# Best Practices in Math: Math Language and Fluency

(Grades 6-8)




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Say hello.

Describe your role as an educator and the mathematics you support.

# Schedule for This Year

| | |
|---|---|
| December 2022 | Best Practices in Math:<br>Math Language and Fluency |
| January 24, 2023 | Best Practices in Math:<br>Modeling and Practice<br>Word-Problem Solving |
| TBD | Best Practices in Math:<br>Use of Multiple Representations |

# Instructional Platform

## INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

Multiple representations

## INSTRUCTIONAL STRATEGIES

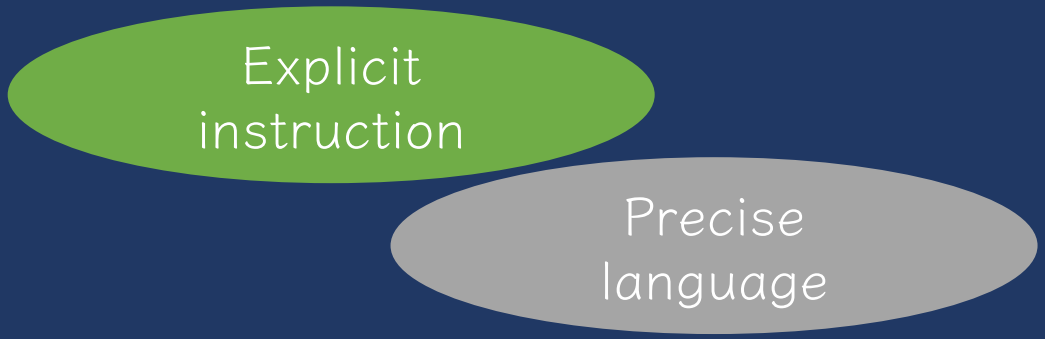
Fluency building

Problem solving instruction

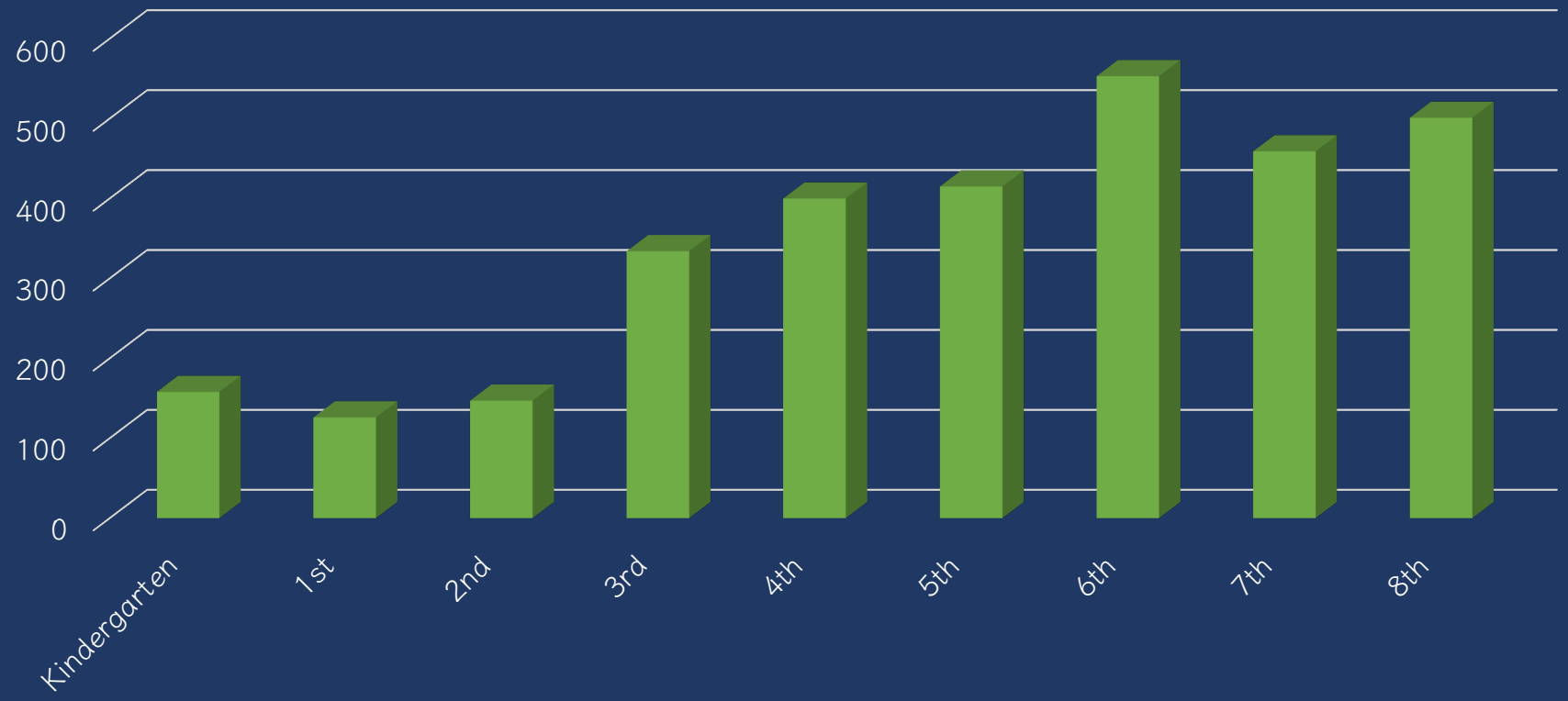
# Mathematical Language

# Instructional Platform

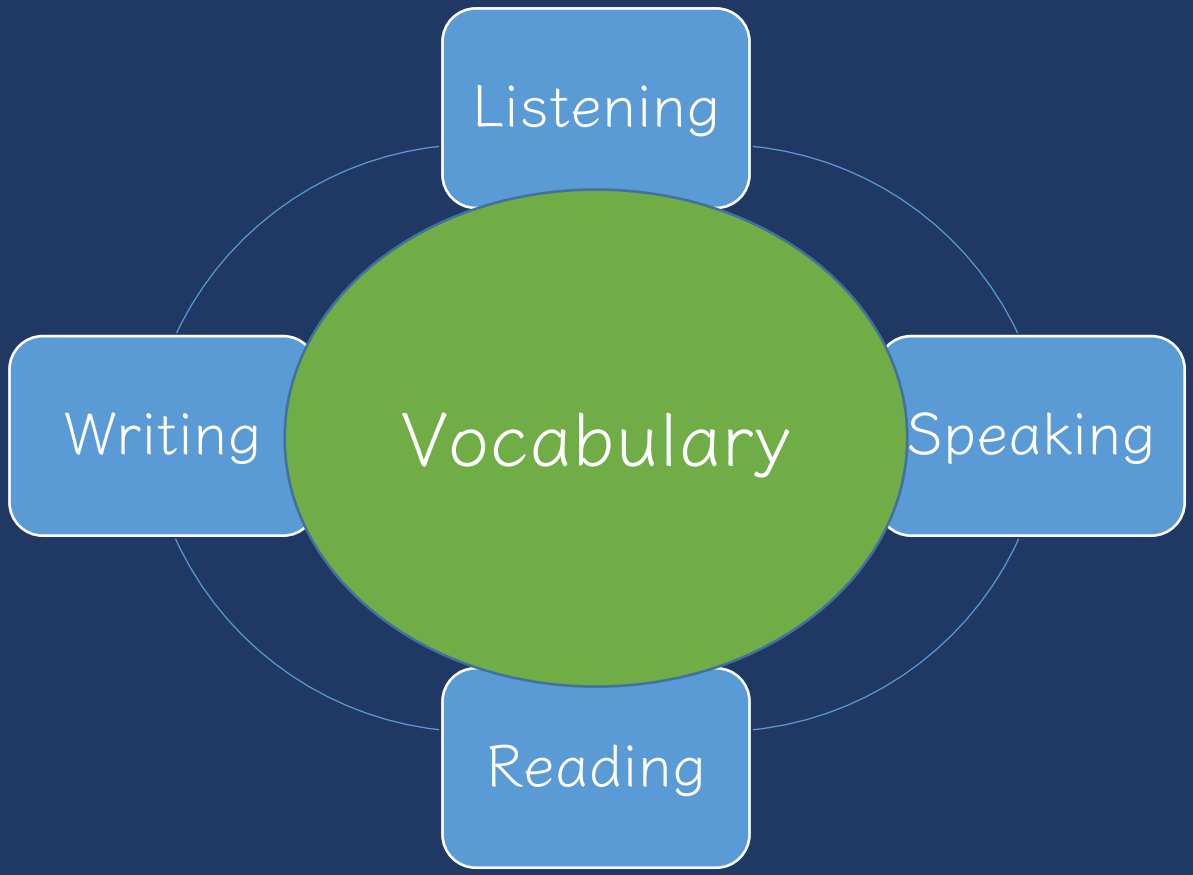
## INSTRUCTIONAL DELIVERY




## INSTRUCTIONAL STRATEGIES




Powell, Bos, & Lin (2019)



# Best Practices in Math:

## Mathematics Language and Fluency

## Grades 6-8

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### Difficulties with Mathematics Vocabulary

### Use Formal Mathematics Language

| Instead of that… | Say this… |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# 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)

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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)

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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)

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7. Some math terms are related but have distinct meanings

factor vs. multiple

hundreds vs. hundredths

numerators vs. denominator

Rubenstein & Thompson (2002)

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

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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)

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9. English spelling and usage may have irregularities

four vs. forty

Rubenstein & Thompson (2002)

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7. Some math terms are related but have distinct meanings

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

skip count vs. multiples

9. English spelling and usage may have irregularities

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

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

What are the ways you see your students experience difficulty with the vocabulary of math?

