

Old Math, New Tricks: Academic Excellence PTAC Session

Wednesday
1/18

10:30-11:30 am

Mike Reid, GPS Coordinator K-8 Math

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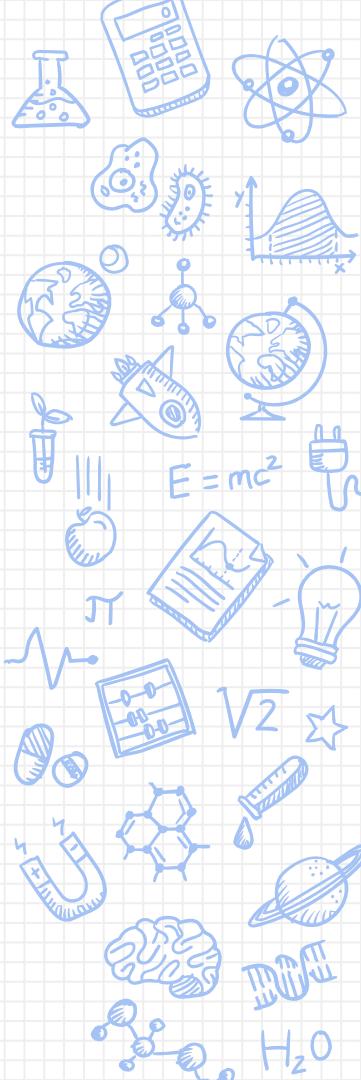


Jason Kim

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Learning Targets (Math)

- I understand the importance of visual models.
- I understand that my child will learn to use algorithms just like I did.
- I can support my child with breaking numbers apart and comparing them.

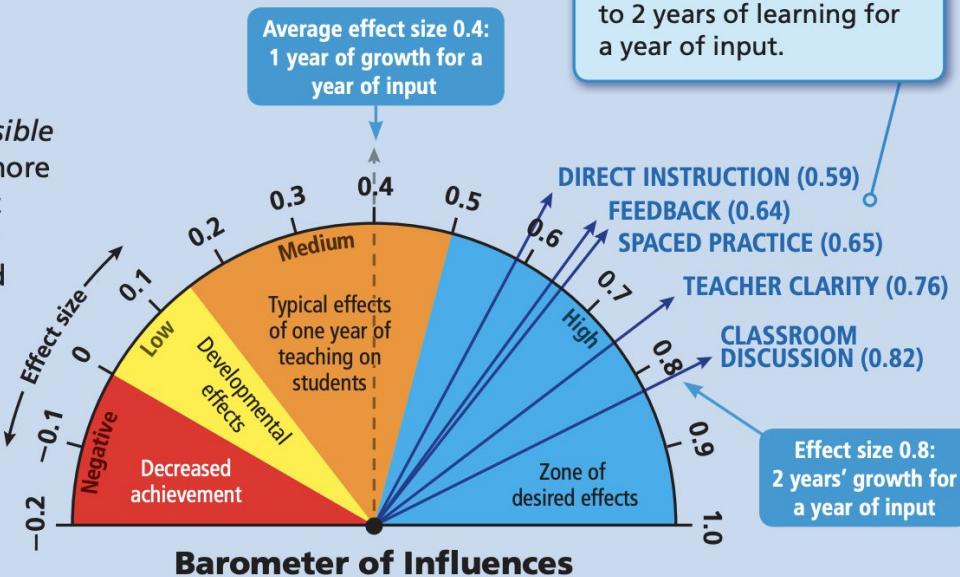


Why Big Ideas Math?

Embedded in every lesson!

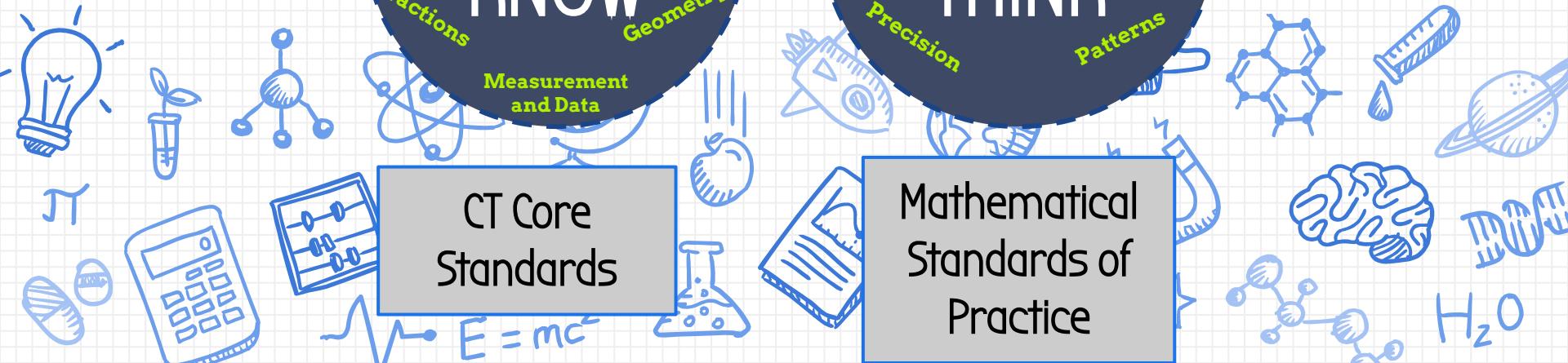
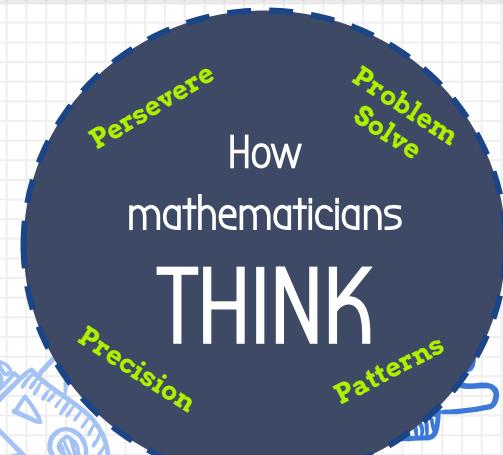
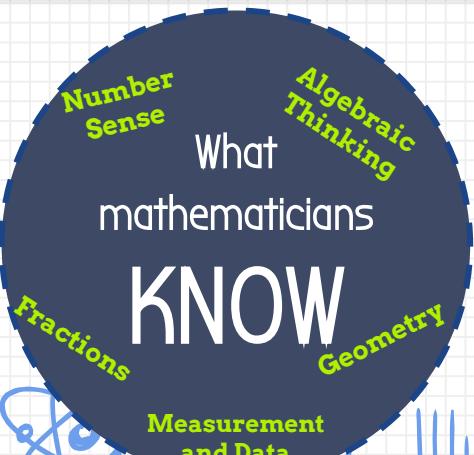
Five Strategies for Purposeful Focus

Professor John Hattie, in his *Visible Learning* network, identified more than 250 influences on student learning, and developed a way of ranking them. He conducted meta-analyses and compared the influences by their **effect size**—the impact the factor had on student learning.



