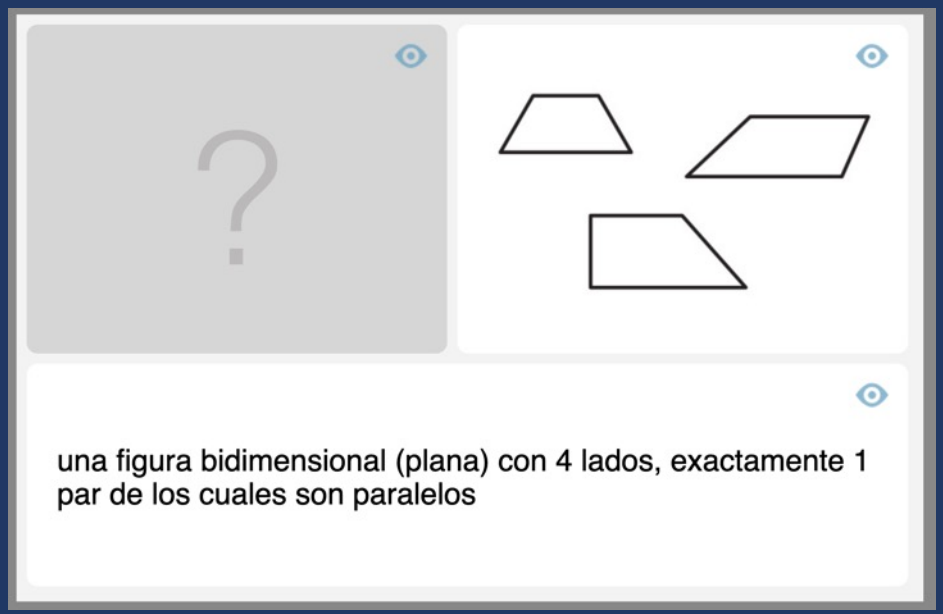
Riccomini et al. (2015)

9. Do word games





10. Use technology



Math Learning Center

Math Lingo

Use Terms With Precision

Strategies for Teaching Mathematics Language

Discuss your strategy for focusing on mathematical language in your teaching.

Increase the fact fluency of your students

Increase the computational fluency of your students

Increase the focus on mathematics vocabulary

Sarah R. Powell, Ph.D.

Associate Professor
The University of Texas at Austin

www.sarahpowellphd.com

srpowell@utexas.edu

@sarahpowellphd