# Best Practices in Math:

## Mathematics Language and Fluency

## Grades 6-8

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### Use Formal Mathematics Language

| Instead of that… | Say this… |
|---|---|
| | |
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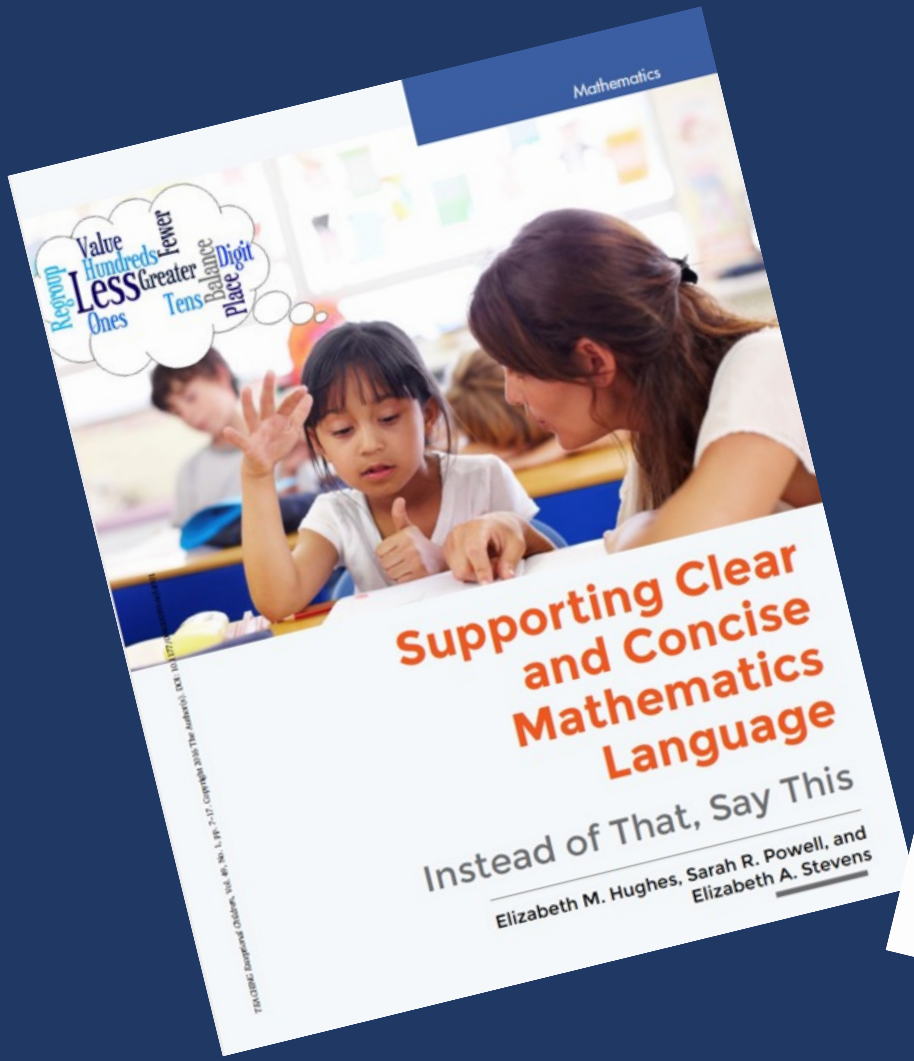
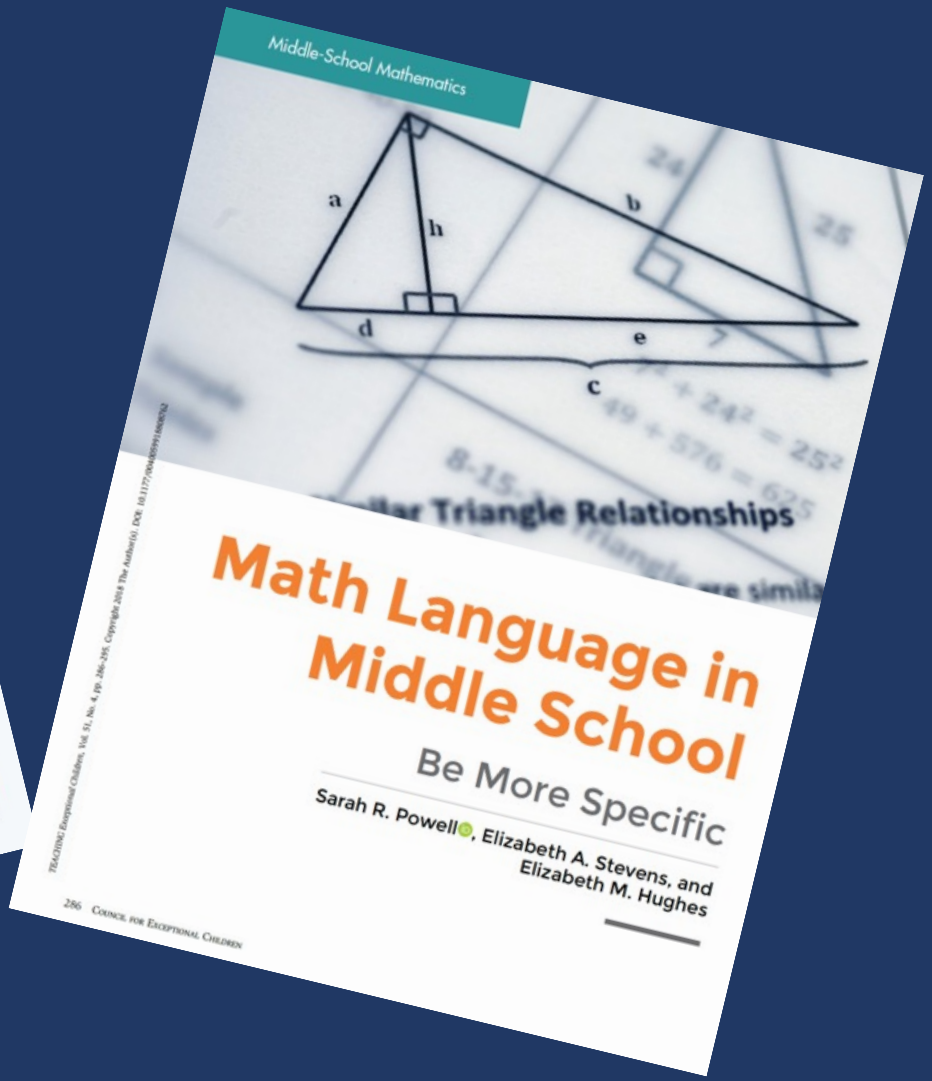
| | |

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...**

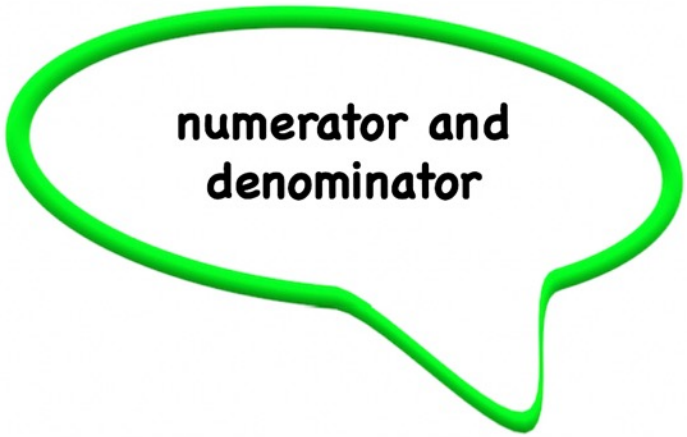
- Students must learn how to read and write the inequality symbols.
- Students must learn to read equations correctly from left to right because < and > are two distinct symbols.



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

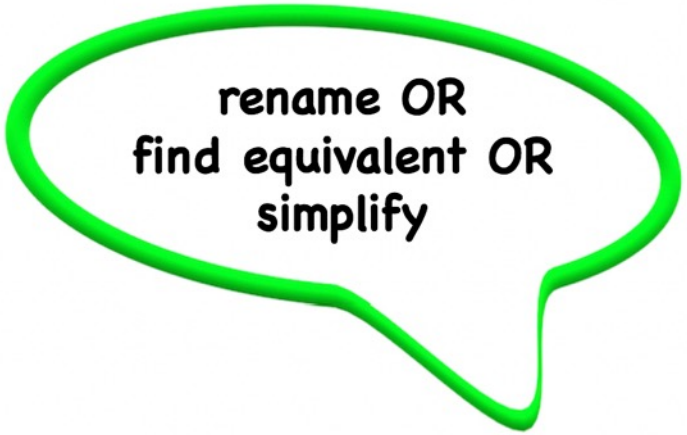
**Why this is important...**

- "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.

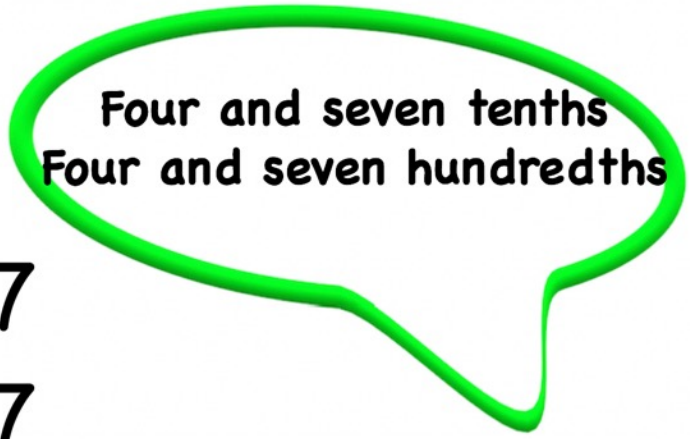

**Why this is important...**

- 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.


**Why this is important...**

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


4.7

4.07

**Why this is important...**

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

box OR ball

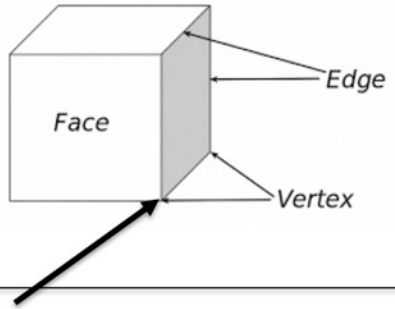
square OR circle

**Why this is important...**

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

point

vertex




**Why this is important...**

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

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|---|---|
| | |
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| | |
| | |

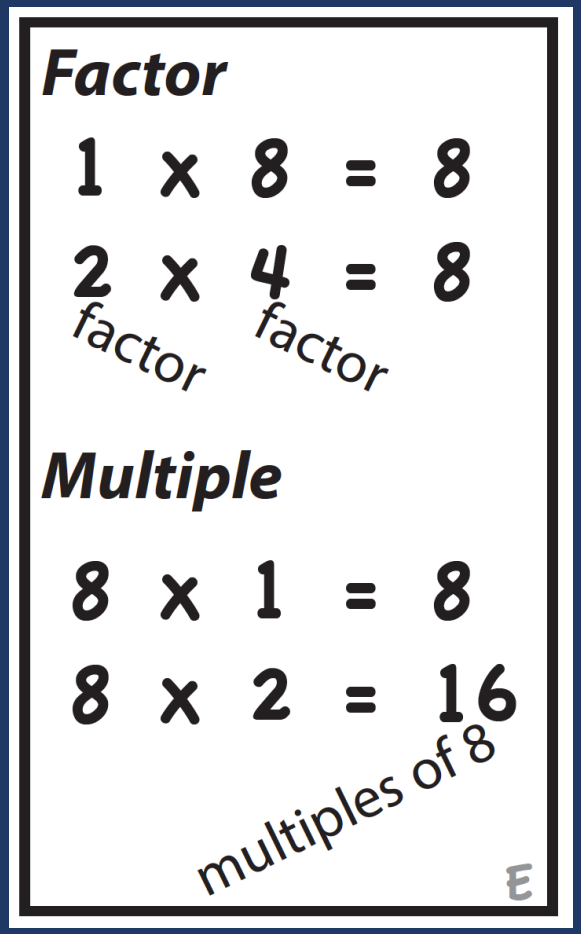
Identify examples of "Instead of ____, say ____."