We focus on **STRATEGIES** with some of the **HIGHEST IMPACT** on student achievement—up to 2 years of learning for a year of input.

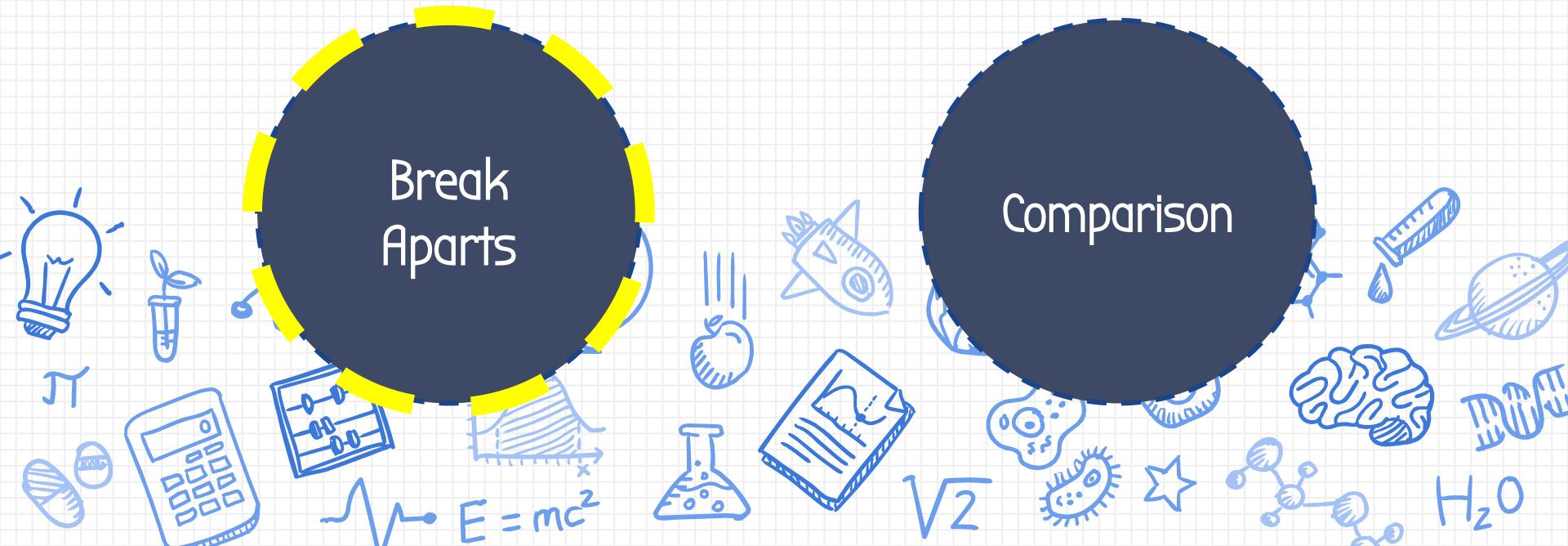
How your student learns math



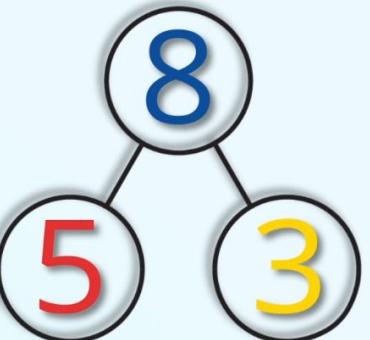
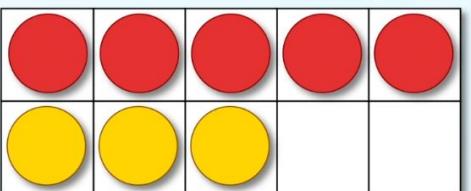
All math boils down to two concepts

Break Apart

Comparison

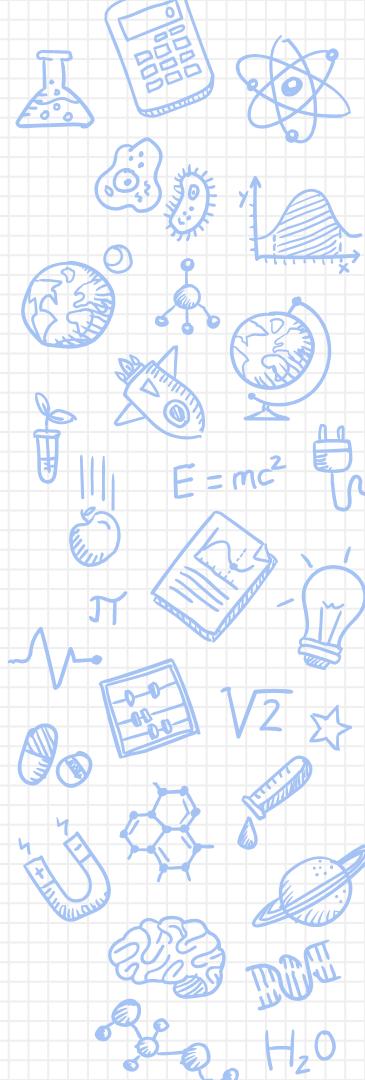


Break Apart (Number Bonds)



$$\underline{5} + \underline{3} = \underline{8}$$

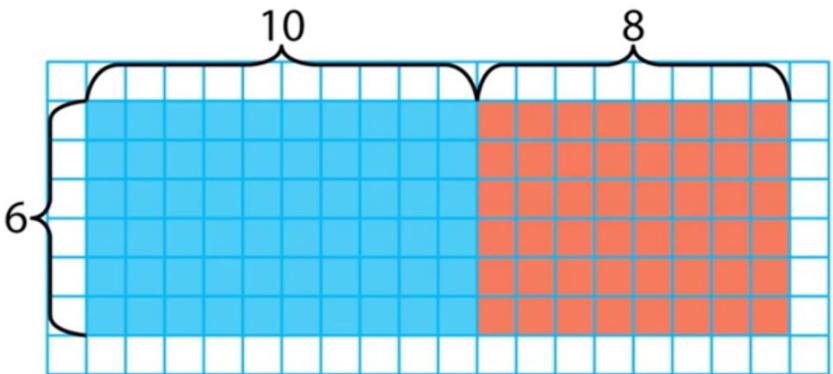
$$\underline{3} + \underline{5} = \underline{8}$$



Break Apart Numbers to Multiply

Use an area model to find 6×18 .

