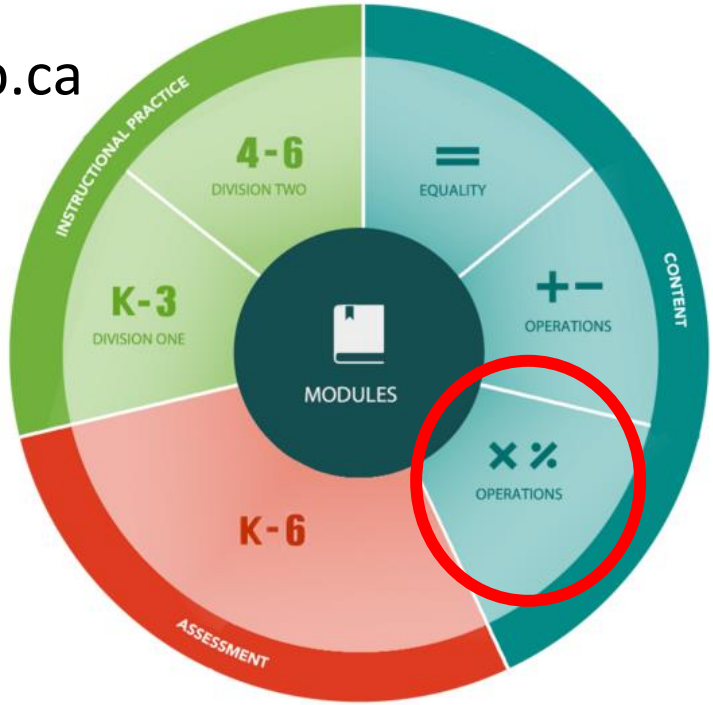
Making Multiplicative Thinking Accessible to All

Learning Guide

http://learning.arpdc.ab.ca



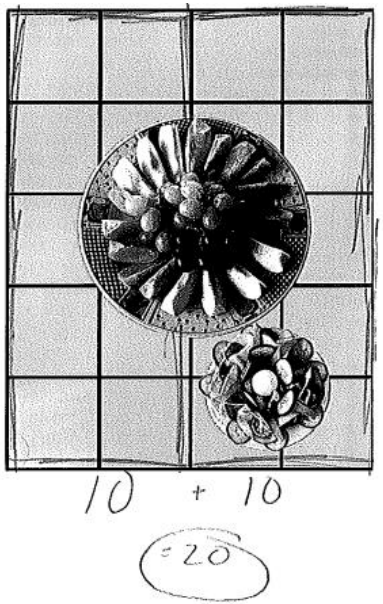
Webinar Objectives

- Develop participants' understanding of Multiplicative Thinking
- Explore a variety of multiplicative strategies
- Provide strategies for supporting students

Which is Which?

Counting
Additive Thinking
Multiplicative Thinking

A



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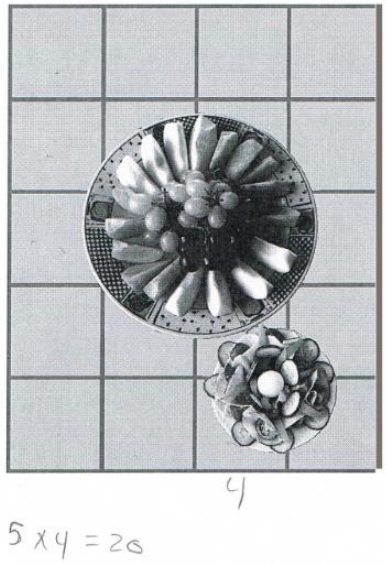

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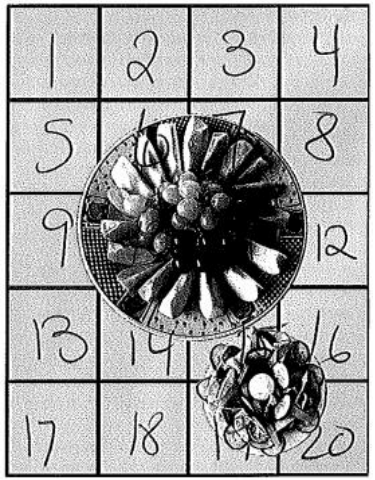
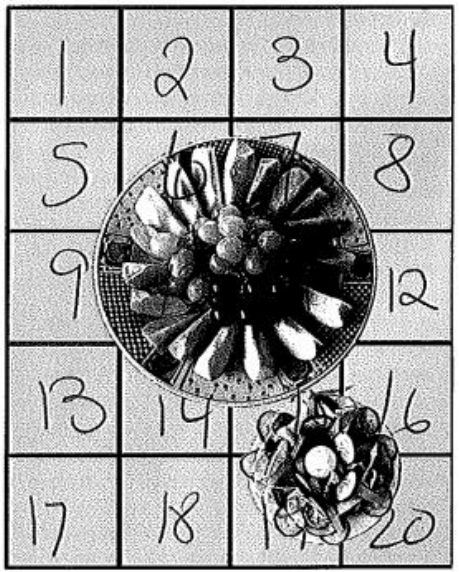
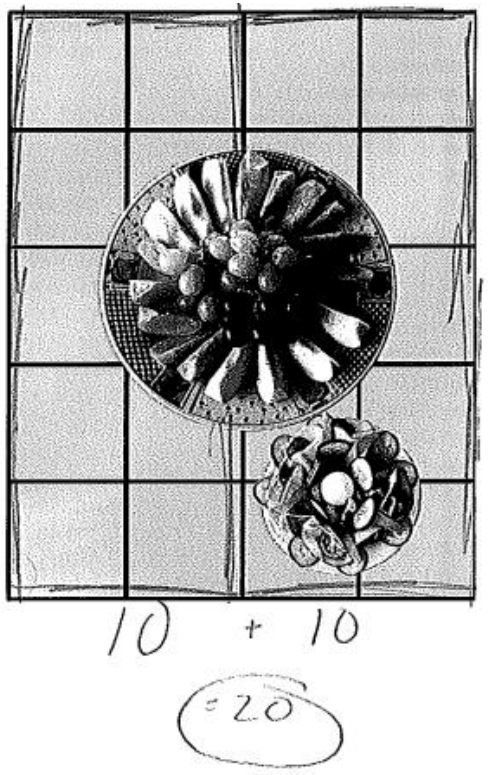


Counting

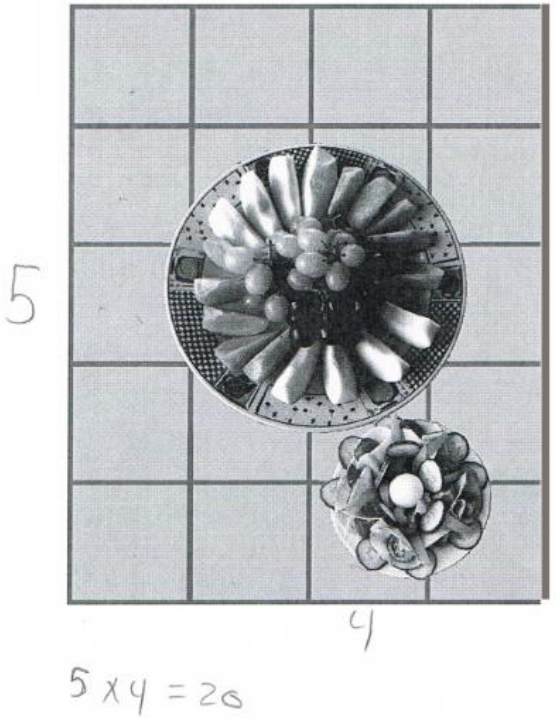


Additive Thinking

Students are able to manipulate numbers by **joining**, **separating**, and **comparing** while engaging in **flexible mathematical reasoning**.



