Welcome to Model Drawing for Problem Solving

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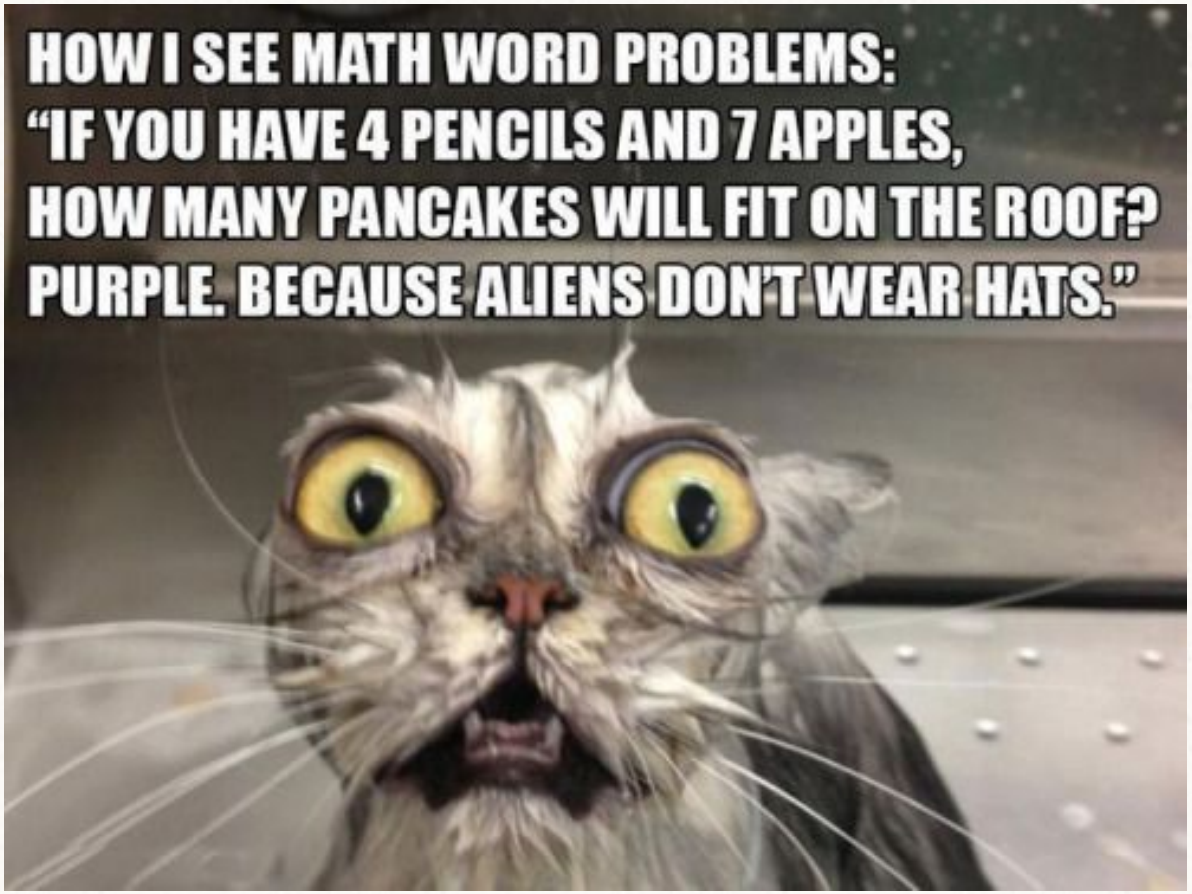
Is this how you feel about word problems?



Entrance Ticket

How do you feel about word problems and why do you feel that way?

For instance, how would you feel about this problem:

Of all the students at Watson Elementary School, 3/5 went on fieldwork to the aquarium, 3/4 of the remainder went on fieldwork to the zoo, and the rest stayed at school to do research online. If there were 640 students who attended Watson Elementary School, how many went to the zoo?