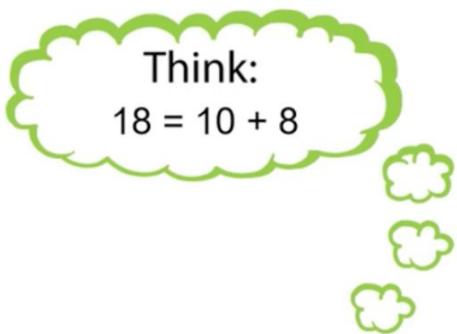
Model the expression. Break apart 18 as $10 + 8$.



$$6 \times 18 = 6 \times (\underline{10} + \underline{8})$$

Rewrite 18 as $10 + 8$.

Distributive Property

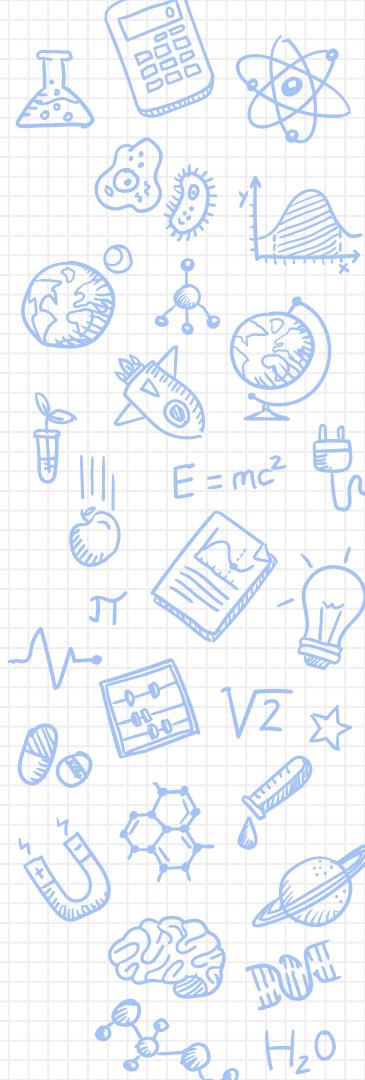


Let's build towards the algorithm.

$$825 + 113$$

$$\begin{array}{r} 825 \\ + 113 \\ \hline 938 \end{array}$$

$$\begin{array}{r} 825 \\ + 113 \\ \hline 938 \end{array} \quad \begin{array}{r} 800 \ 20 \ 5 \\ 100 \ 10 \ 3 \\ \hline 900+30+8 \end{array}$$

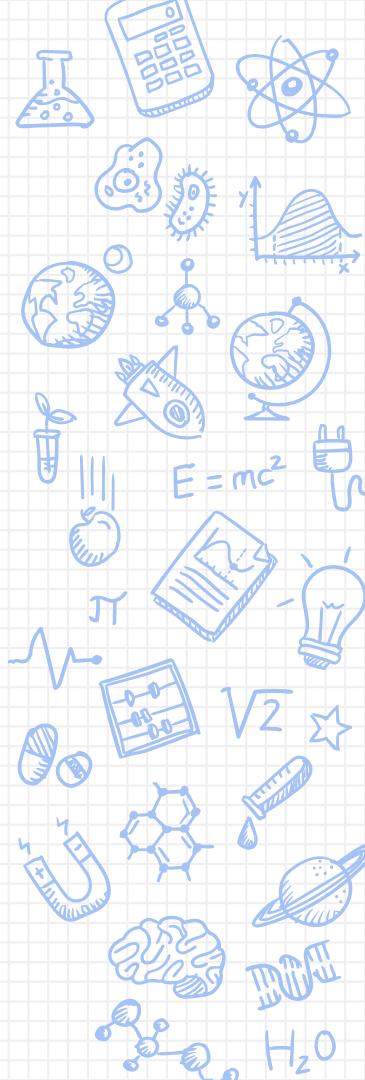


Let's build towards the algorithm.

$$825 - 247$$

$$\begin{array}{r} 7 \cancel{1} \cancel{2} \cancel{15} \\ 825 \\ - 247 \\ \hline 578 \end{array}$$

$$\begin{array}{r} 825 \rightarrow \cancel{800} \quad \cancel{110} \quad \cancel{15} \\ - 247 \rightarrow 200 \quad 40 \quad 7 \\ \hline 578 \quad 500 + 70 + 8 \end{array}$$



Let's build towards the algorithm.

$$825 \times 3$$

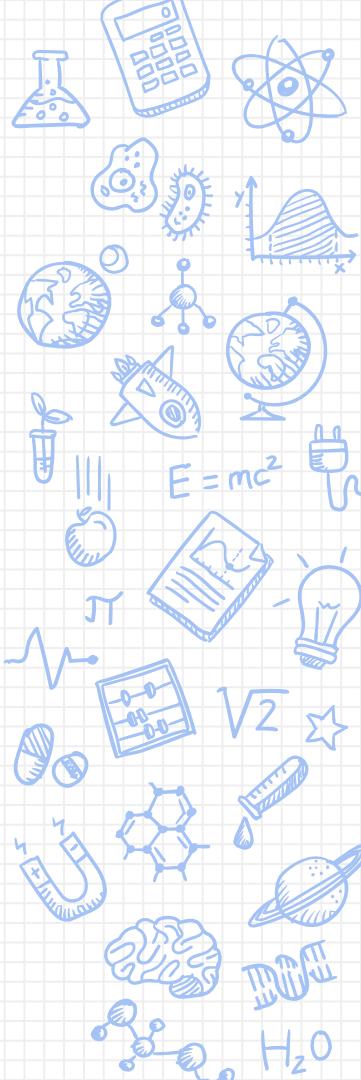
$$\begin{array}{r} 825 \\ \times \quad 3 \\ \hline 2,475 \end{array}$$

$$\begin{array}{r} 825 \\ \times \quad 3 \\ \hline \end{array}$$

$$800 \times 3 = 2,400$$

$$20 \times 3 = \quad 60$$

$$\begin{array}{r} 5 \times 3 = \quad 15 \\ \hline 2,475 \end{array}$$



Let's build towards the algorithm.