Multiplicative Thinking

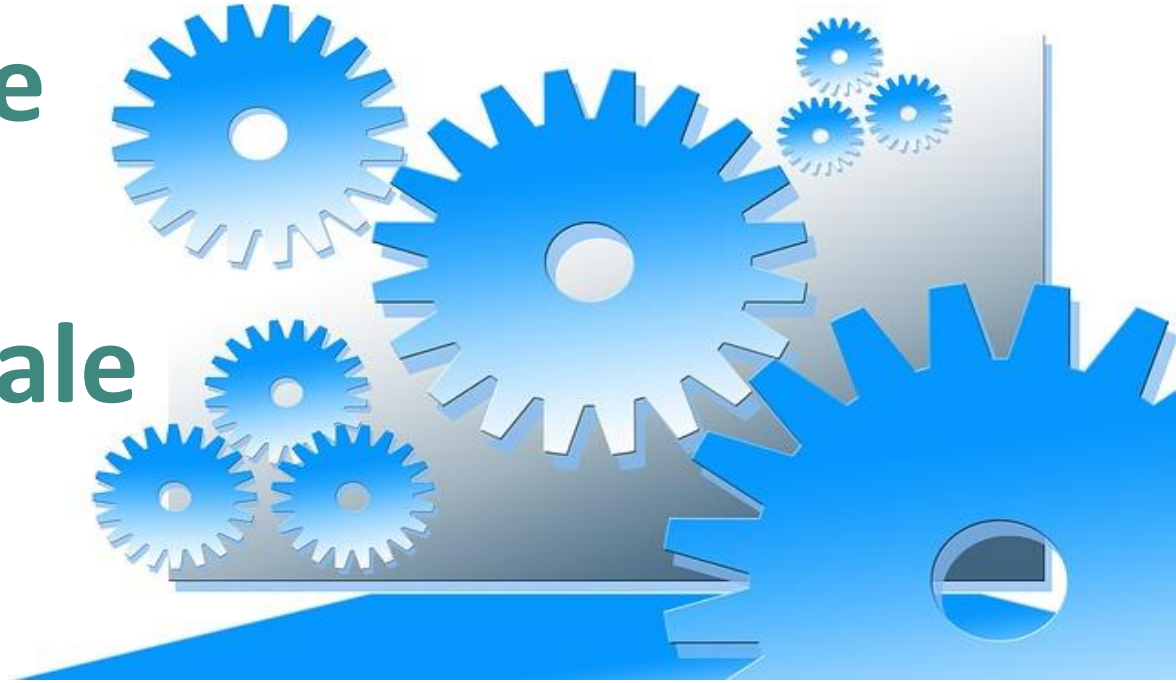


Definition

Multiplicative Thinking is

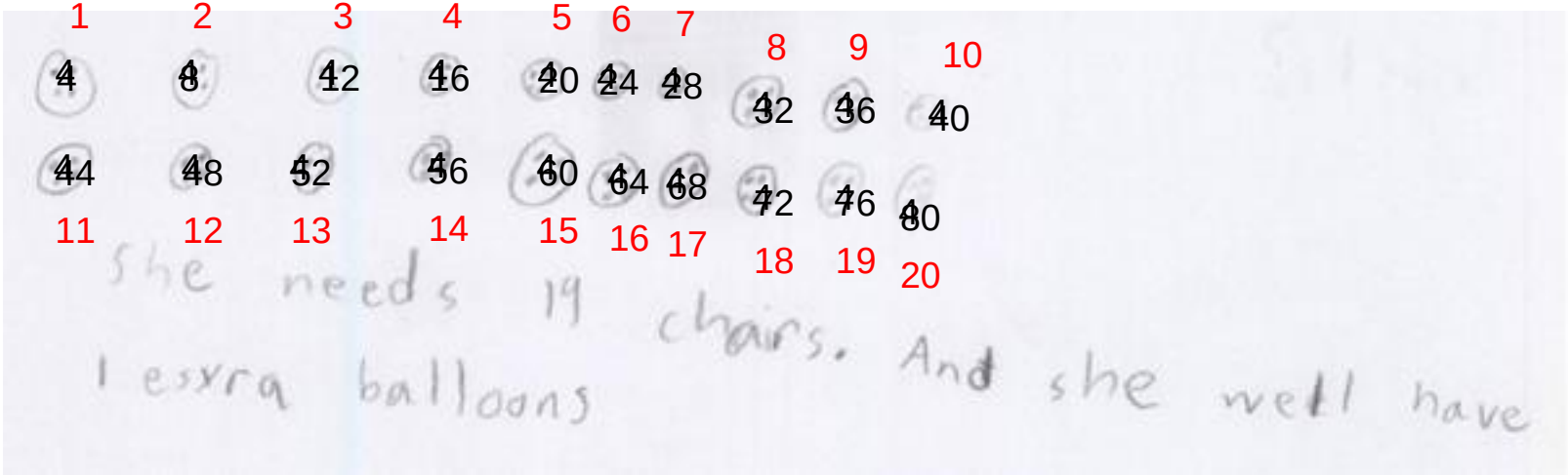
- a capacity to work flexibly with the concepts, strategies and representations of multiplication and division as they occur in a wide range of contexts. (mathematical reasoning)
- going beyond memorization of basic arithmetic skills, and
- the means to communicate multiplicative understanding effectively in a variety of ways (for example, words, diagrams, symbolic expressions, and written algorithms).

Multiplicative Thinking
A Cautionary Tale



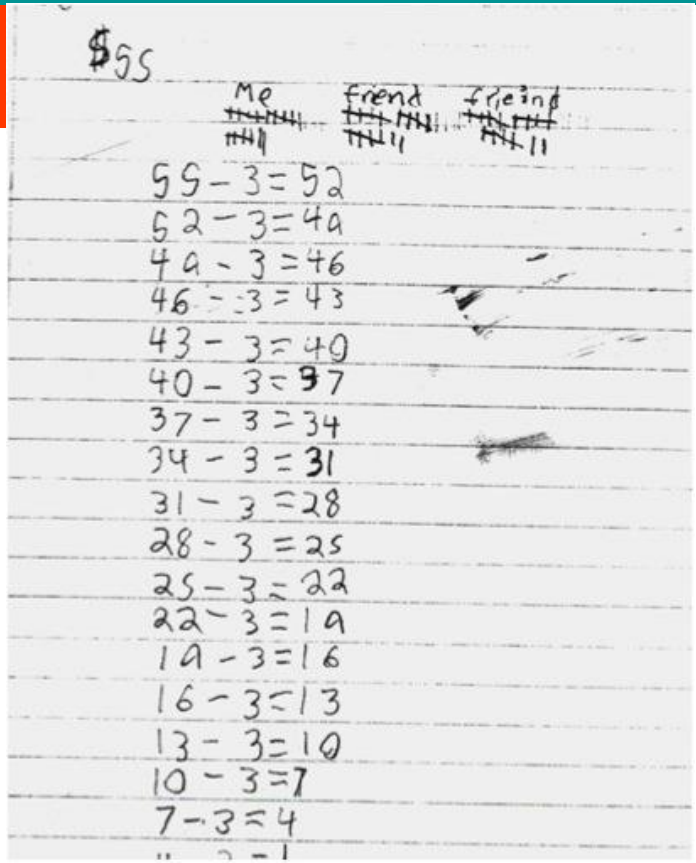
A Cautionary Tale – Part 1

My sister is tying balloons to the chairs for a birthday party. She wants to tie 4 balloons to each chair. The bag contains 77 balloons. How many chairs can she decorate?



A Cautionary Tale – Part 2

I found a bike. My neighbour said he'd give me a $40 reward for finding it. If I cleaned it up, I'd get another $15. Can I share the money equally with my two friends?



The student says the answer is 17.

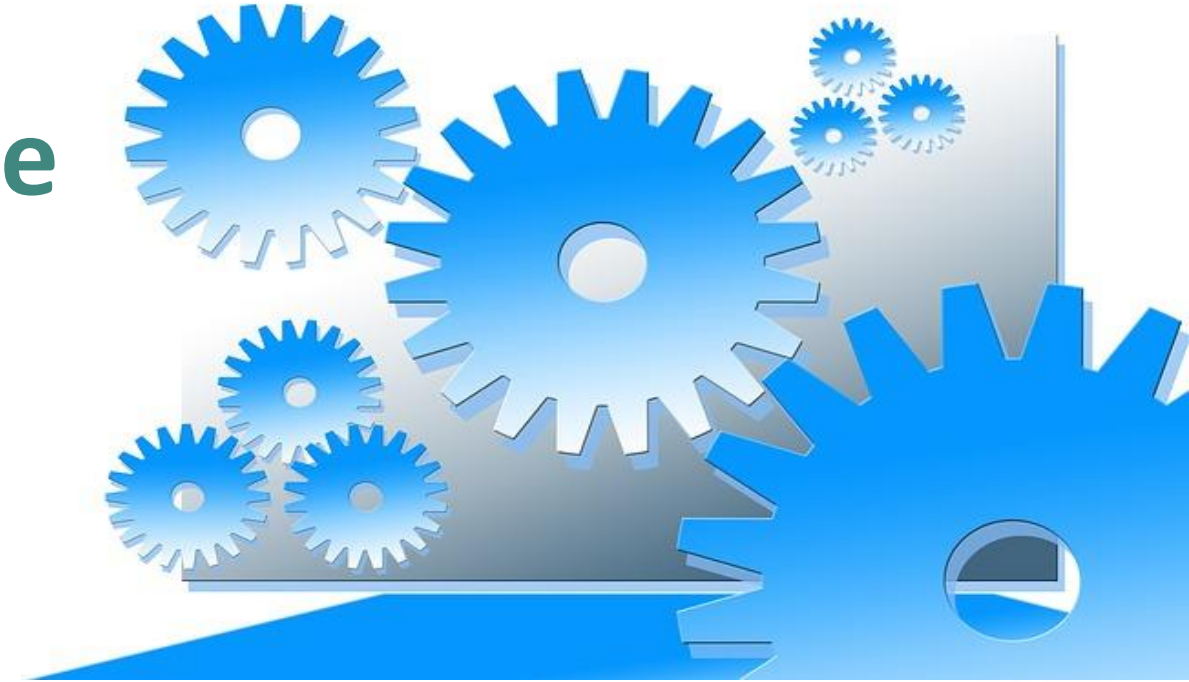
Keep in Mind

We want kids to <u>eventually</u> see multiplication and division as an efficient upgrade for repeated addition and subtraction.

Keep in Mind

Support kids where they are but…
make it very difficult to remain
where they are.

Multiplicative Thinking Big Idea 1



Big Idea 1: Multiplicative Thinking covers…

Big Idea 1: Multiplicative Thinking extends to…

place value, percentages, scale, proportions, rate, ratio, arrays, division, fractions, decimals, etc.

True or False

In the number 342, there are 4 tens.

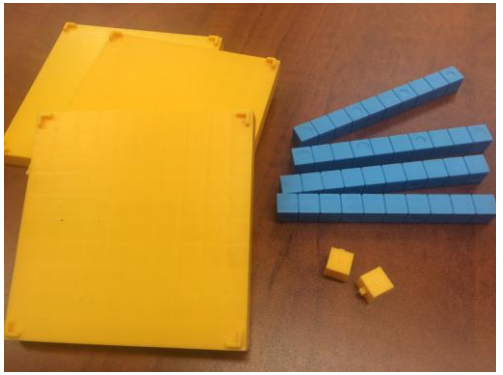
Place Value: Numbers are Composite

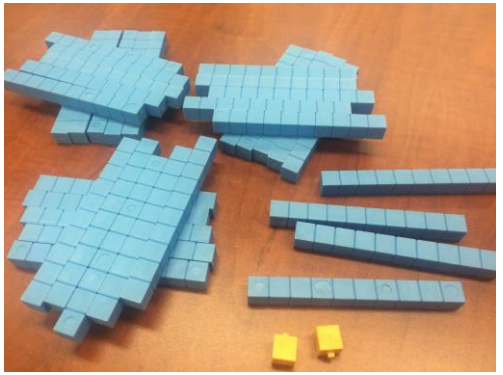
Whole Numbers:

- Tens, Hundreds, Thousands, etc.