Use formal math language

Use terms precisely

Use Mathematics Vocabulary 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

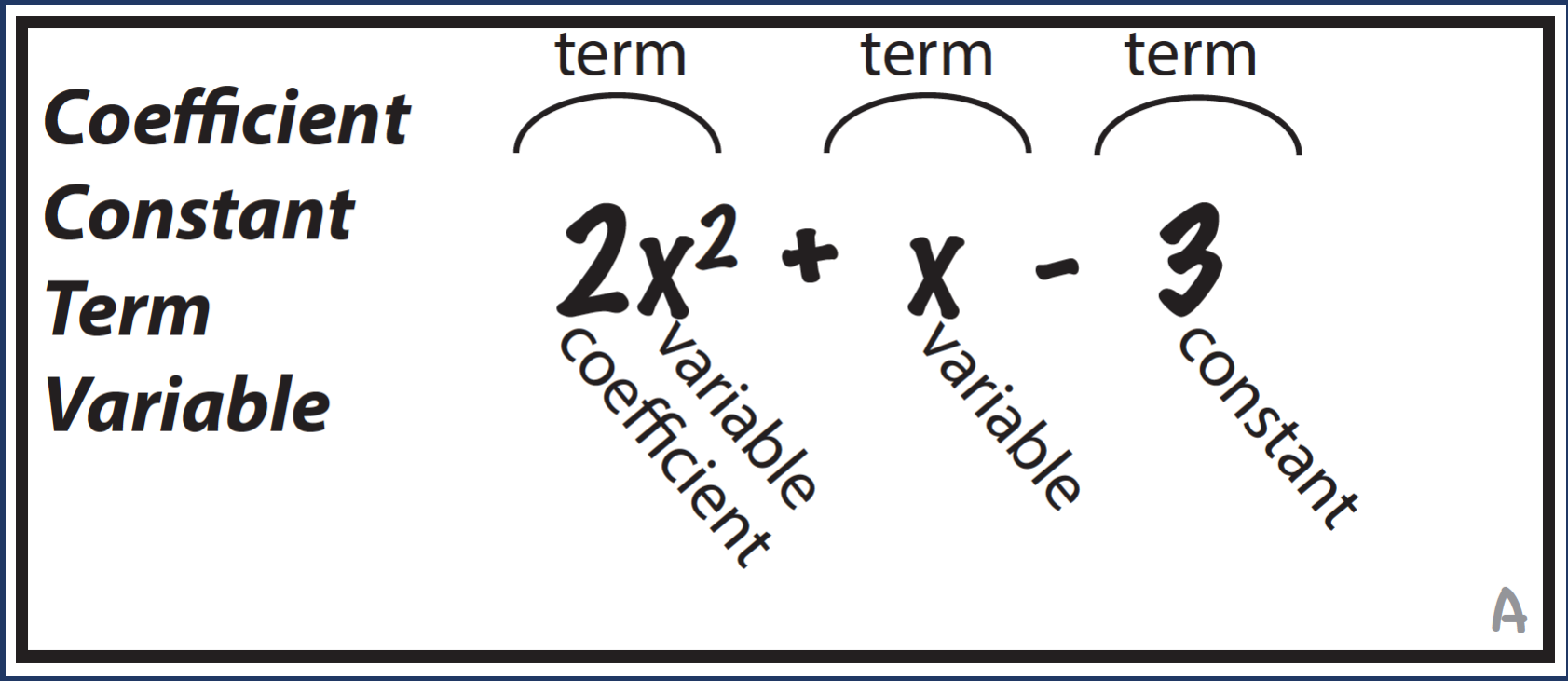
***Proper fraction***

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

***Unit fraction***

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

D

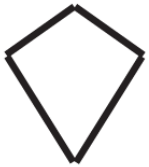


| | |
|---|---|
| *Equation* | $9x - 4 = 7x$ |
| *Expression* | $9x - 4$ |
| *Formula* | $a^2 + b^2 = c^2$ |
| *Function* | $f(x)$ |
| *Inequality* | $9x - 4 > 6x$ |