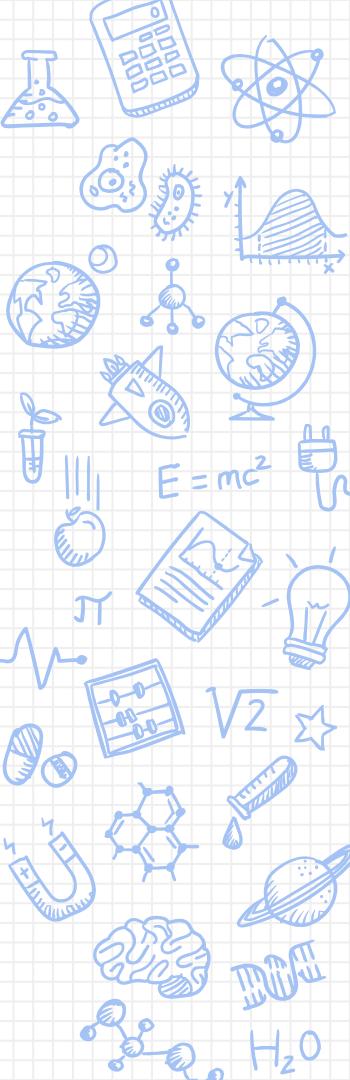
$$\begin{array}{r}
 275 \\
 \hline
 3) 825 \\
 -6 \downarrow \\
 \hline
 22 \\
 -21 \downarrow \\
 \hline
 15
 \end{array}$$

$$825 \div 3$$

600 210 15

$$600 \div 3 = 200$$
$$210 \div 3 = 70$$
$$15 \div 3 = 5$$

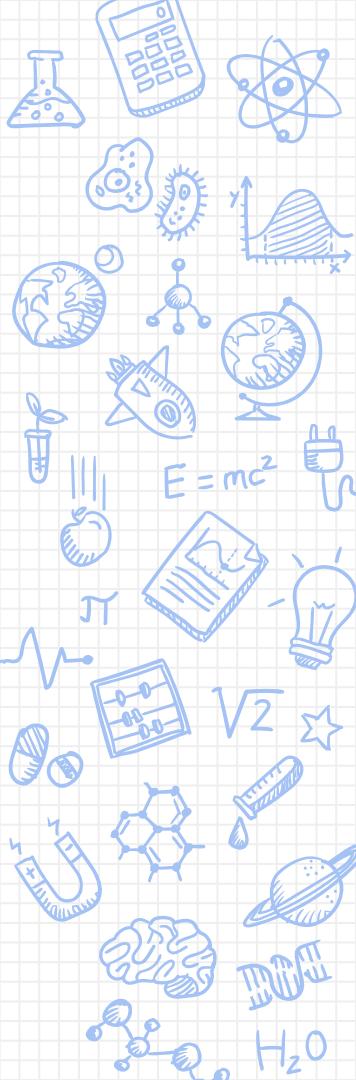
$$275$$



Let's build towards the algorithm.

$$3x + 5 = 17$$
$$\begin{array}{r} -5 \\ \hline 3x \\ \hline 3 \end{array}$$
$$x = 4$$

$$3x + 5 = 17$$
$$12 + 5 = 17$$
$$3 \times 4 = 12$$
$$x = 4$$



All math boils down to two concepts

Break
Apart

Comparison



Algebra in Grade 1? Absolutely!!

1.OA.8. Addition & Subtraction Equations

Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations $8 + ? = 11$, $5 = \underline{\hspace{1cm}} - 3$, $6 + 6 = \underline{\hspace{1cm}}$.