Decimals:

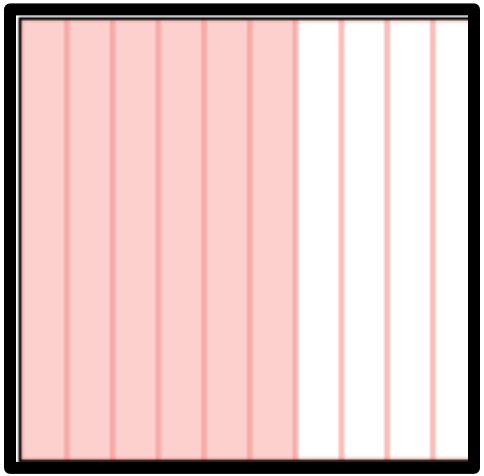
- Tenths, Hundredths, Thousandths, etc.





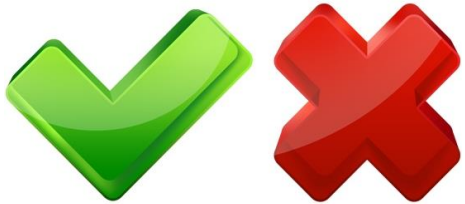
True or False

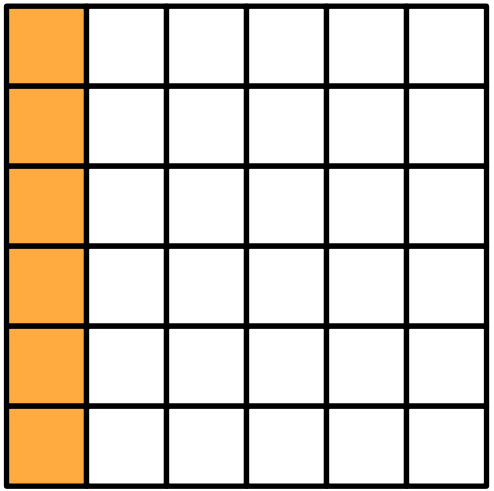
The picture below represents 2/5



True or False

Both ratios 1:5 and 1:6 can be used to represent the picture.





T – Charts or Ratio Tables

# of cars	# of tires
1	4
2	8
4	How could I find this value?
6	?
10	?
8	?
?	36

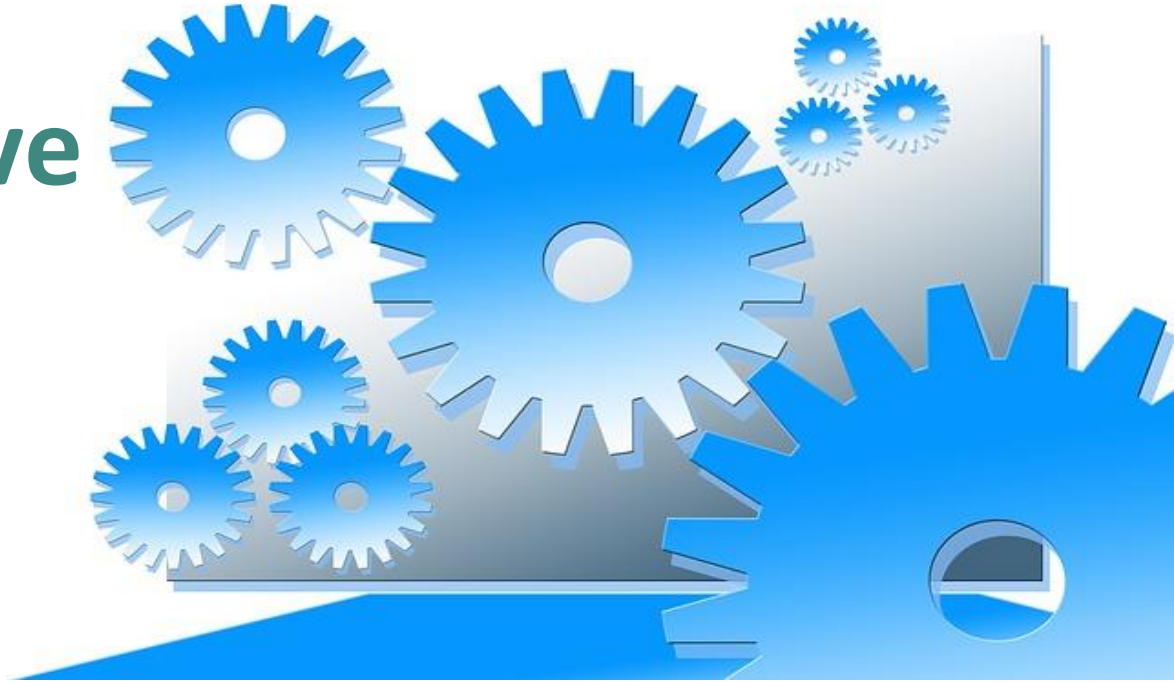
Keep in Mind

Multiplicative Thinking takes years to develop because it consists of many concepts and involves multiple ways to solve them.

When facing a problem, we need to ask:

- What is the question talking about?
- How can it be represented?
- How can we use what we know?
- Which strategies are better and why?

Multiplicative Thinking Big Idea 3



Big Idea 3

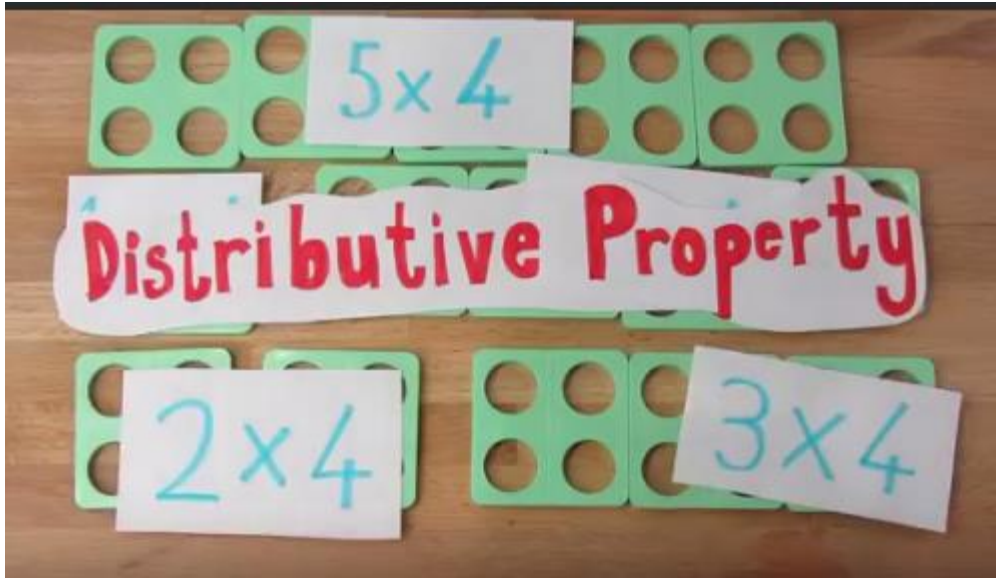
The distributive property is a powerful strategy for mental math

The Distributive Property

A number in a multiplication expression can be decomposed into two or more numbers strategically in order to make solving questions easier.