C

# Quadrilaterals

**Kite**



**Rhombus**

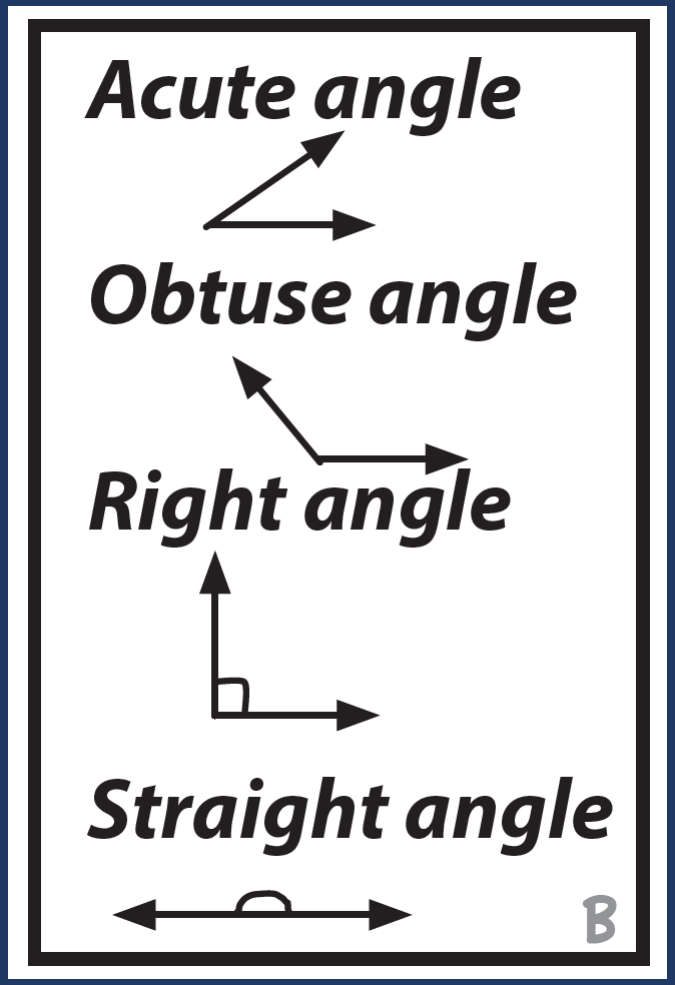
**Parallelogram**

**Square**

**Rectangle**

**Trapezoid**

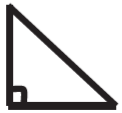
A



**Acute triangle**

**Obtuse triangle**

**Right triangle**



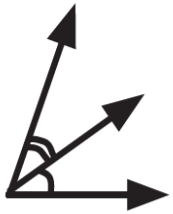
**Equilateral triangle**

**Isosceles triangle**

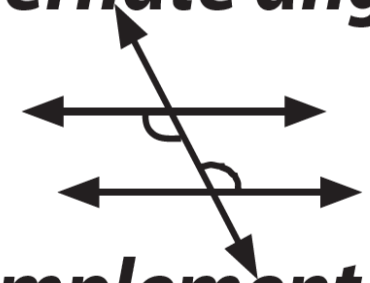
**Scalene triangle**

C

## Adjacent angles

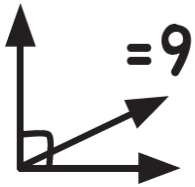


## Alternate angles

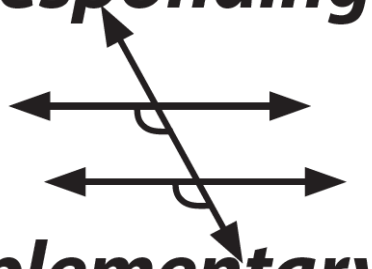


## Complementary angles

=90°



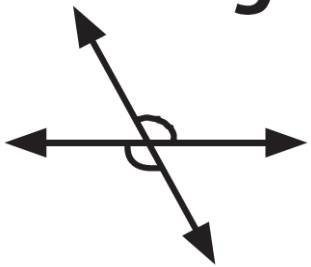
## Corresponding angles



## Supplementary angles

=180°

## Vertical angles

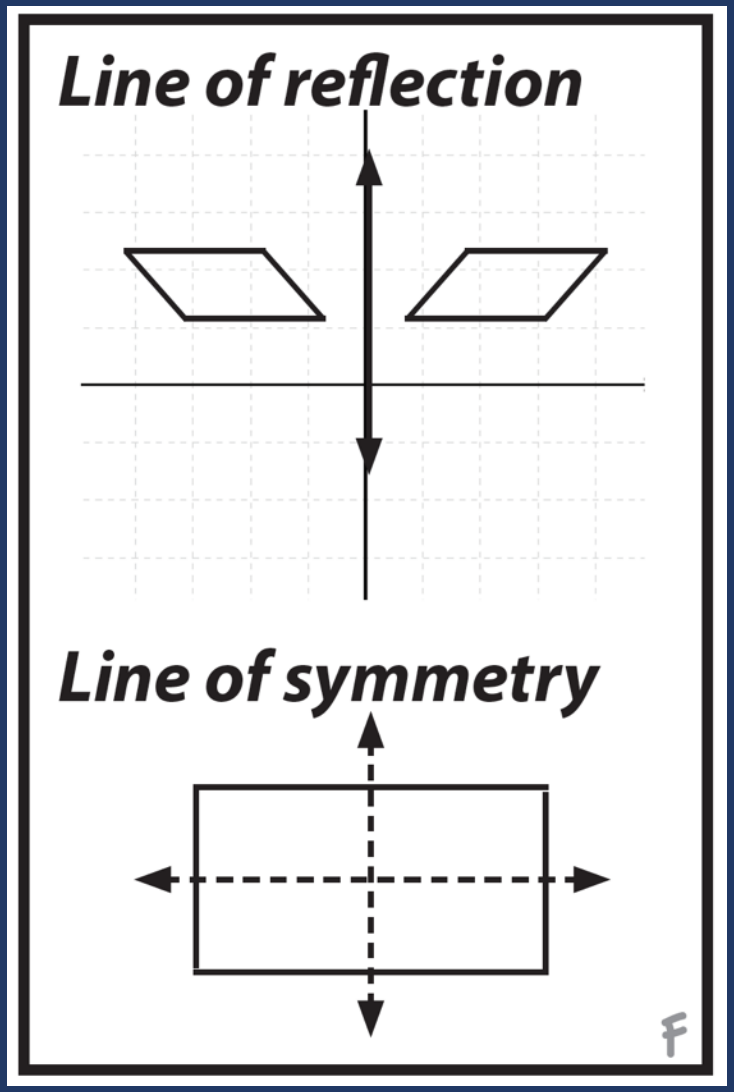


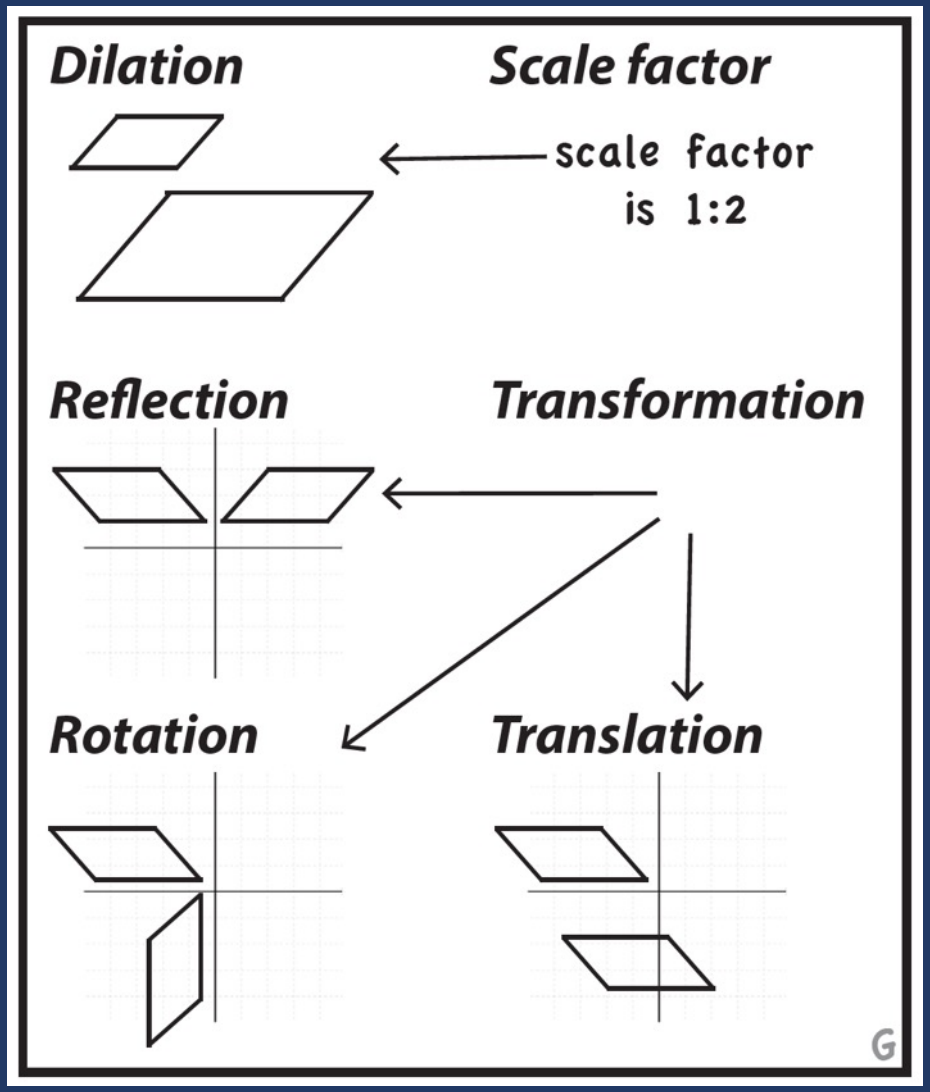
D

**Congruent figures**

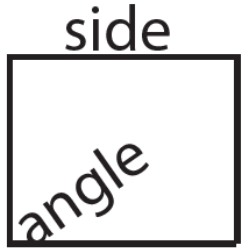
**Similar figures**

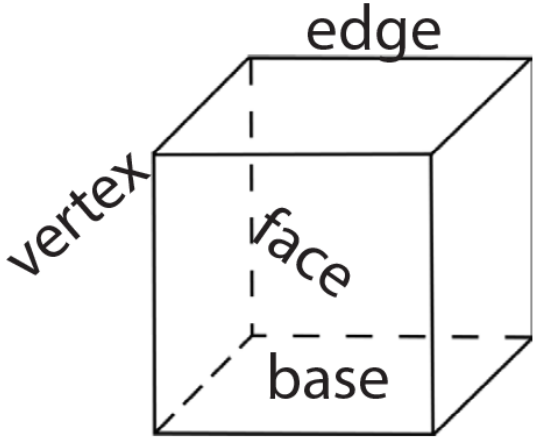
E

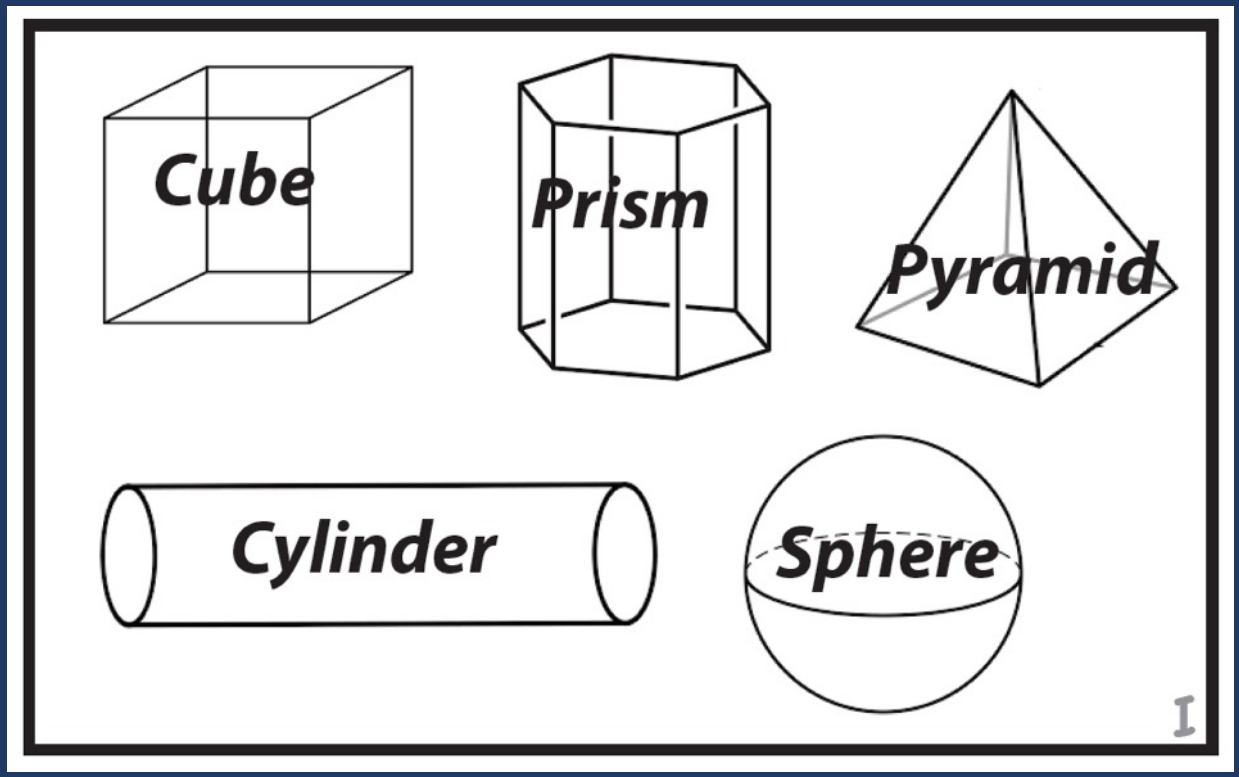




***Angle***
***Base***
***Edge***
***Face***
***Side***
***Vertex***





***Coordinate plane***

***Ordered pair***

***Quadrants***

***x***

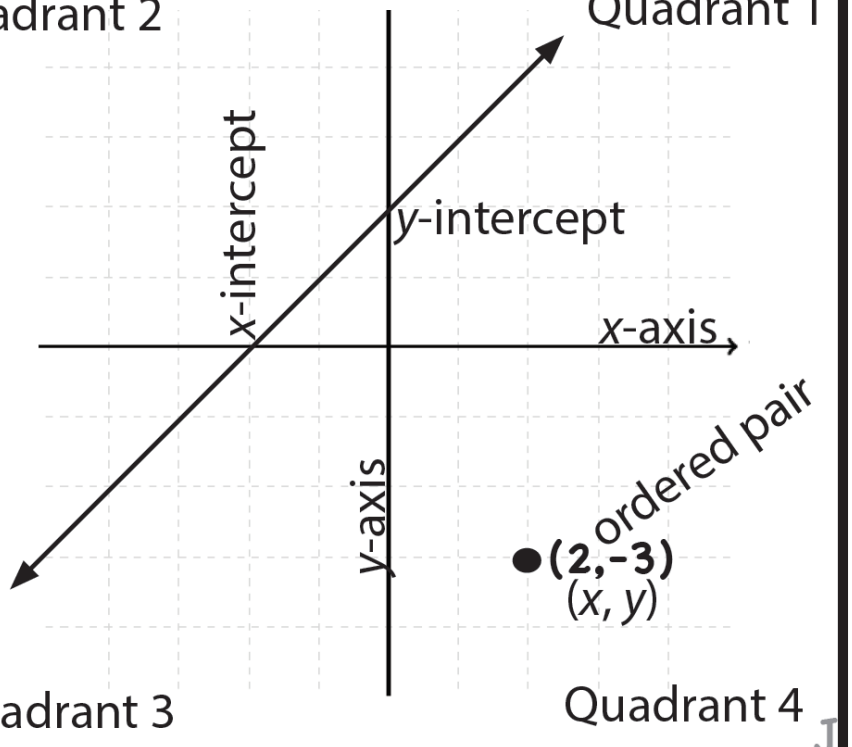
***x-axis***

***x-intercept***

***y***

***y-axis***

***y-intercept***



Use Mathematics Vocabulary With Precision

Strategies for Teaching Mathematics Language

Discuss terms you want your students to use with precision.