Addition

a. $8 + 6 = \underline{\hspace{1cm}}$

b. $\underline{\hspace{1cm}} = 8 + 6$

Missing Sum

c. $8 + \underline{\hspace{1cm}} = 14$

d. $14 = 8 + \underline{\hspace{1cm}}$

Missing 2nd Addend

e. $\underline{\hspace{1cm}} + 6 = 14$

f. $14 = \underline{\hspace{1cm}} + 6$

Missing 1st Addend

Subtraction

a. $14 - 6 = \underline{\hspace{1cm}}$

b. $\underline{\hspace{1cm}} = 14 - 6$

Missing Difference

c. $14 - \underline{\hspace{1cm}} = 8$

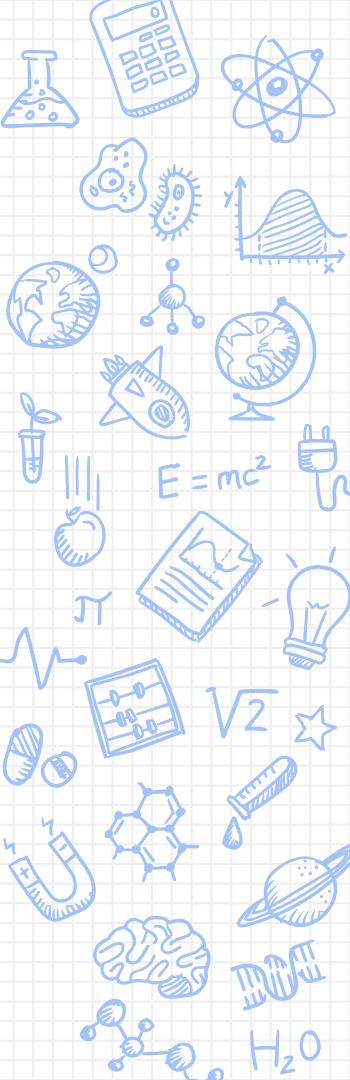
d. $8 = 14 - \underline{\hspace{1cm}}$

Missing Subtrahend

e. $\underline{\hspace{1cm}} - 6 = 8$

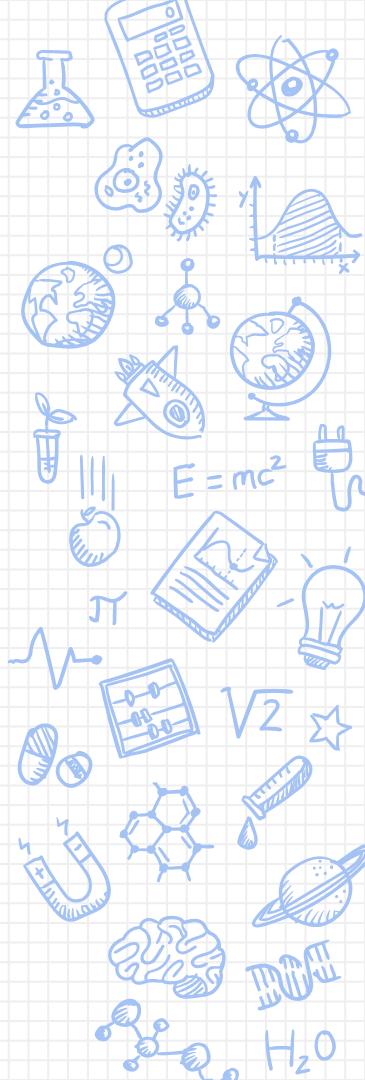
f. $8 = \underline{\hspace{1cm}} - 6$

Missing Minuend

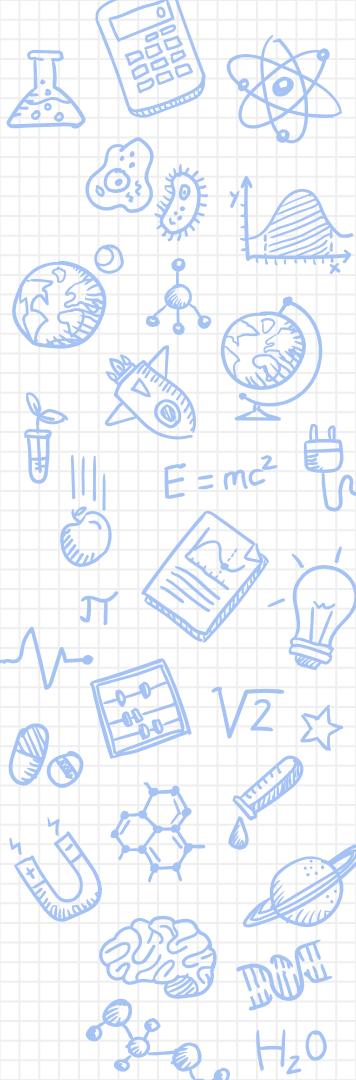


K-2 Word Problem Types

K-2 Word Problems	Easy	Moderate	Hard
	Result Unknown	Change Unknown	Start Unknown
Add to (join)	1K. Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now?	2. Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two?	3. Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before?
Take from (separate)	4K. Five apples were on the table. I ate two apples. How many apples are on the table now?	5. Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat?	6. Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before.

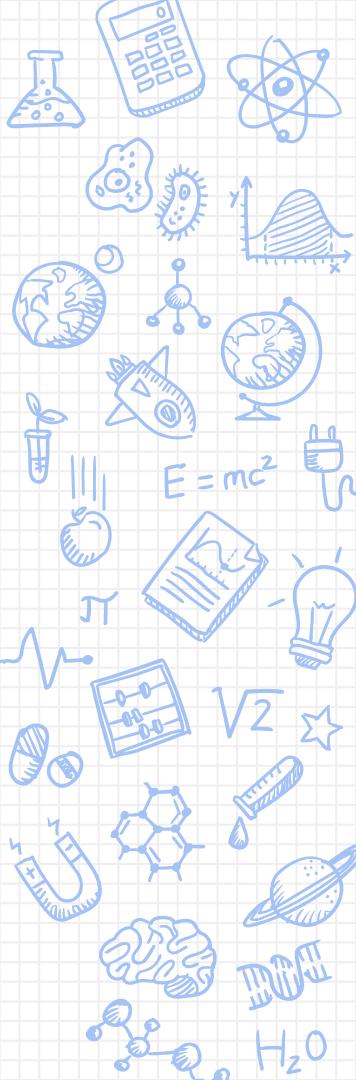


K-2 Word Problem Types



	Easy	Moderate	Hard
	Total Unknown	Addend Unknown	Both Addends Unknown
Add together/ Take apart (part-part-whole)	7K. Three red apples and two green apples are on the table. How many apples are on the table?	8K. Five apples are on the table. Three are red and the rest are green. How many apples are green?	9. Grandma has five flowers. How many can she put in her red vase and how many in her blue vase?
	Difference Unknown	Bigger Unknown	Smaller Unknown
Compare with <u>more</u>	*10. Tammy has two apples. Greg has five apples. How many <u>more</u> apples does Greg have than Tammy?	12. Greg has three <u>more</u> apples than Tammy. Tammy has two apples. How many apples does Greg have?	*14. Greg has three <u>more</u> apples than Tammy. Greg has five apples. How many apples does Tammy have?
	11. Tammy has two apples. Greg has five apples. How many <u>fewer</u> apples does Tammy have than Greg?	*13. Tammy has three <u>fewer</u> apples than Greg. Tammy has two apples. How many apples does Greg have?	15. Tammy has three <u>fewer</u> apples than Greg. Greg has five apples. How many apples does Tammy have?

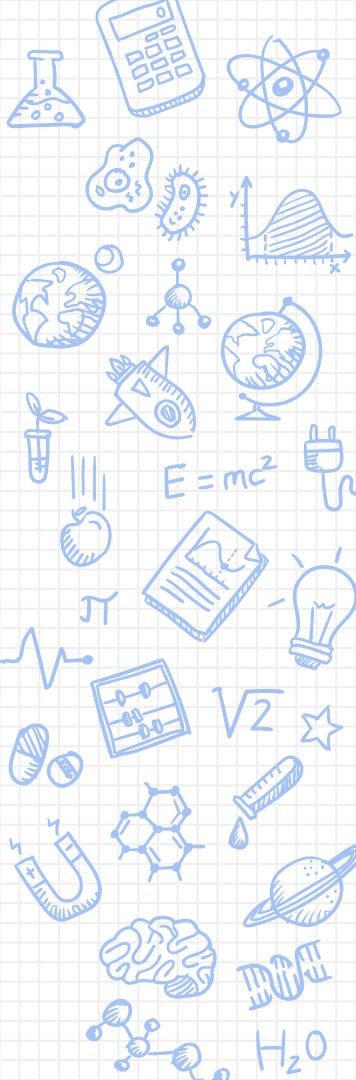
3-5 Word Problem Types



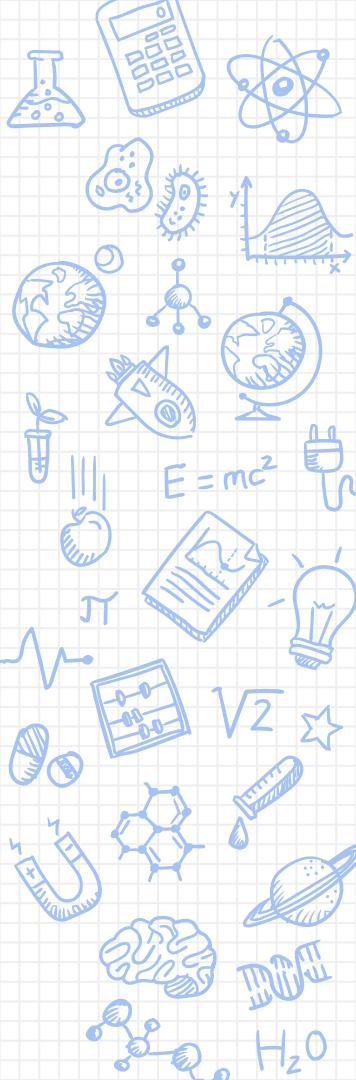
Common Multiplication & Division Situations	Product Unknown $3 \times 6 = ?$	Group Size Unknown "How many in each group?" partitive or sharing $3 \times ? = 18, 18 \div 3 = ?$	Group Number Unknown "How many groups?" quotative or grouping $? \times 6 = 18, 18 \div 6 = ?$
3.OA.3 Equal Groups	<p>1a. There are 3 bags with 6 plums in each bag. How many plums are there in all?</p> <p><i>1b. Measurement example.</i> You need 3 lengths of string, each 6 inches long. How much string will you need altogether?</p>	<p>2a. If 18 plums are shared equally into 3 bags, then how many plums will be in each bag?</p> <p><i>2b. Measurement example.</i> You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?</p>	<p>3a. If 18 plums are to be packed 6 to a bag, then how many bags are needed?</p> <p><i>3b. Measurement example.</i> You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?</p>