For example: 47 can be represented as 40 + 7

The Distributive Property Video



The Distributive Property

5 x 4

The Distributive Property

5 x 4

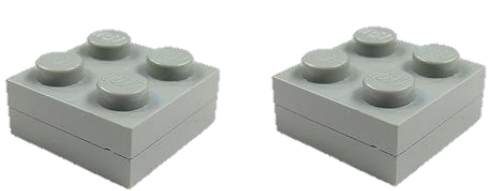
1 x 4

4 x 4

The Distributive Property

5 x 4

2 x 4



3 x 4

The Distributive Property

5 x 4

3 x 4

2 x 4

The Distributive Property

5 x 4

4 x 4

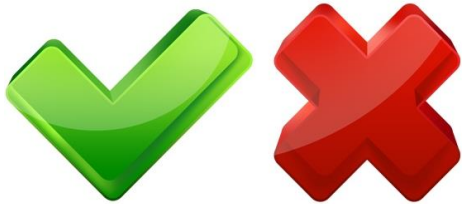
1 x 4

Number Sense Grade 3 N11 and N12

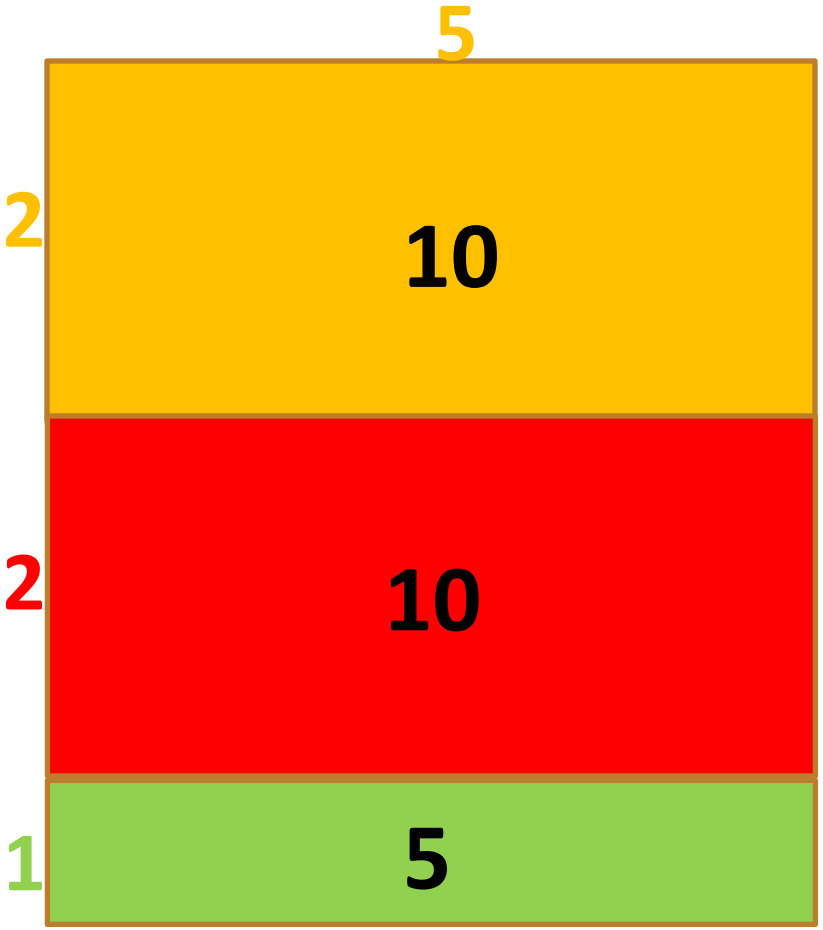
Understand and recall multiplication facts to 5 × 5 and related division facts.

True or False

If you know your 2 times tables and your 5 times tables, you can solve any multiplication fact.



5 x 5



2x5 = 10

(2x5) + (2x5)= 20

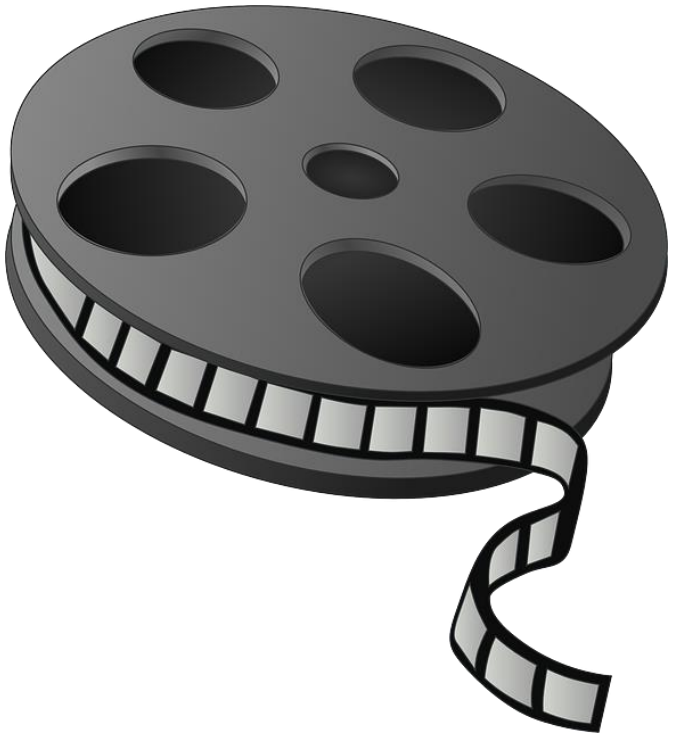
(2x5) + (2x5)+ (1x5) = 25

If All They Know is 2 x 5, They Can Figure Out…

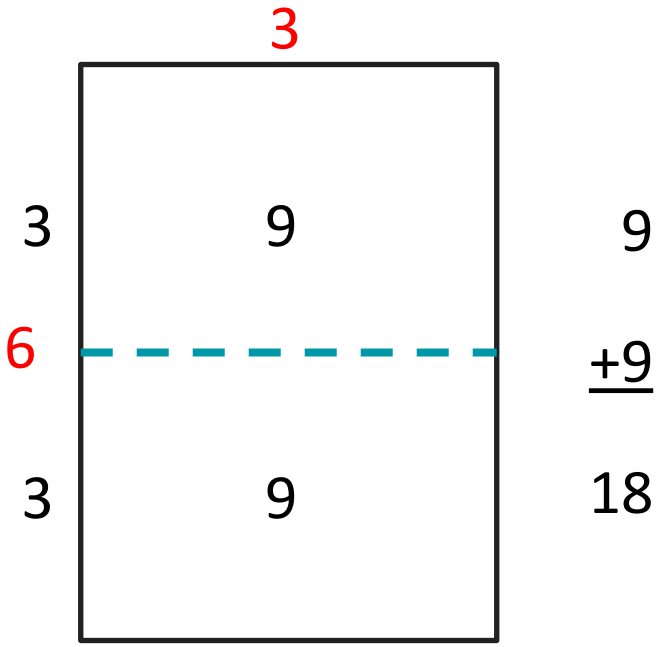
3 x 5	2 x 10	4 x 5	2 x 6
4 x 5	2 x 15	8 x 5	2 x 7
5 x 5	2 x 20	12 x 5	2 x 8
…	…	…	…

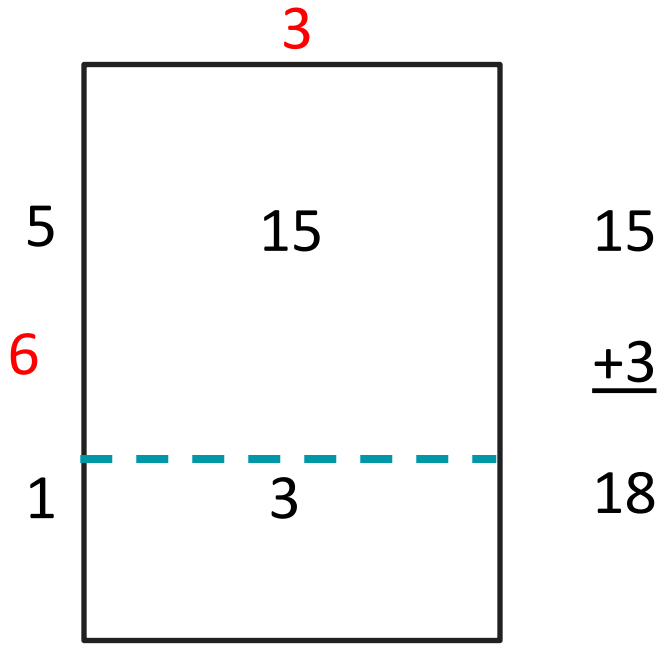
Any factor higher than 5 hits Grade 4 and 5 outcomes