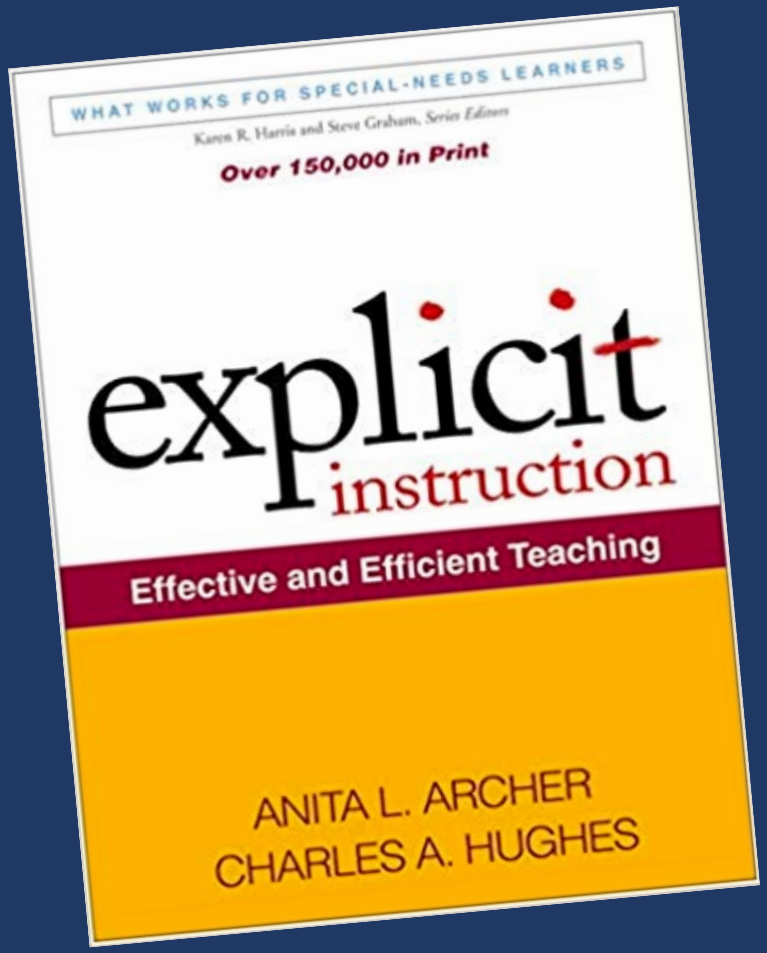
Use formal math language

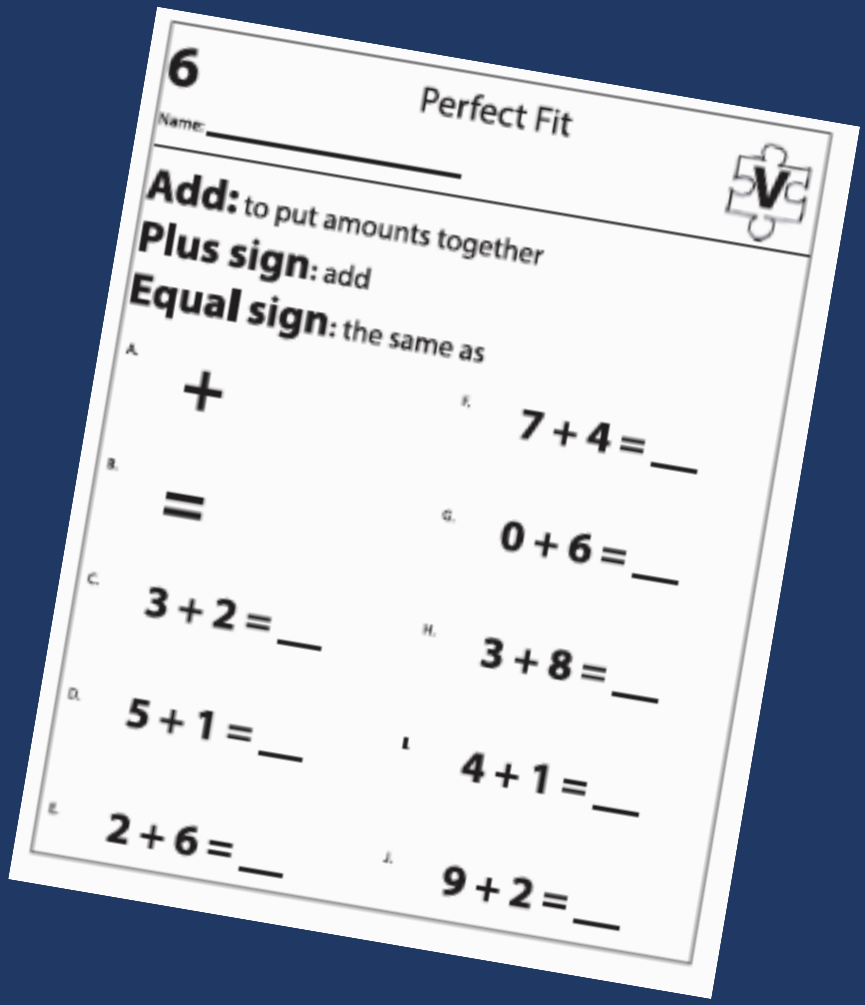
Use terms precisely

Use Mathematics Vocabulary With Precision

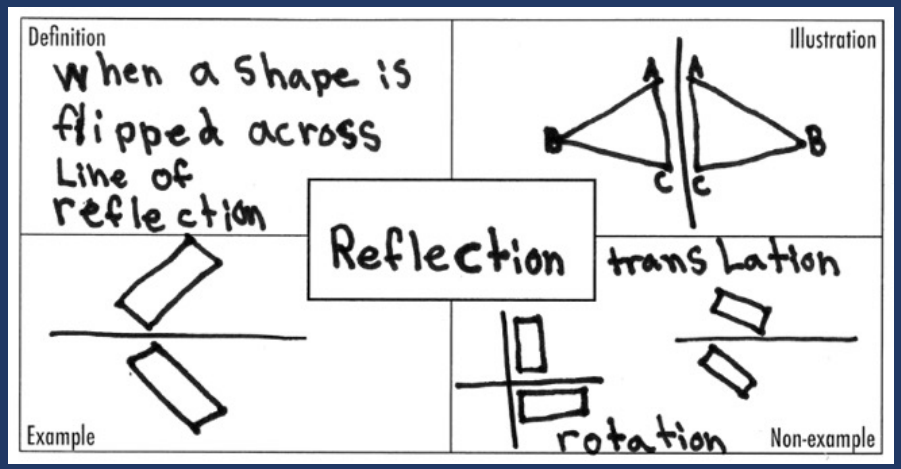
Strategies for Teaching Mathematics Language

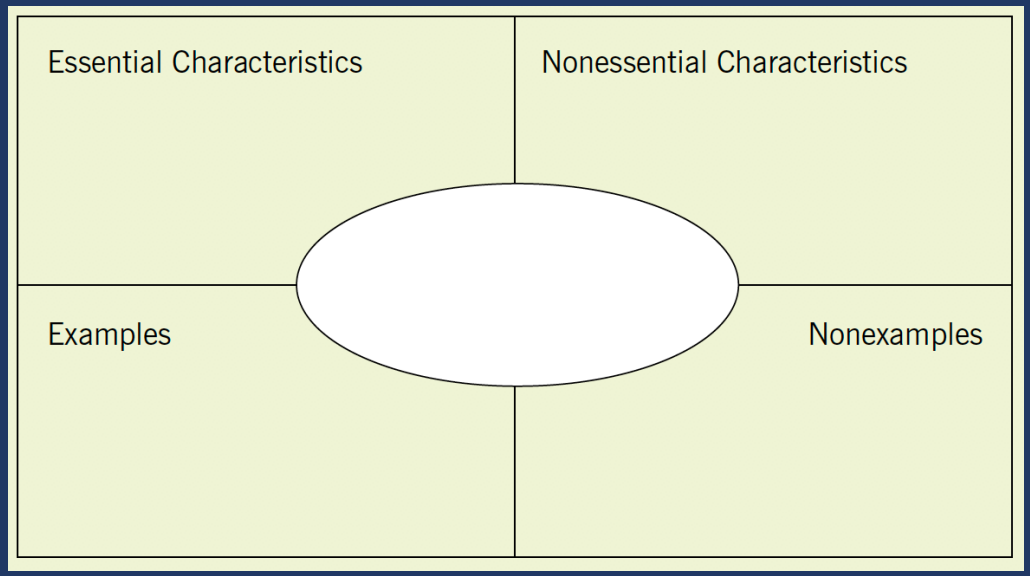
# 1. Use explicit instruction



# 2. Use graphic organizers



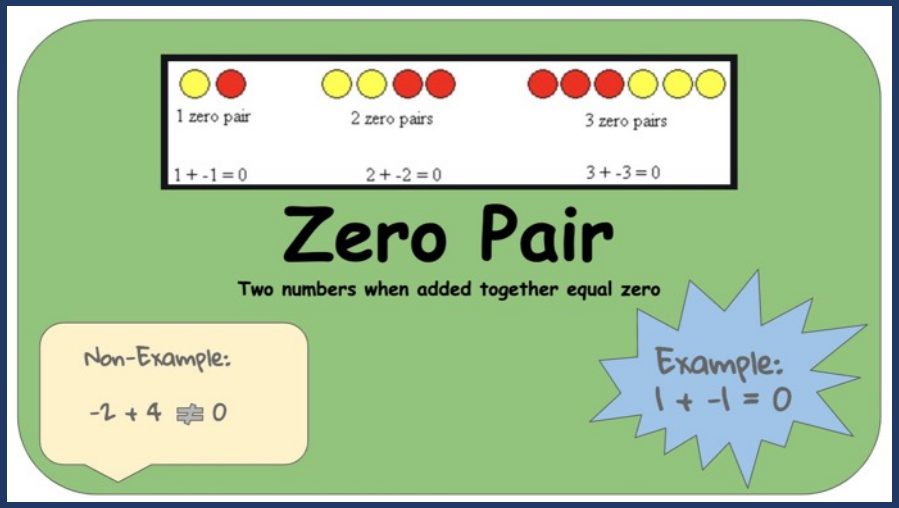

Dunston & Tyminski (2013)