3-5 Word Problem Types

Common Multiplication & Division Situations	Product Unknown	Group Size Unknown "How many in each group?" partitive or sharing	Group Number Unknown "How many groups?" quotative or grouping
	$3 \times 6 = ?$	$3 \times ? = 18, 18 \div 3 = ?$	$? \times 6 = 18, 18 \div 6 = ?$
3.OA.3 Arrays Area	4a. There are 3 rows of apples with 6 apples in each row. How many apples are there? 4b. <i>Area example.</i> What is the area of a 3 cm by 6 cm rectangle?	5a. If 18 apples are arranged into 3 equal rows, how many apples will be in each row? 5b. <i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?	6a. If 18 apples are arranged into equal rows of 6 apples, how many rows will there be? 6b. <i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?



3-5 Word Problem Types



Common Multiplication & Division Situations	Product Unknown	Group Size Unknown "How many in each group?" partitive or sharing	Group Number Unknown "How many groups?" quotative or grouping
4.OA.2. Compare	$3 \times 6 = ?$	$3 \times ? = 18, 18 \div 3 = ?$	$? \times 6 = 18, 18 \div 6 = ?$
	<p>1a. A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost?</p> <p>1b. <i>Measurement example.</i> A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?</p>	<p>2a. A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost?</p> <p>2b. <i>Measurement example.</i> A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?</p>	<p>3a. A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat?</p> <p>3b. <i>Measurement example.</i> A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?</p>

Why do we need to visualize?

A jacket and scarf cost \$110. The jacket costs \$100 more than the scarf. How much does the scarf cost?

Algebra

$$\text{Scarf} = x$$

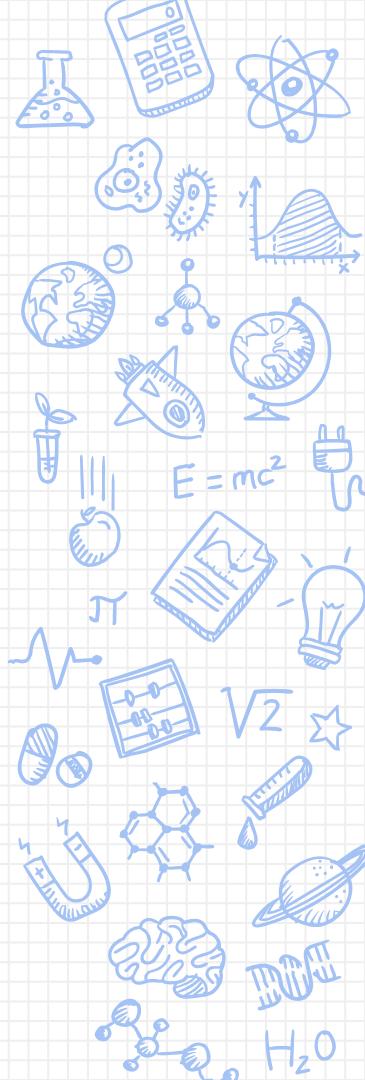
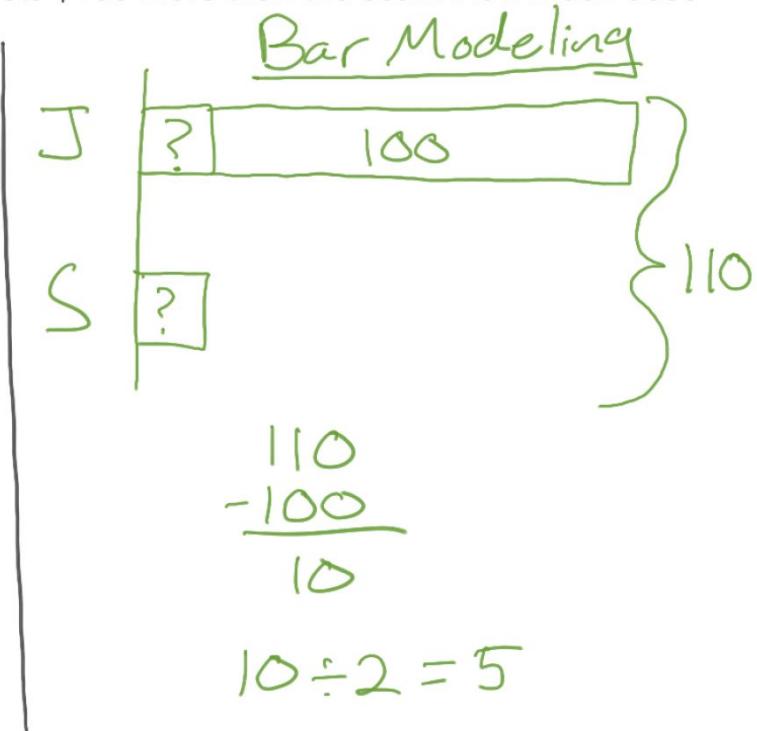
$$\text{Jacket} = x + 100$$

$$x + x + 100 = 110$$

$$2x + 100 = 110$$

$$-100 \brace -100$$

$$\frac{2x}{2} \quad \frac{10}{2}$$
$$x = 5$$



Grade 1- “Add to”

There were 5 birds in a flock. 8 more birds joined them. How many birds are in the flock now?