Using the Distributive Property

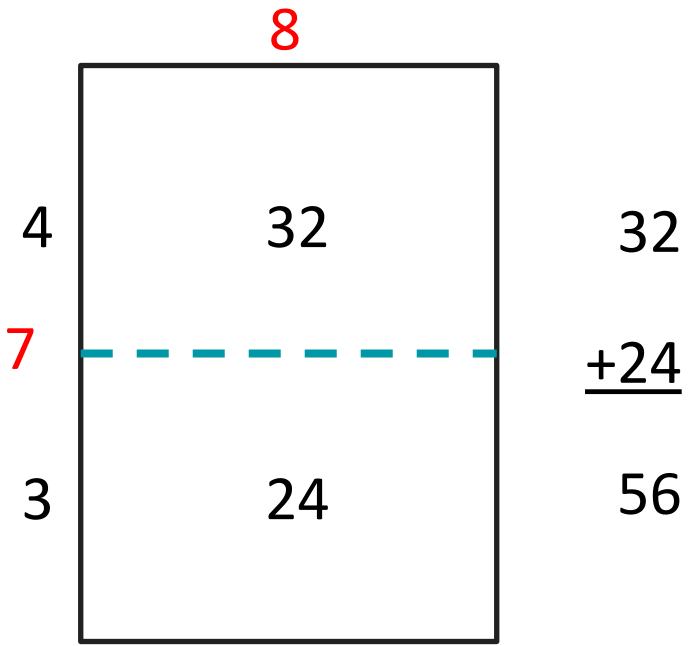


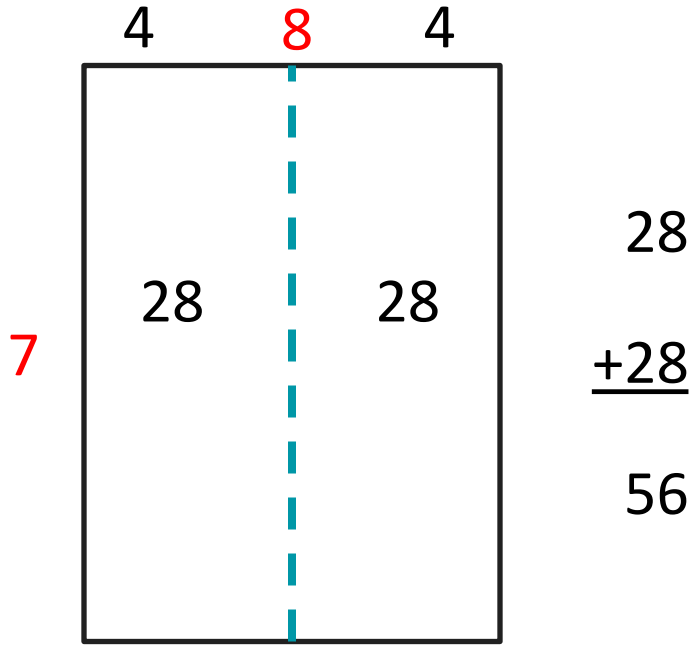
Using What I Know to Solve 3 x 6





Using What I Know to Solve 7 x 8





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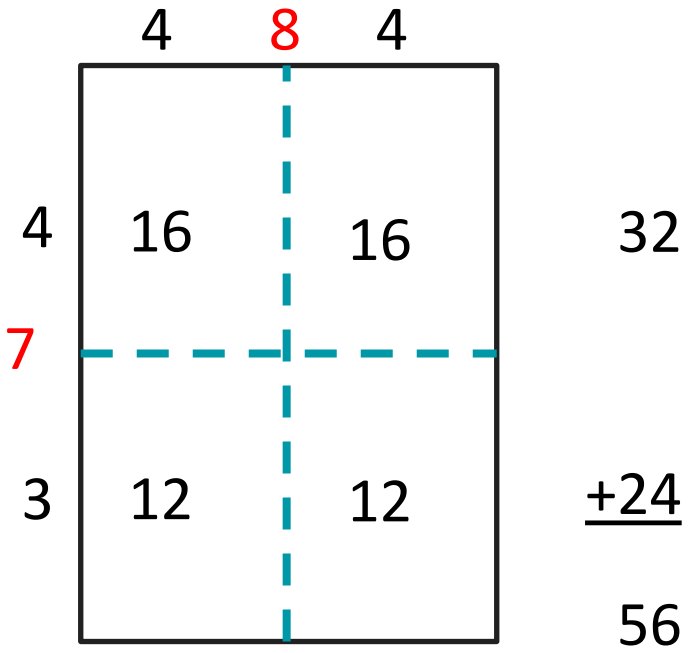
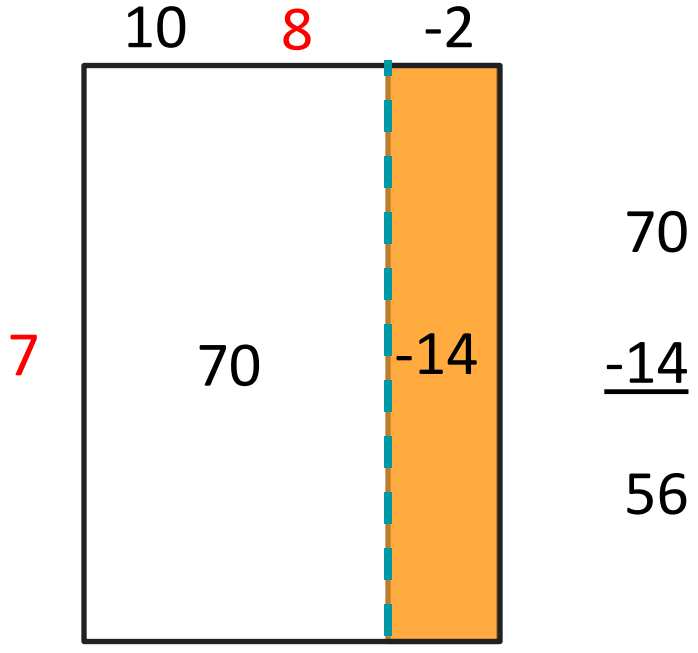
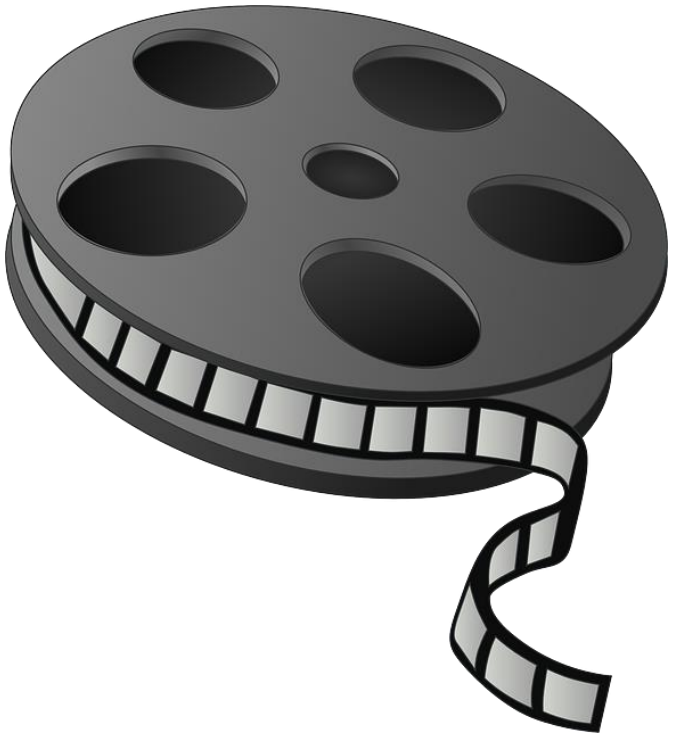




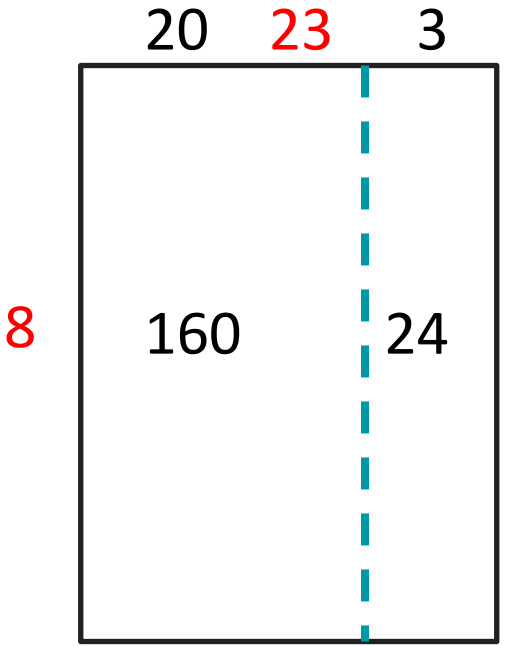
Using the Distributive Property



Number Sense Grade 4 N6 and N7

Demonstrate an understanding of multiplication (2- or 3-digit by 1-digit) and their related division facts.

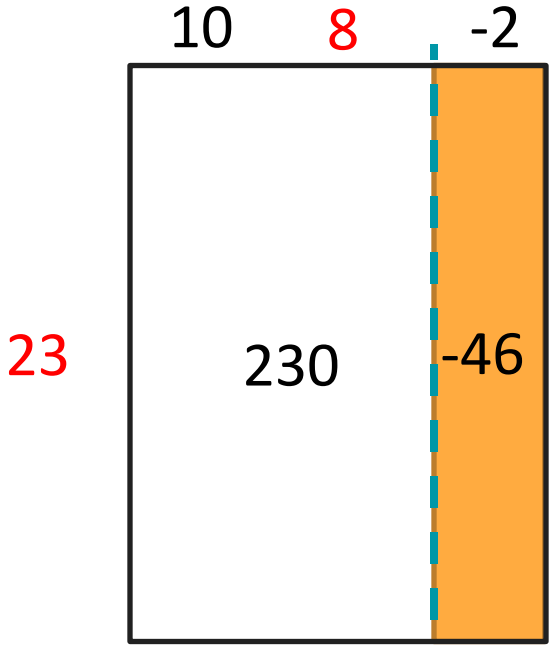
Using What I Know to Solve 23 x 8



160

+24

184



230

-46

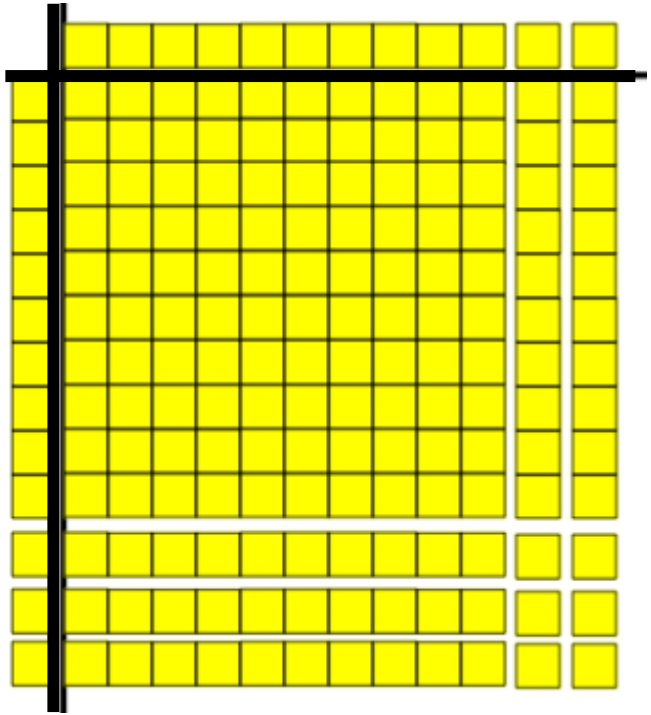
184

Number Sense Grade 5 N5

Demonstrate an understanding of multiplication (2 digit by 2 digit).