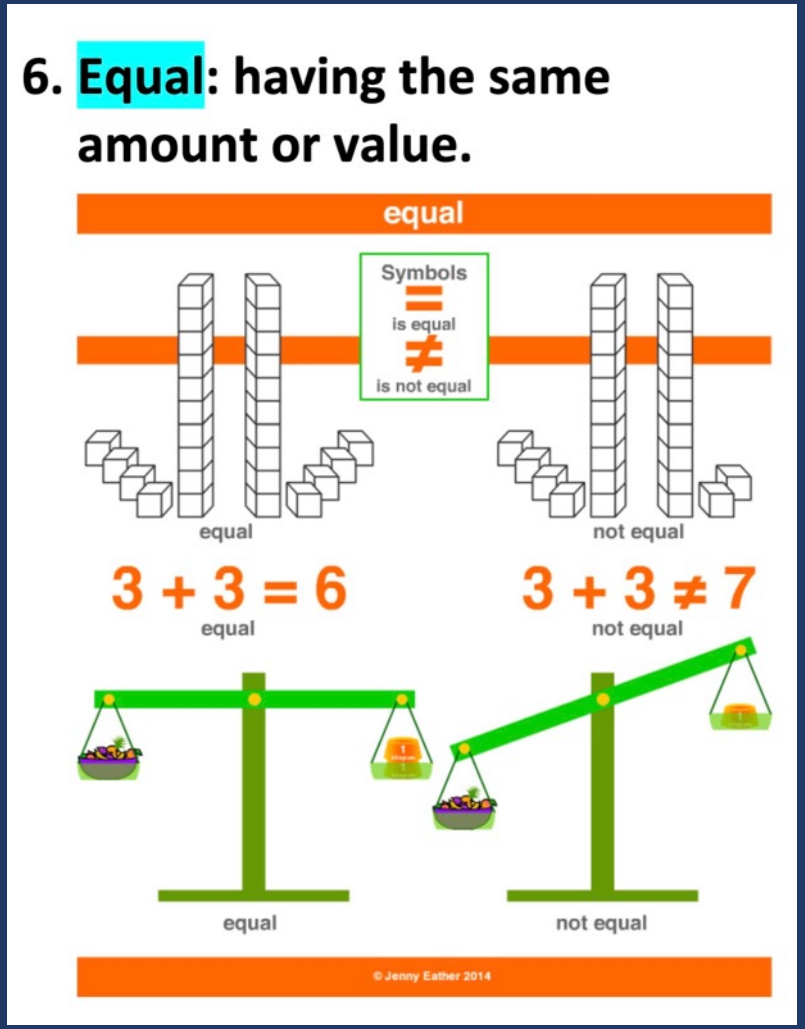
# 2. Use graphic organizers

| Word | Lightbulb Word |
| --- | --- |
| Definition | Picture |

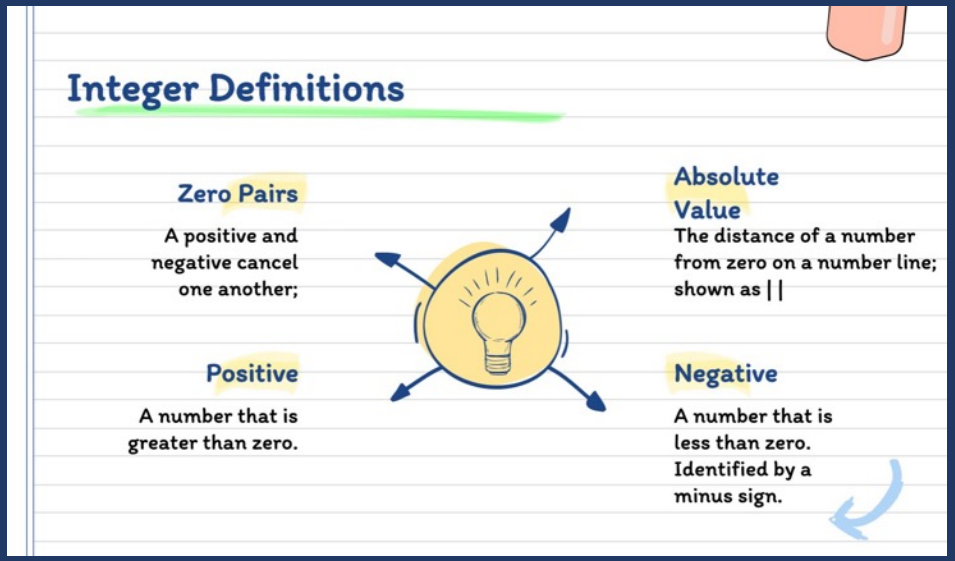
Dunston & Tyminski (2013)

# 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....

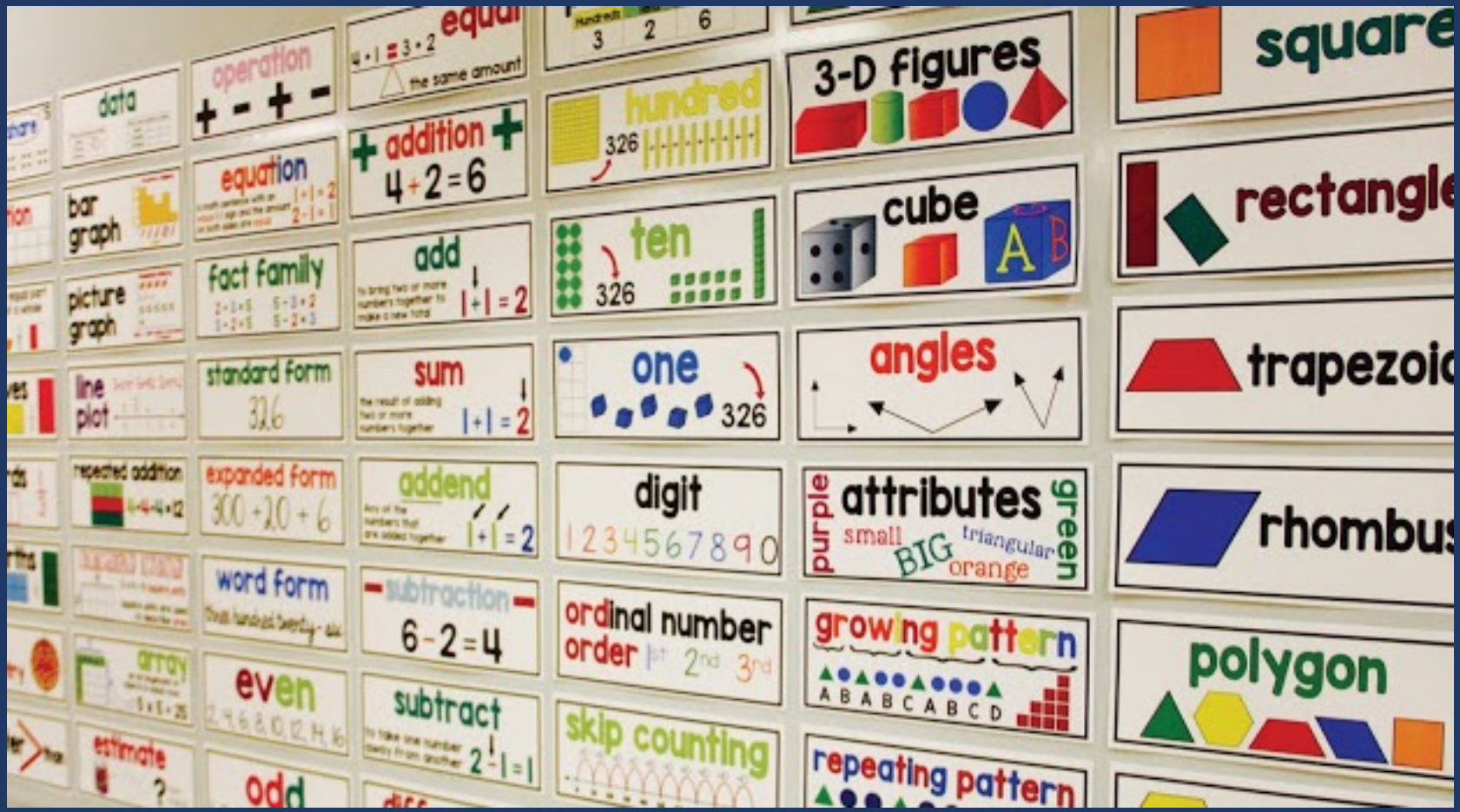
**Percent:** a specific number in comparison to 100

- 74%

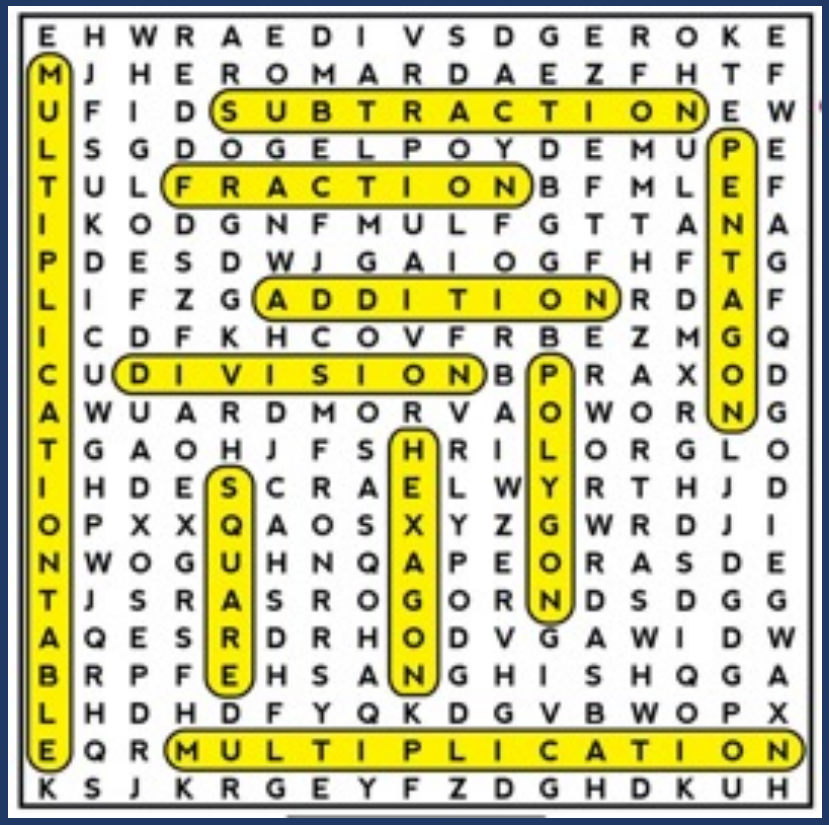
**Polygon:** any enclosed shape that is made up of 3 or more straight lines