Fall Grade 1
Part Part Whole

Total	
Start	Change
5	8

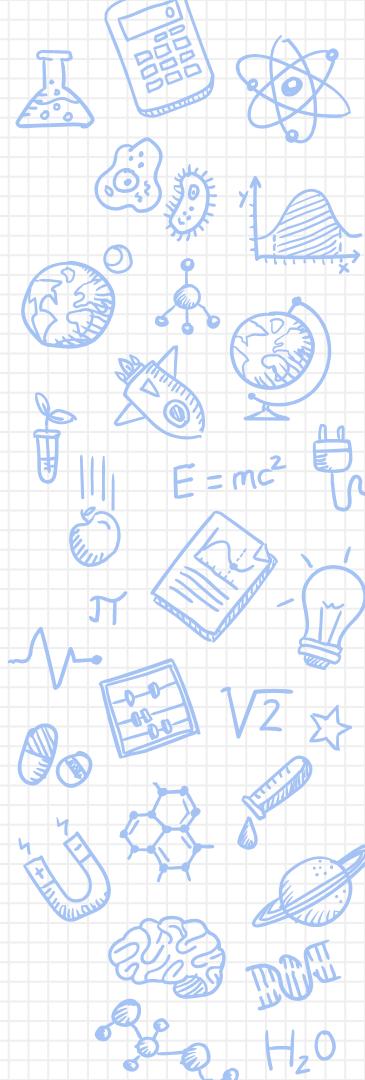
$$5 + 8 = \boxed{13}$$

Grade 2
Bar Model or Tape Diagram

B

A bar model is shown. A vertical line on the left is labeled 'B'. To its right is a bracket spanning the width of the bar. Above the bracket is the number '13'. Below the bracket is a horizontal bar divided into two segments by a vertical line in the middle. The left segment is labeled '5' and the right segment is labeled '8'.

$$5 + 8 = \boxed{13}$$



Grade 1- "Take From"

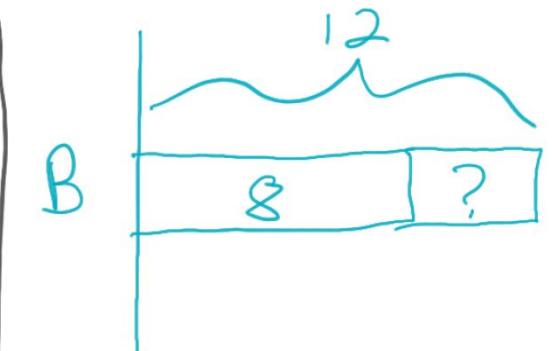
There were 12 bees in a hive. 8 bees flew away. How many bees are still in the hive?

Total	
12	
8	?

Change End

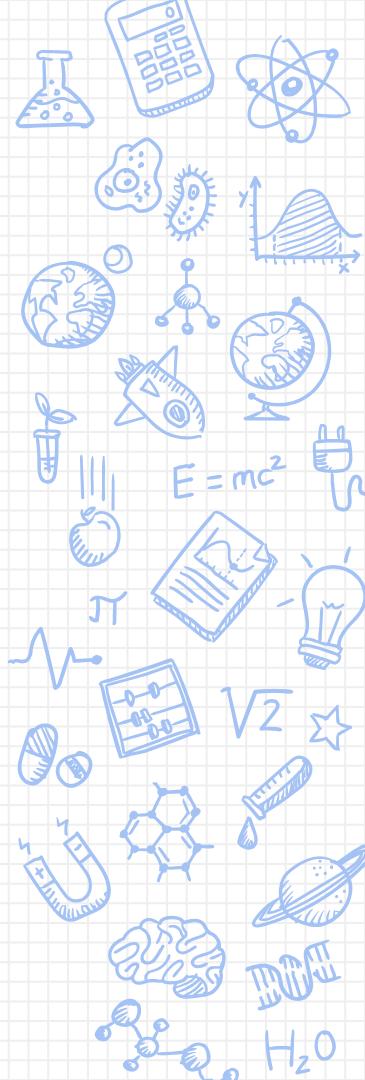
$$12 - 8 = \boxed{4}$$

$$8 + \boxed{4} = 12$$



$$12 - 8 = \boxed{4}$$

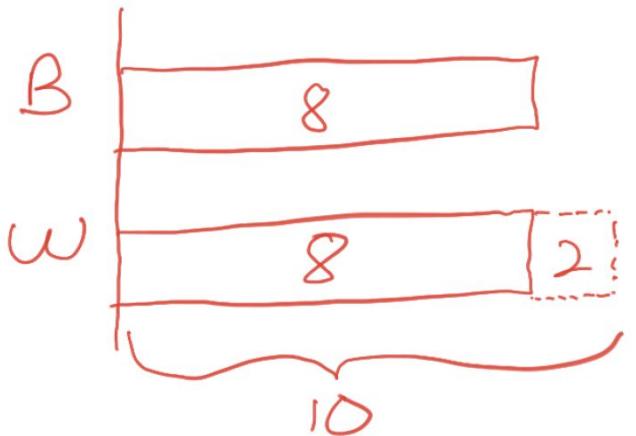
$$8 + \boxed{4} = 12$$



Grade 1- “Compare Bigger”

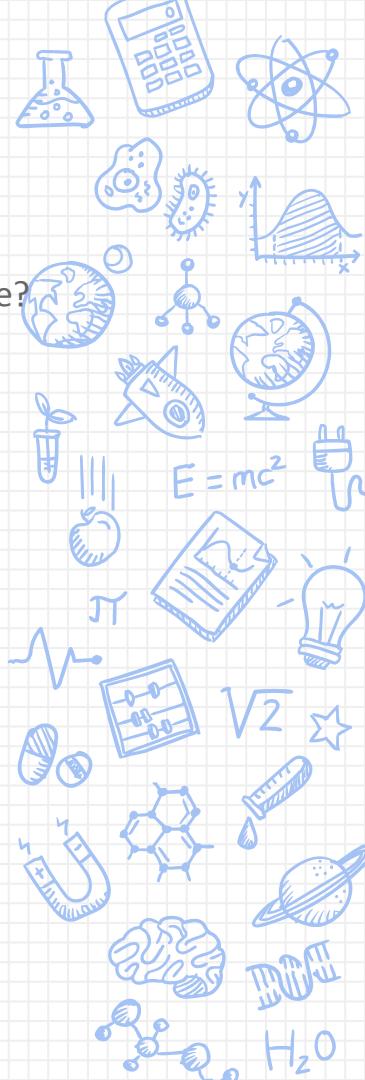
There are 2 fewer black sheep than white sheep. 8 sheep are black. How many sheep are white?

Bar Model



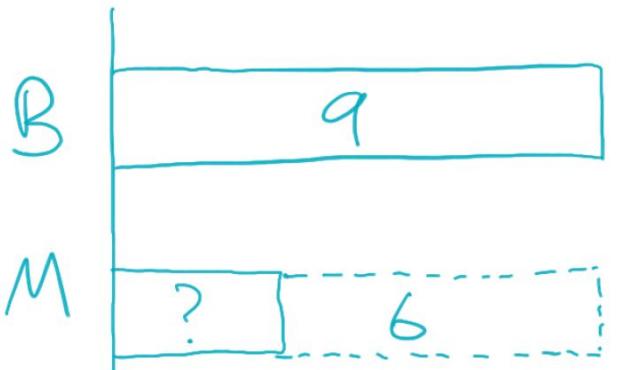
$$8+2=10$$

10 sheep are white.