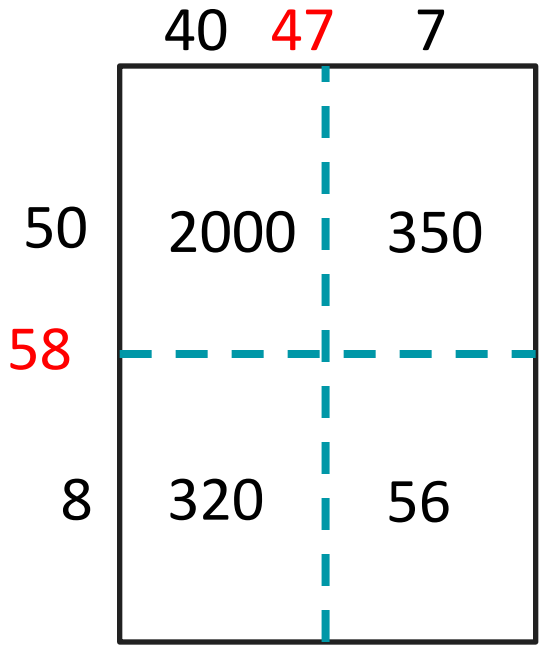
Manipulatives Build Concrete Understanding

12 x 13



	10	+ 2
10	100	20
+ 3	30	6

Using What I Know to Solve 47 x 58



2000
350
320
+56
2726

Other Ways to Solve 36 x 27 Symbolically

	20	7
30	600	210
6	120	42

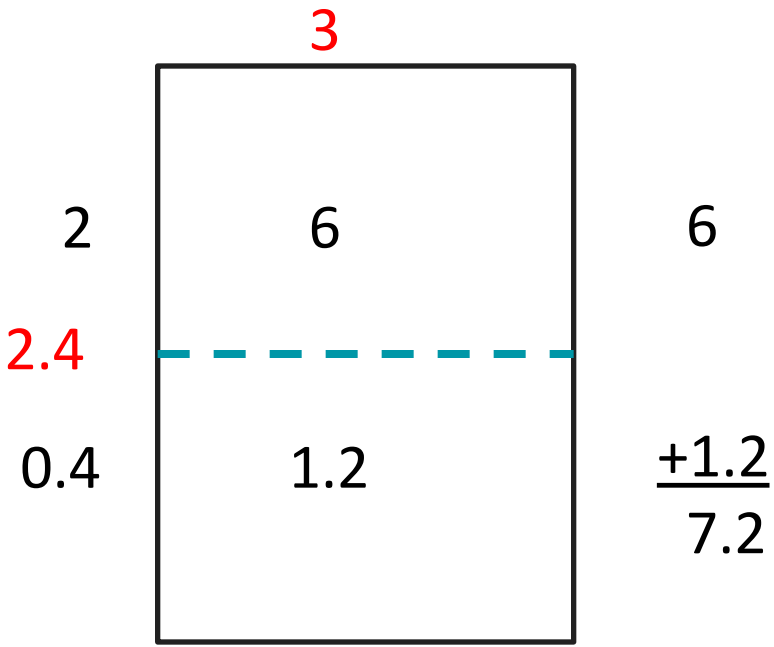
$$
\begin{array}{r}
36 \\
\times\ 27 \\
\hline
42 \\
210 \\
120 \\
600 \\
\hline
\end{array}
$$

$$
\begin{array}{r}
{\scriptstyle 1\ \ }{\scriptstyle 4} \\
36 \\
\times\ 27 \\
\hline
252 \\
720 \\
\hline
\end{array}
$$

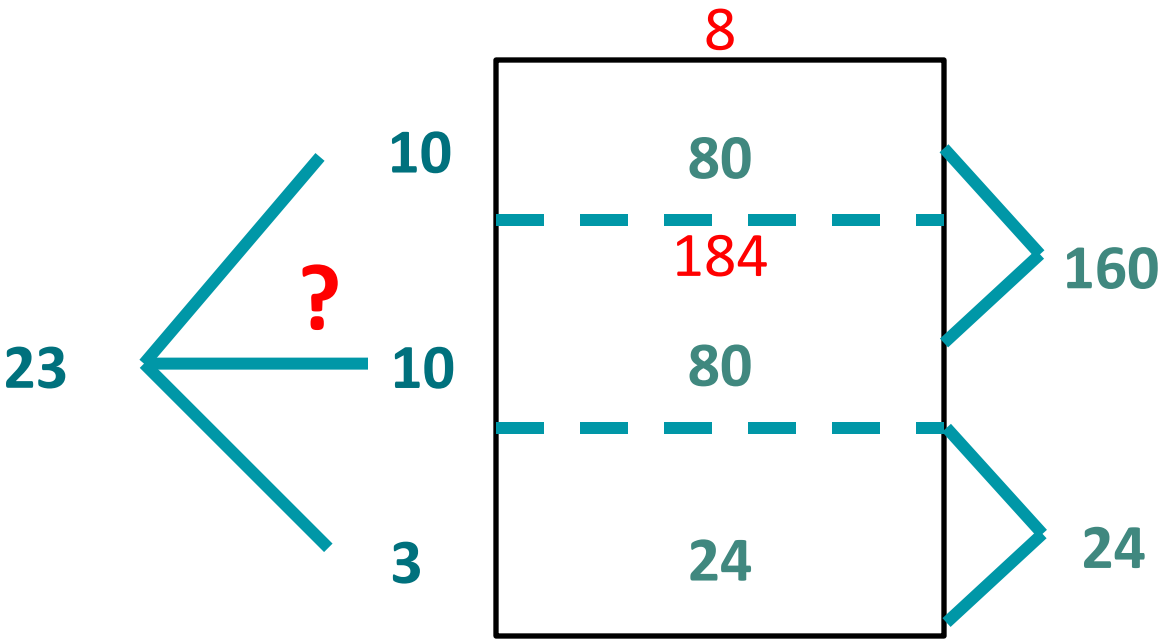
Number Sense Grade 6 N8

Demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors).

Using What I Know to Solve 3 x 2.4



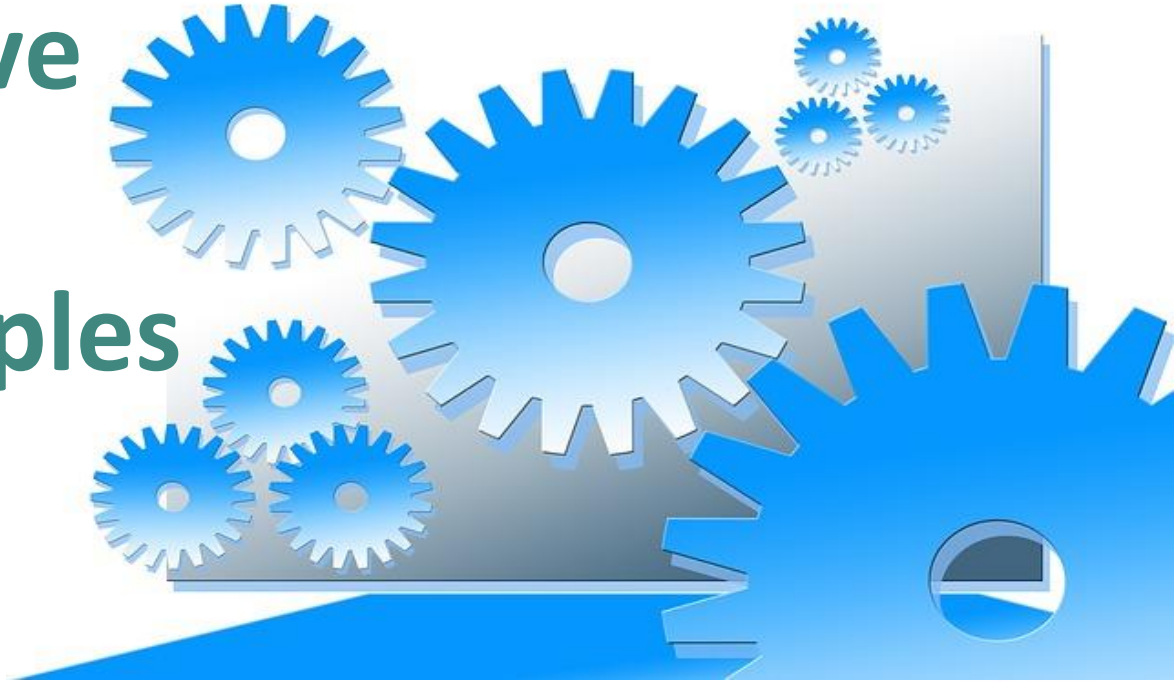
Using Blank Arrays for Division: 184 ÷ 8



Keep in Mind

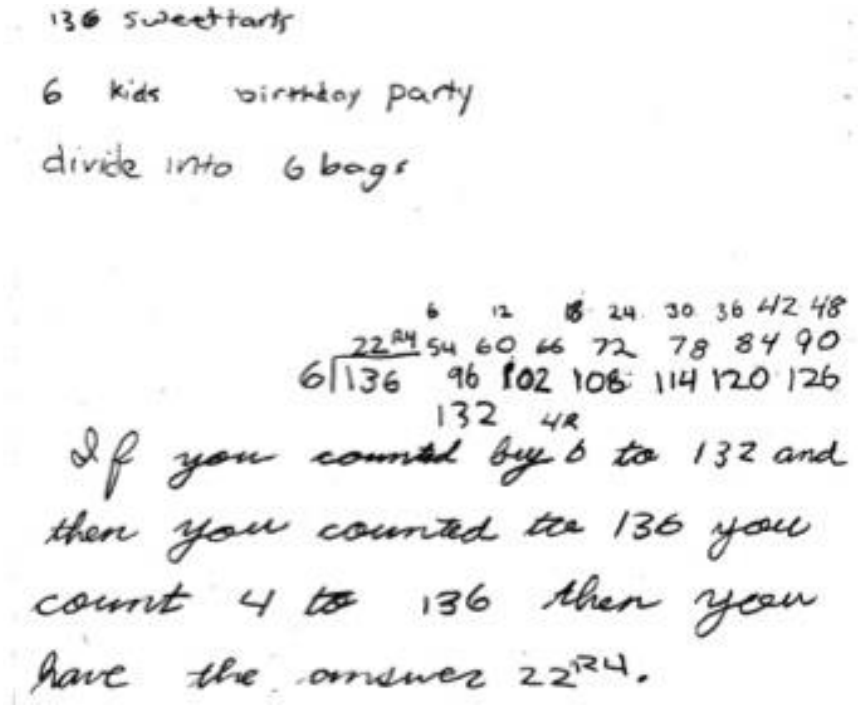
Known facts help students be strategic when using the distributive property.