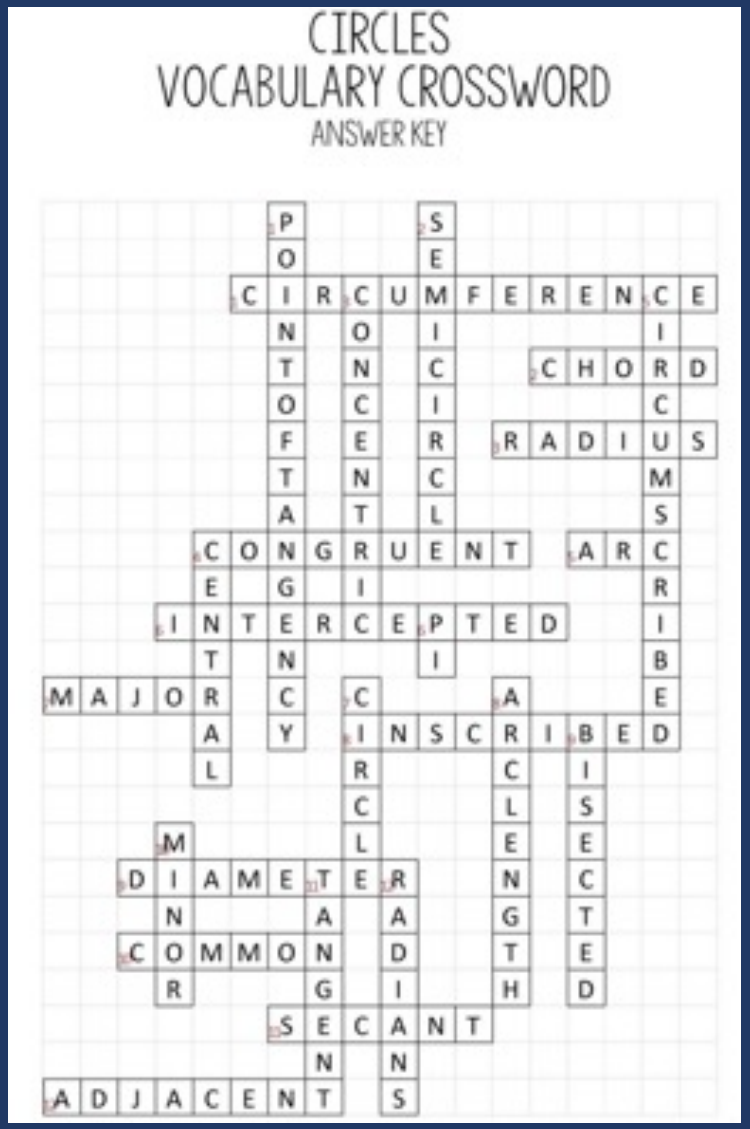
- Ex. 

# 5. Create a word wall

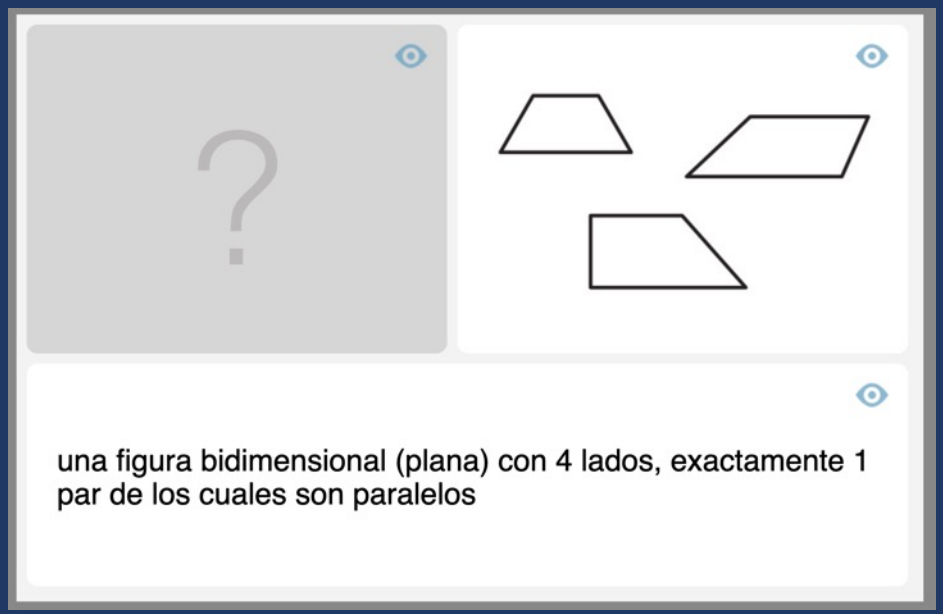


# 6. Do word games



# 7. Use technology




Math Learning Center


Math Lingo

Use Mathematics Vocabulary With Precision

Strategies for Teaching Mathematics Language

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

# Fluency

Fluency

What is your mathematical language goal for January?

What is your fluency goal for January?

# Instructional Platform

## INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

Multiple representations

## INSTRUCTIONAL STRATEGIES

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

Addition

# 100 addition facts

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

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

Subtraction

# 100 subtraction facts

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

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

Multiplication

# 100 multiplication facts

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

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

Division

# 90 division facts

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

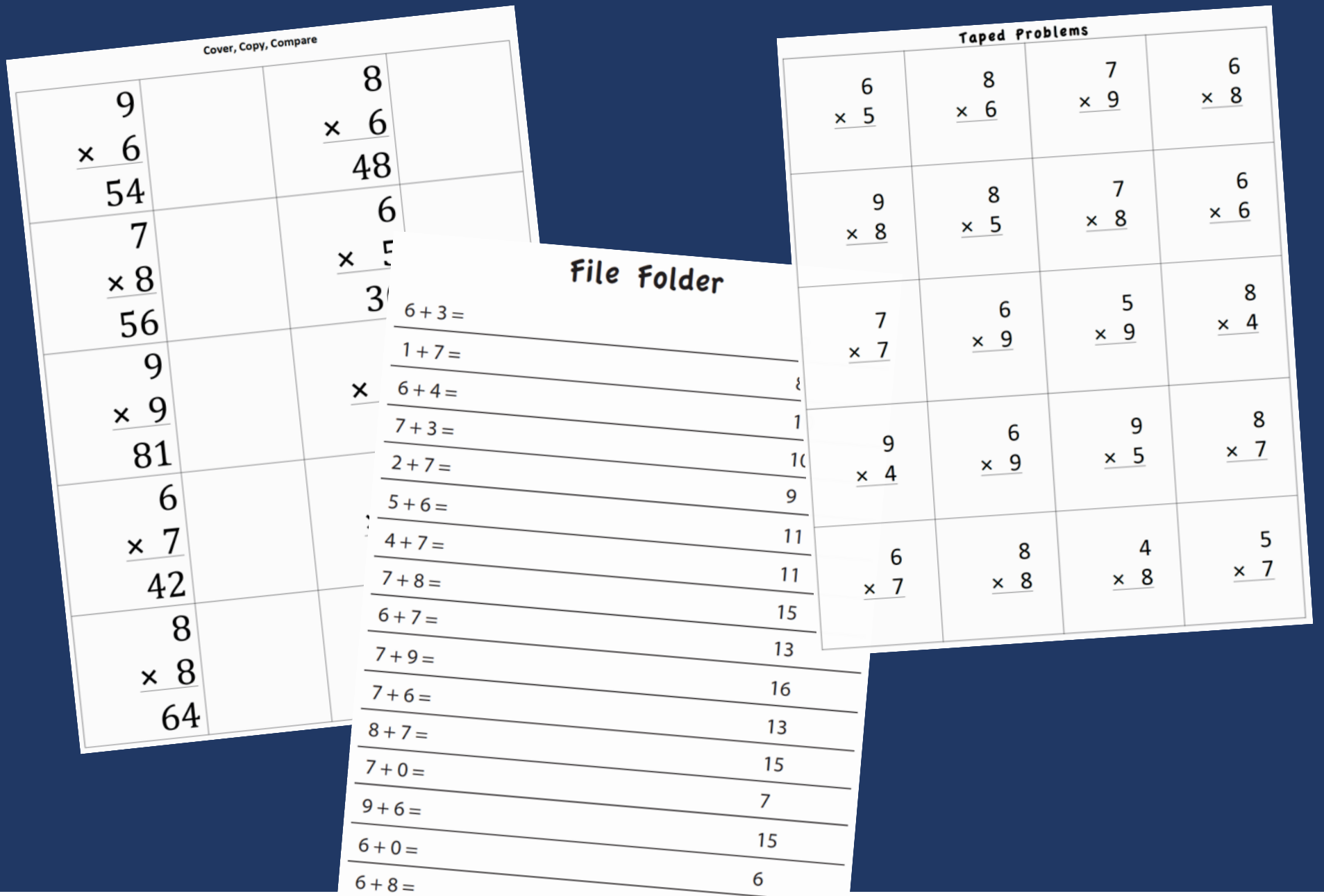
| 8 | ÷ | 4 | = | 2 |
|---|---|---|---|---|
| (dividend) | | (divisor) | | (quotient) |