Grade 1- "Compare Smaller"

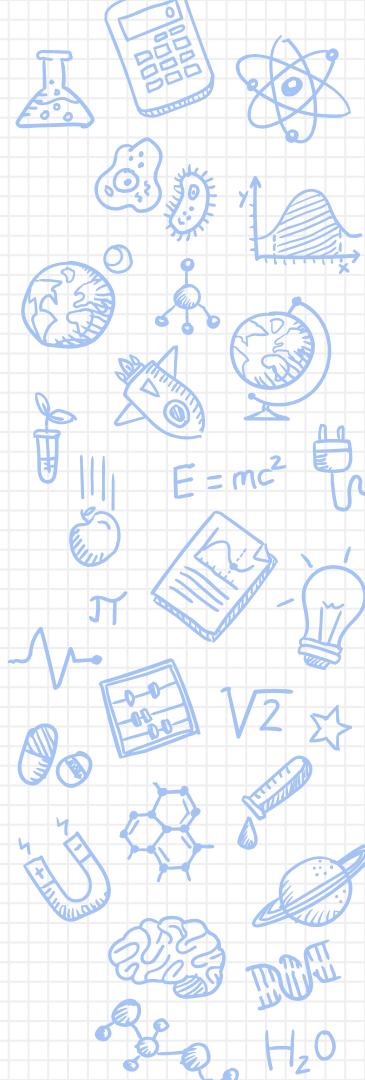
There are 6 more butterflies than moths. There are 9 butterflies. How many moths are there?



$$9 - 6 = 3$$

$$3 + 6 = 9$$

There are
3 moths.



Grade 4

Last summer, Claire swam 4 times as many miles as Julie. Together they swam 65 miles. How many fewer miles did Julie swim than Claire?

Algebra

$$\text{Julie} = x = 13$$

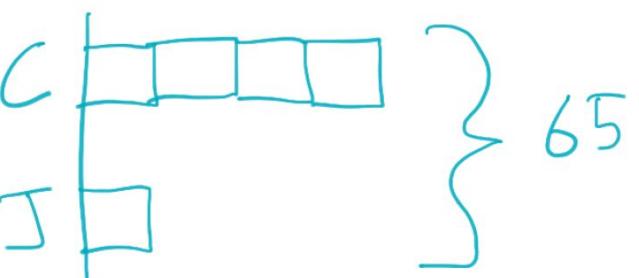
$$\text{Claire} = 4x = 52$$

$$4x + x = 65$$

$$5x = 65$$

$$x = 13$$

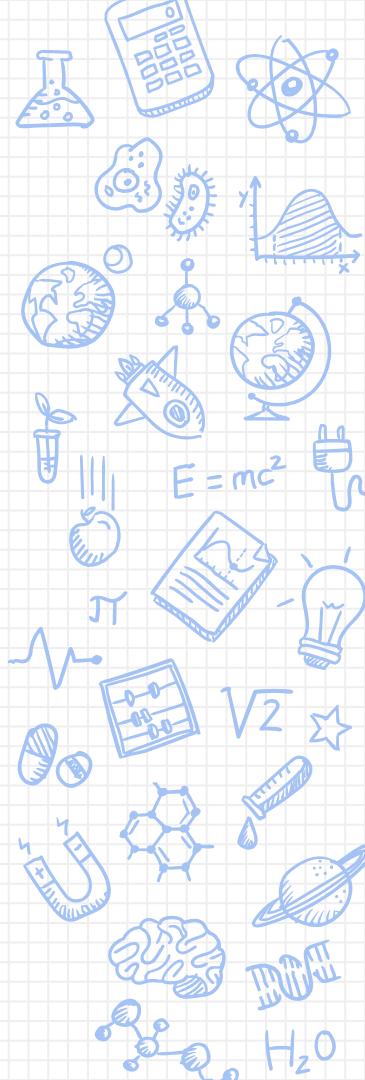
$$52 - 13 = \boxed{39}$$



$$65 \div 5 = 13 \text{ (Julie)}$$

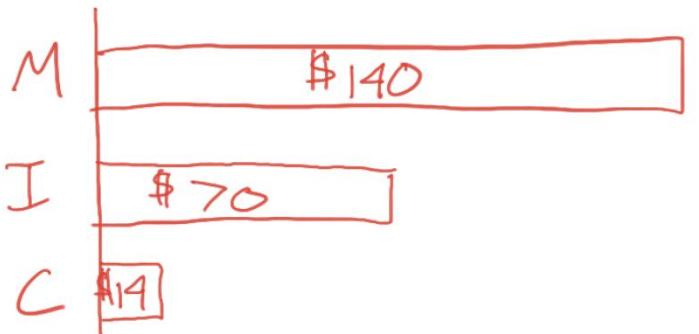
$$13 \times 4 = 52 \text{ (Claire)}$$

$$52 - 13 = \boxed{39}$$



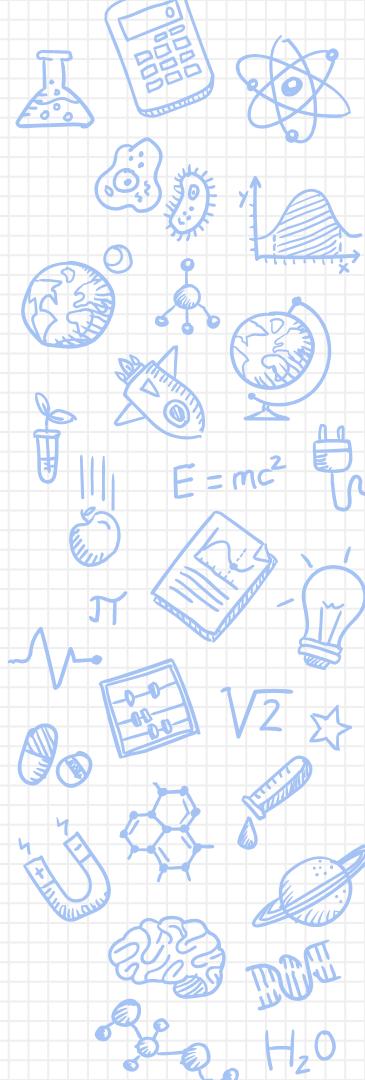
Grade 4

Isabella has five times as much money as Carlo and one-half as much money as Marcos. If Marcos has \$140, how much money does Carlo have?



$$140 \div 2 = 70$$

$$70 \div 5 = 14$$



Parent Resources!



[Coffee Chat Word Problems](#)

[Cohesive Progressions](#)

[Standards for Mathematical Practice |](#)
[Common Core State Standards Initiative](#)