Multiplicative Thinking Student Examples

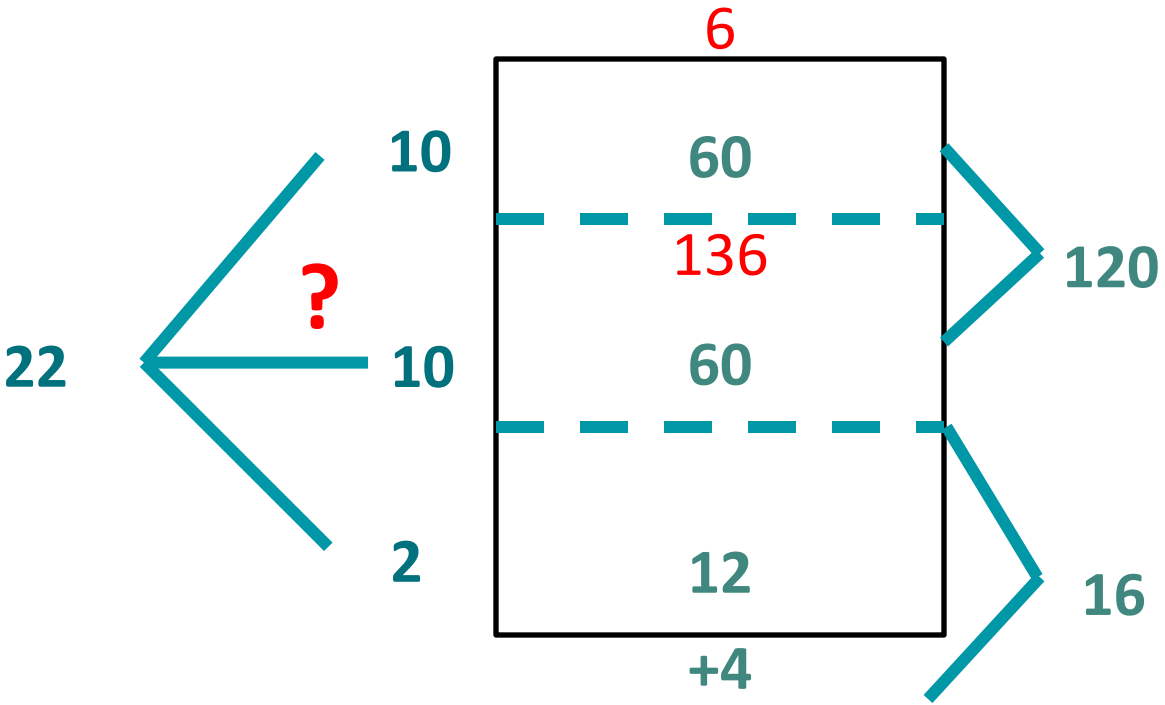


Sweettarts

I have 136 Sweettarts to put in 6 birthday party goody bags. How many Sweettarts will go in each bag?



Using Blank Arrays for Division: 136 ÷ 6



Quick Assessment

Quick Assessment

The Answer

- ☐ **Is Correct**
  - ☐ Obvious
  - ☐ Inferred slightly
  - ☐ Inferred majorly
- ☐ **Is Incorrect**
  - ☐ Has a minor mistake
  - ☐ Has a misunderstanding

The Strategy is a(n)

- ☐ **Counting** Strategy
  - ☐ Counting
  - ☐ Counting on/back
- ☐ **Additive Thinking** Strategy
  - ☐ Making 10
  - ☐ Using doubles (3+3)
  - ☐ Part-Part-Whole
- ☐ **Multiplicative Thinking** Strategy
  - ☐ Using Doubles (3x2)
  - ☐ Arrays
  - ☐ Part-Part-Whole
  - ☐ Known Facts
- ☐ Other

Notes/Next Steps

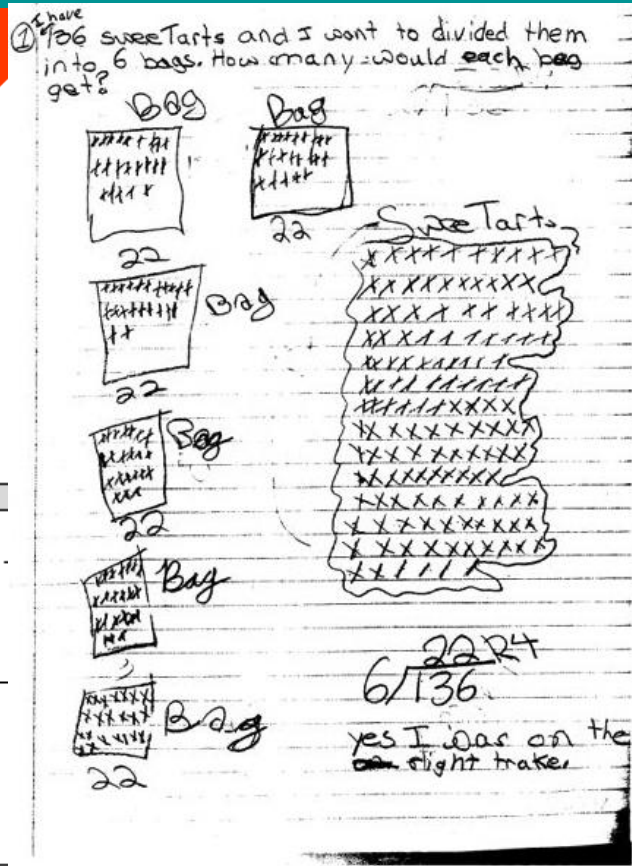
Follow up Questions to Ask the Student

Follow up Steps for Student

Sweettarts

I have 136 Sweettarts to put in 6 birthday party goody bags. How many Sweettarts will go in each bag?

Quick Assessment							
The Answer	☐ Is Correct ☐ Obvious ☐ Inferred slightly ☐ Inferred majorly	☐ Is Incorrect ☐ Has a minor mistake ☐ Has a misunderstanding	The Strategy is a(n)	☐ Counting Strategy ☐ Counting ☐ Counting on/back	☐ Additive Thinking Strategy ☐ Making 10 ☐ Using doubles (3+3) ☐ Part-Part-Whole	☐ Multiplicative Thinking Strategy ☐ Using Doubles (3x2) ☐ Arrays ☐ Part-Part-Whole ☐ Known Facts	☐ Other
Notes/Next Steps:	Follow up Questions to Ask the Student			Follow up Steps for Student			



Sweettarts

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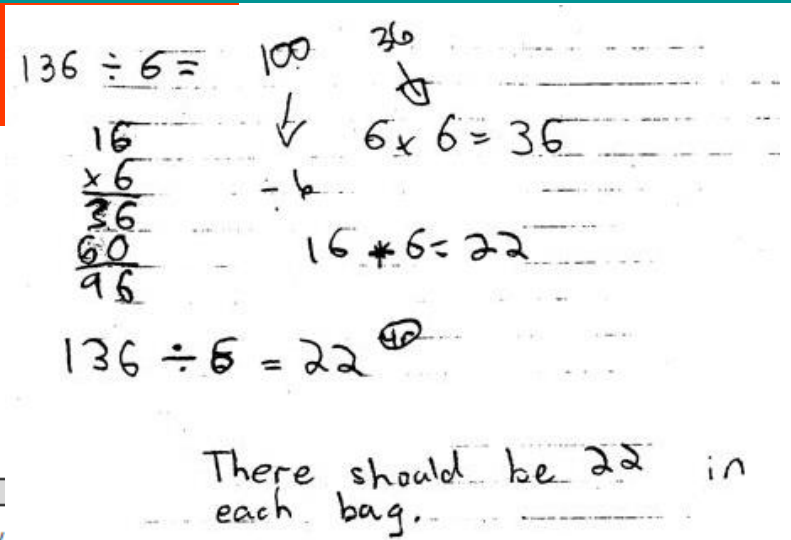
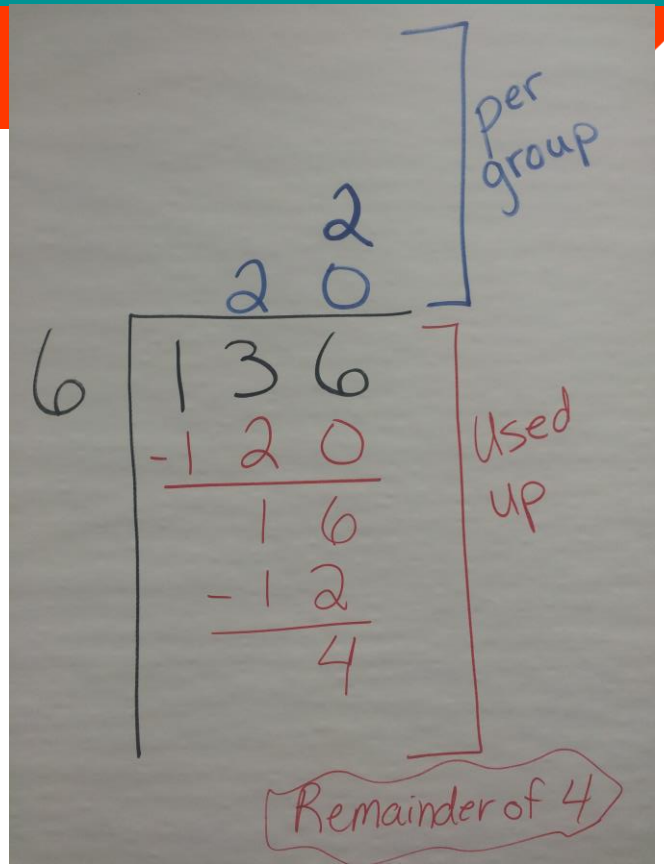