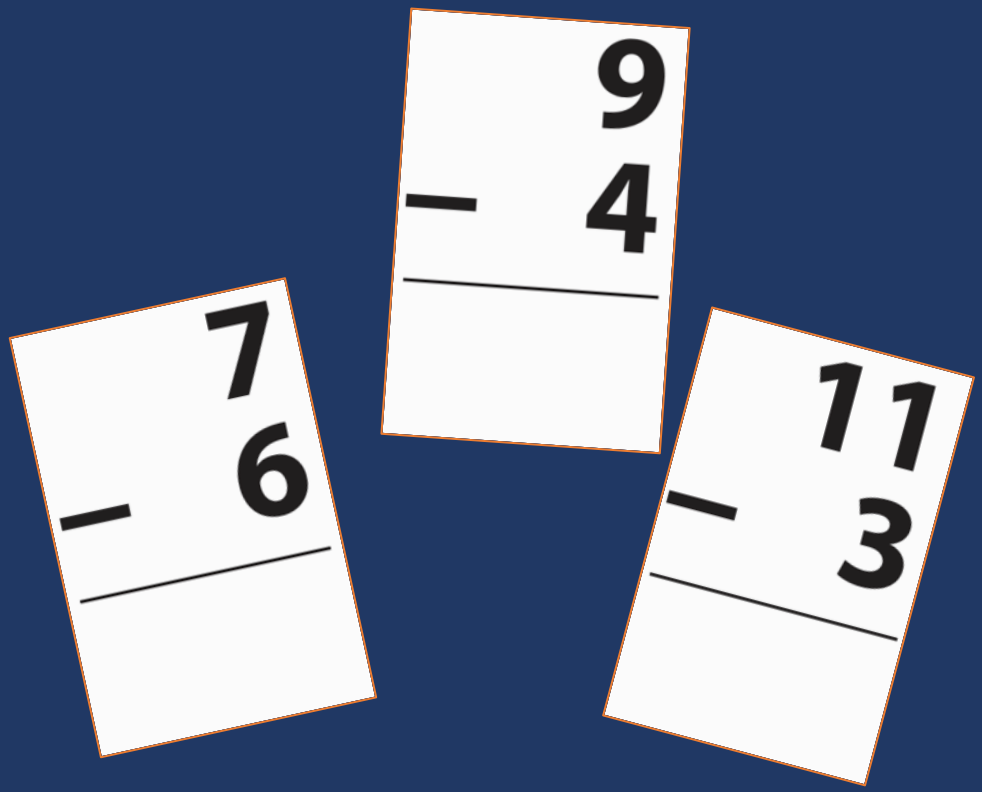
| | |
|---|---|
| Addition | Subtraction |
| Multiplication | Division |

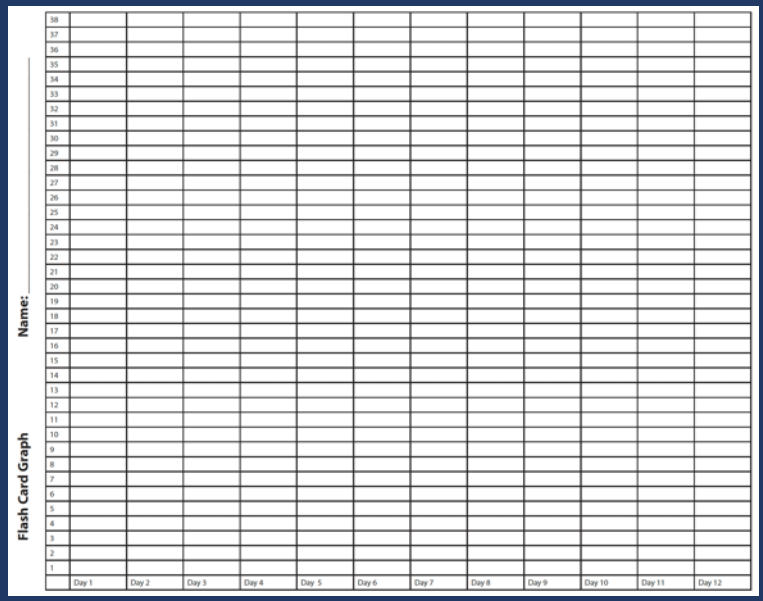
Build fluency with math facts.

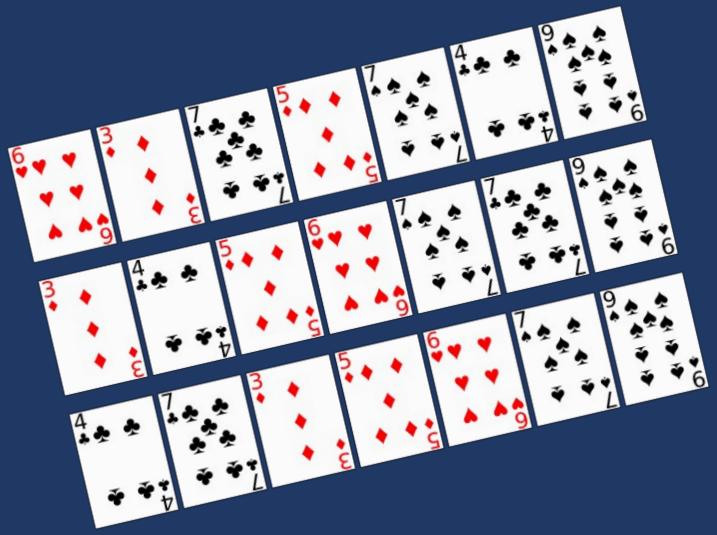
- Addition: single-digit addends
- Subtraction: single-digit subtrahend
- Multiplication: single-digit factors
- Division: single-digit divisor

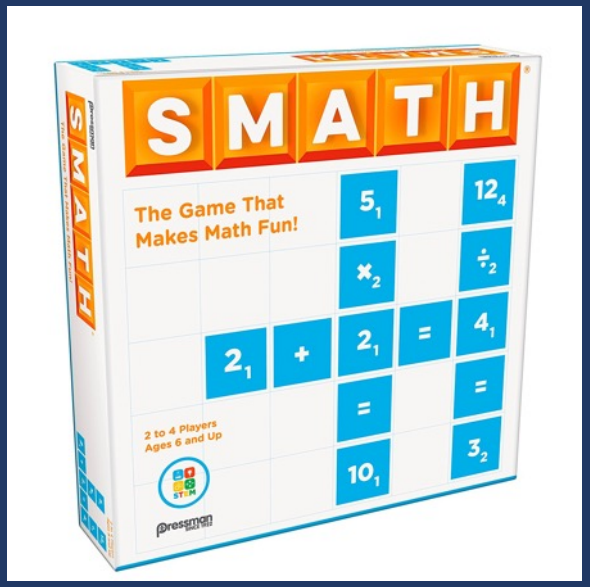
$$\begin{array}{r} 5 \\ +\ 8 \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ -\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 6 \\ \times\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 56 \\ \div\ 8 \\ \hline \end{array}$$

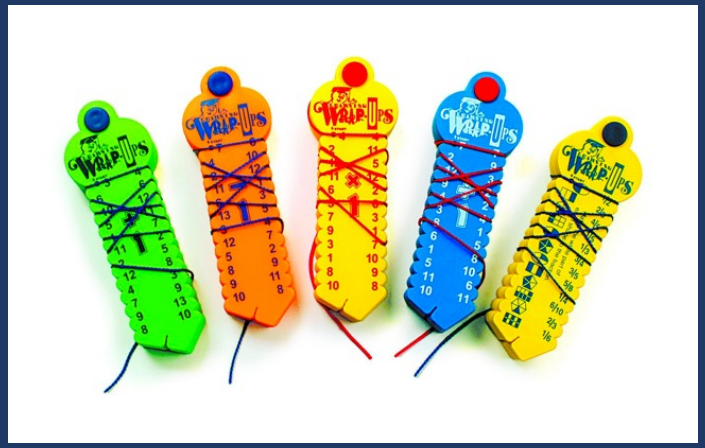




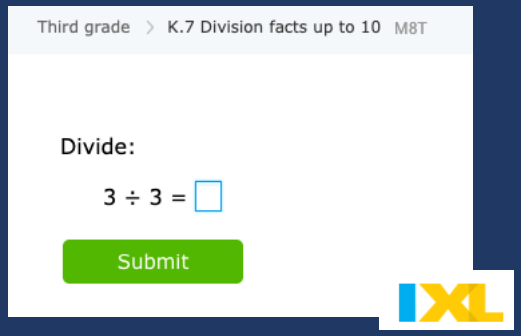


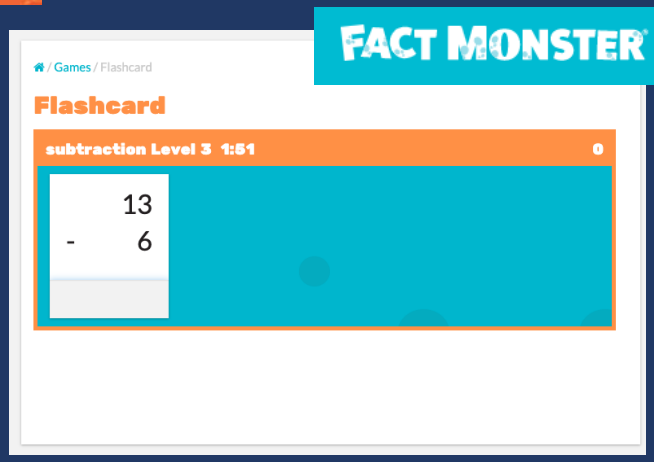








DAILY and BRIEF

| 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

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

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

$-14 - (-7) =$

$-135 \div 2 =$

| | |
|---|---|
| Addition | Subtraction |
| Multiplication | Division |

What fluency practice do your students need?

# Instructional Platform

## INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

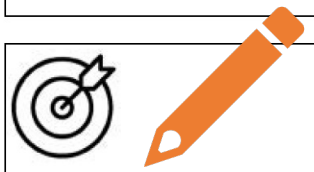
Multiple representations

## INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving instruction

Fluency



What is your mathematical language goal for January?

What is your fluency goal for January?

What is your mathematical language goal for January?

What is your fluency goal for January?

# Schedule for This Year

| | |
|---|---|
| December 2022 | Best Practices in Math:<br>Math Language and Fluency |
| January 24, 2023 | Best Practices in Math:<br>Modeling and Practice<br>Word-Problem Solving |
| TBD | Best Practices in Math:<br>Use of Multiple Representations |

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