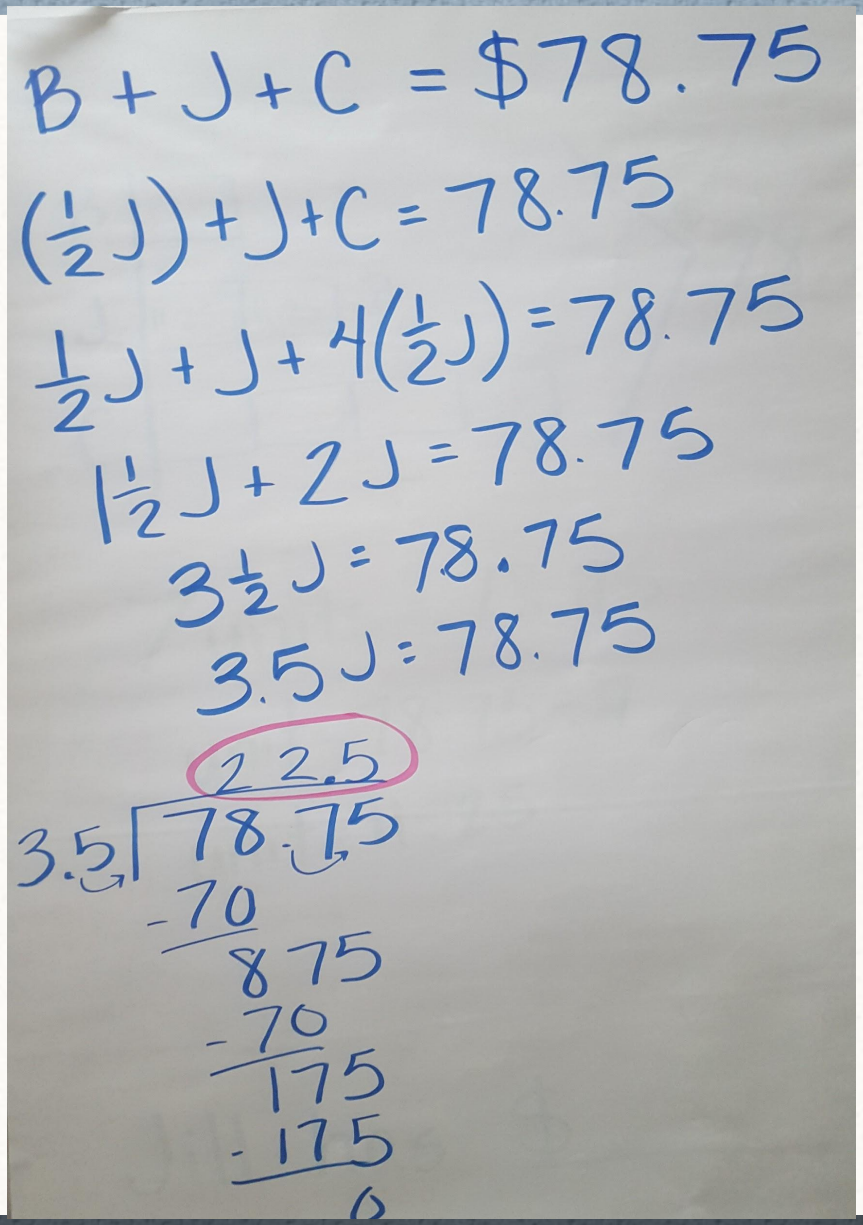
Learning Targets:

- I can apply my understanding of model drawing to solve word problems.
- I can implement model drawing in my classroom as a strategy to help students solve word problems.

Give it a try…

Betty, Jill and Chris shared $78.75. Betty had ½ as much money as Jill and Chris had 4 times as much money as Betty. How much money did Jill have?

Your way to finding a solution:


B + J + C = $78.75
(1/2 J) + J + C = 78.75
1/2 J + J + 4(1/2 J) = 78.75
1 1/2 J + 2J = 78.75
3 1/2 J = 78.75
3.5 J = 78.75
22.5
3.5 | 78.75
-70
875
-70
175
-175
0

What is model drawing?

"Model drawing is a process of synthesis that a student goes through as they construct the model based on the information given in the problem, then he or she analyzes the model to develop a sequence of logical steps for the solution."

– The Singapore Model Method

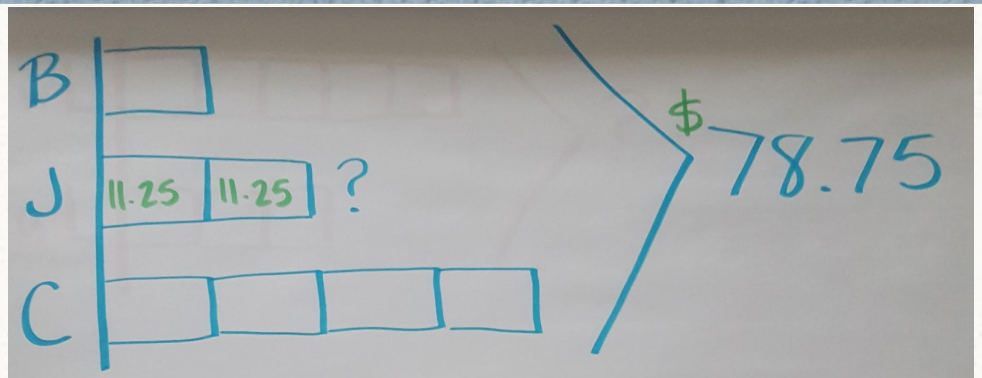
Model Drawing helps students to:

- Solve word problems accurately and efficiently
- Communicate math thinking
- Strengthen problem-solving skills and algebraic thinking
- Identify known and unknown quantities
- Visually represent their thinking
- Organize complex information in word problems

Give it a try…

Betty, Jill and Chris shared $78.75. Betty had ½ as much money as Jill and Chris had 4 times as much money as Betty. How much money did Jill have?

Model-drawing solution:



7 units = 78.75

unit = 78.75 ÷ 7

unit = 11.25

Jill has $____.

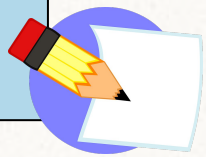
Model Drawing Process

1. Read the entire problem.
2. Rewrite the question as an "mmm" statement.
3. Draw and label the unit bars. (Remember to include a question mark.)
4. Solve the problem.
5. Write the answer in the "mmm" statement.
6. Does the answer makes sense?

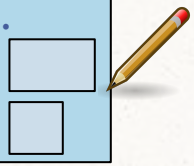
Model Drawing Flow Chart

Read the whole problem.

Restate the question with an "mmm" statement.

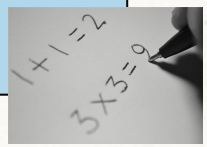


Draw the unit bars.



Put in the question mark.

Solve the problem.



Write the answer in the "mmm" statement. Does it make sense?

Model Drawing Progression

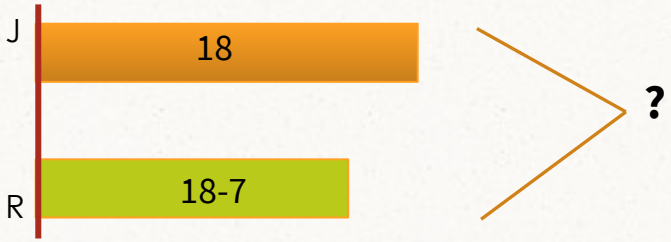
First, students use concrete objects to represent numbers.

Brooke has 8 oranges. She has 3 more oranges than apples. How many apples does Brooke have?

Brooke has _____ apples.

Next, students progress to drawing unit bars as the pictorial representation of a word problem.

John's ribbon is 18 inches long. Robin's ribbon is 7 inches shorter than John's. How many inches of ribbon do they have altogether?



They have _____ inches altogether.

Discrete Model:

The discrete model uses a one-to-one correspondence between the number of units in the model and the quantity represented in the problem.

Ally ate 2 plums and 1 orange. What was the total number of pieces of fruit that Ally ate?

Ally's fruit

Ally ate a total of ____pieces of fruit.