Quick Assessment						
The Answer	☐ Is Correct ☐ Obvious ☐ Inferred slightly ☐ Inferred majorly	☐ Is Incorrect ☐ Has a minor mistake ☐ Has a misunderstanding	The Strategy is a(n)	☐ Counting Strategy ☐ Counting ☐ Counting on/back	☐ Additive Thinking Strategy ☐ Making 10 ☐ Using doubles (3+3) ☐ Part-Part-Whole	☐ Multiplicative Thinking Strategy ☐ Using Doubles (3x2) ☐ Arrays ☐ Part-Part-Whole ☐ Known Facts
Notes/Next Steps:	Follow up Questions to Ask the Student			Follow up Steps for Student		

Sweettarts

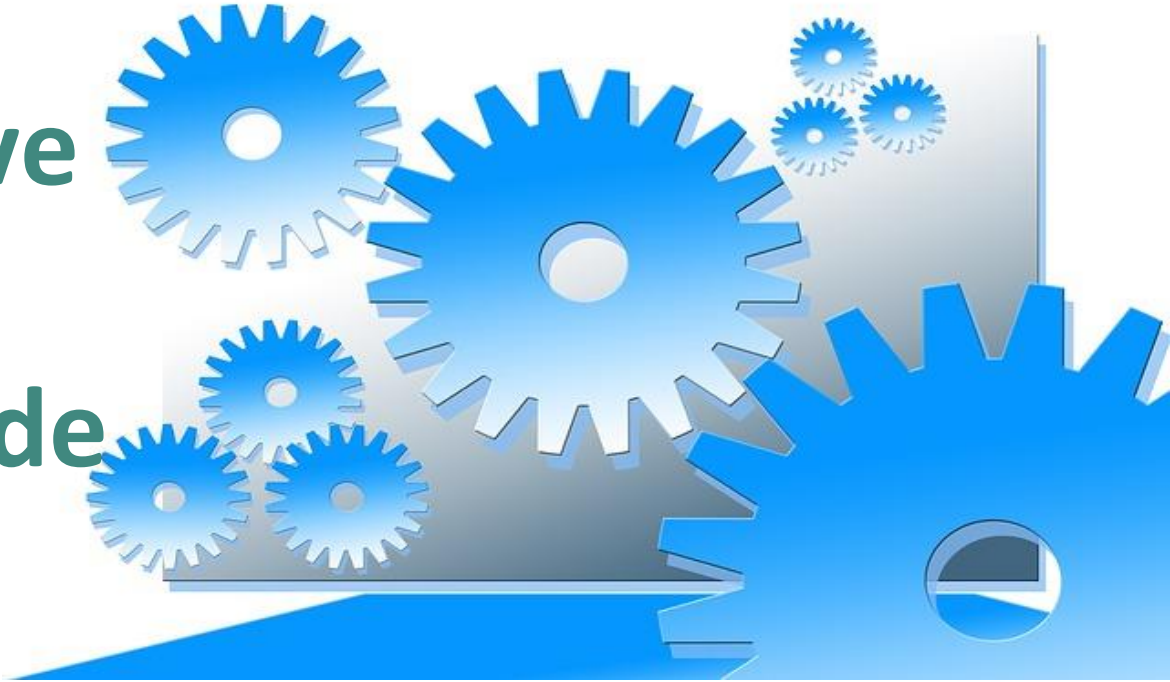


Alberta Regional Consortia

Elementary Mathematics Professional Learning

Apprentissage professionnel en mathématiques à l'élémentaire

Multiplicative Thinking Learning Guide



NRLC Regional Learning Consortium

Edmonton Regional Learning Consortium

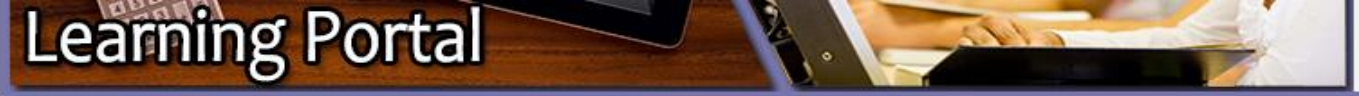
Learning Network Educational Services

Consortium provincial francophone

Central Alberta Regional Consortium

Calgary Regional Consort

Northern Alberta Professional Development Consortium



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Log in

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Tutorials

Elementary Mathematics Professional Learning
Apprentissage professionnel en mathématiques à l'élémentaire

Elementary Mathematics Professional Learning

Equality Webinar

English: November 2, 2015 at 1:00pm or 4:30pm

French: November 3, 2015 at 1:00pm or 4:00pm

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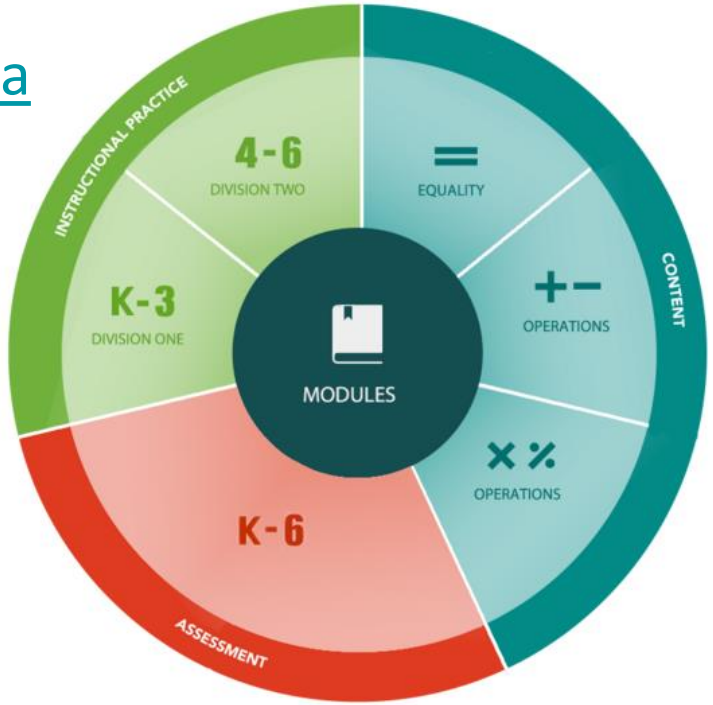
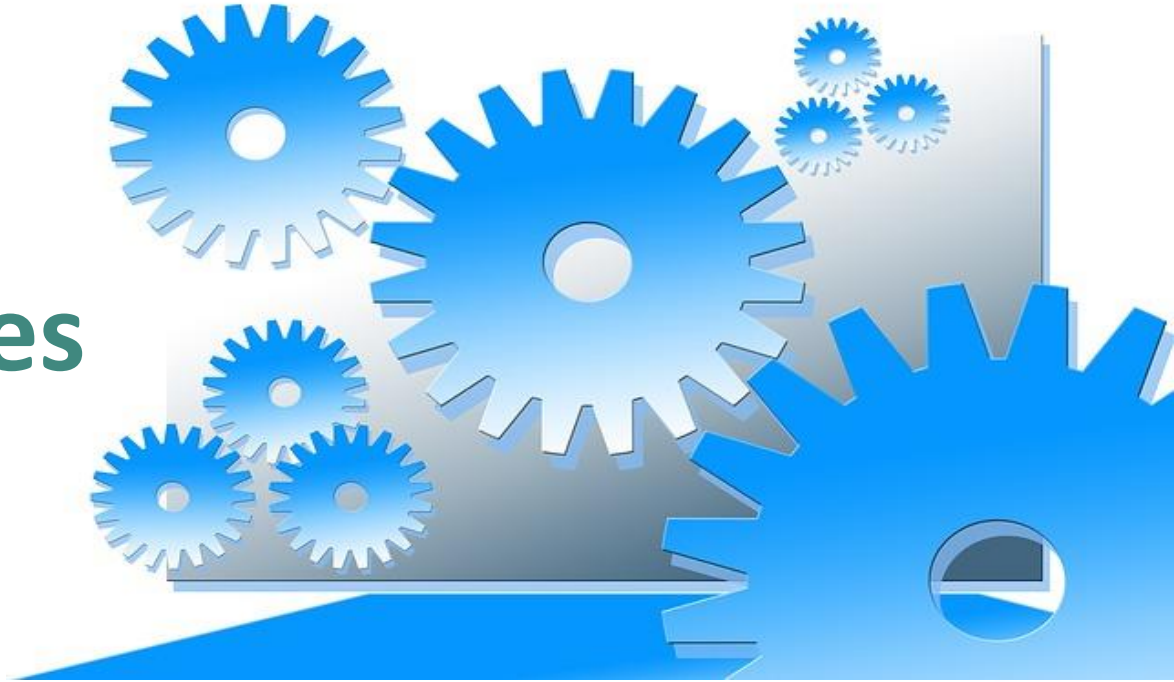
EMPL Website Tour

http://learning.arpdc.ab.ca



EMPL Opportunities



Upcoming Webinars

Assessment

February 22, 2016

- 1 pm - 2 pm
- 4 pm - 5 pm

Elementary Math Professional Learning Opportunity
Register at: http://arpdc.ab.ca

ARPDC

Calgary Regional Consortium — www.crcpd.ab.ca

Central Alberta Regional Consortium — www. carcpd.ab.ca

Consortium provincial francophone — www.cpfpp.ab.ca

Edmonton Regional Learning Consortium — www.erlc.ca

Learning Network Educational Services — www.learning-network.org

NRLC Northwest Regional Learning Consortium — www.nrlc.net

Southern Alberta Professional Development Consortium — www.sapdc.ca

Final Thought…

“Go down deep enough into ANYTHING and you will find Mathematics.”

~Dean Schlicter