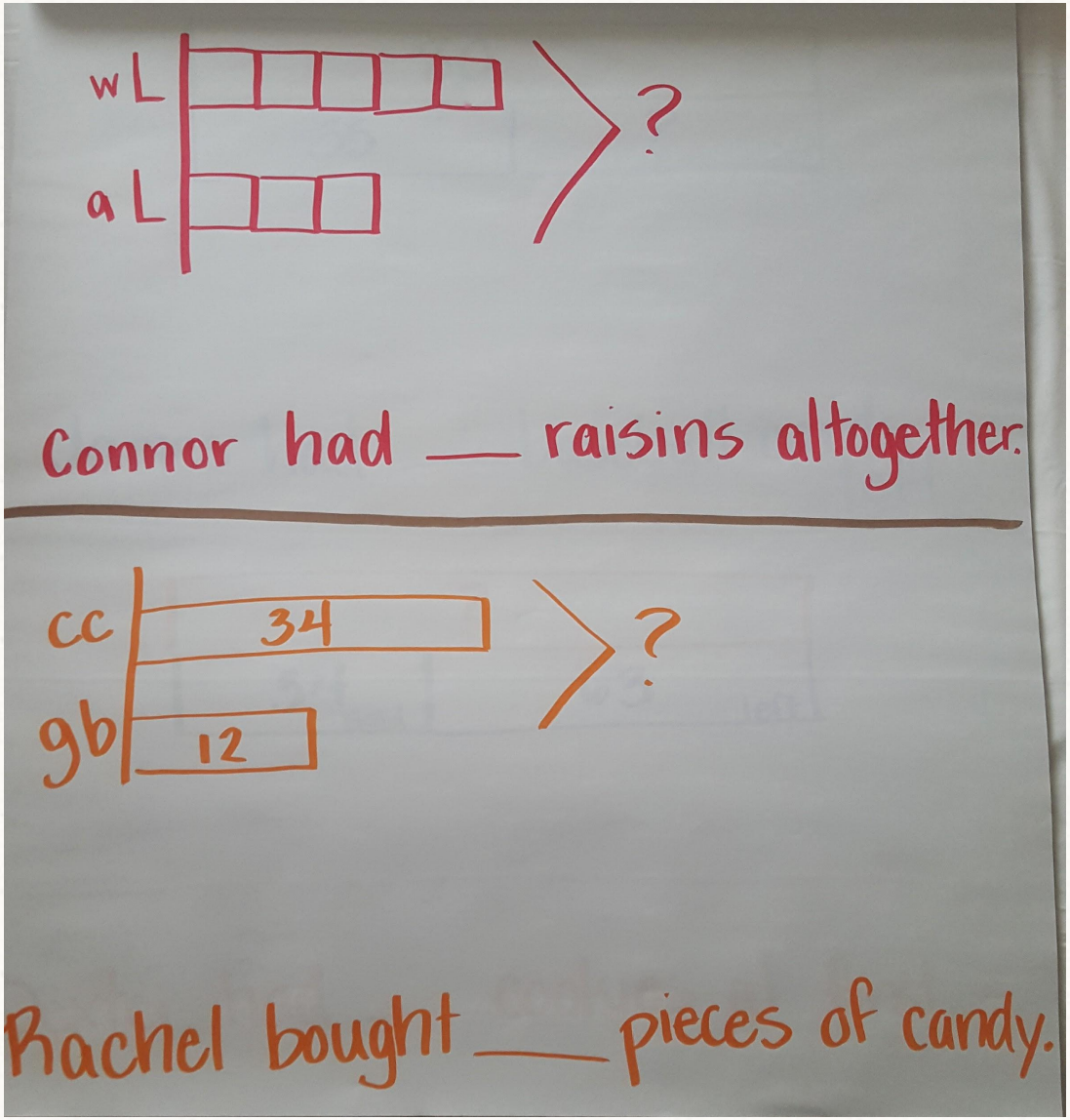
Practice drawing a model and solving with a partner.

Connor ate 5 raisins with lunch and 3 raisins after lunch. How many raisins did Connor eat altogether?

Connor ate ____ raisins altogether.

Rachel bought 34 candy canes and 12 gumballs. How many total pieces of candy did Rachel buy?

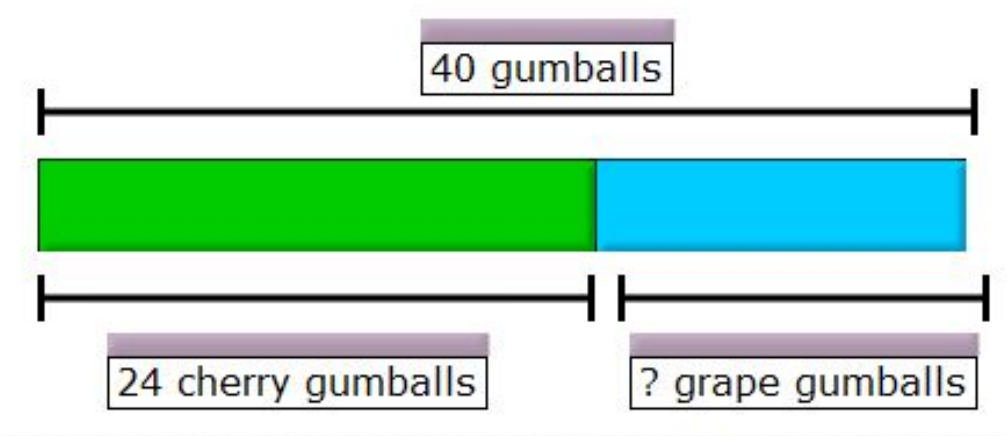
Rachel bought ____ pieces of candy.


wL
aL
?
Connor had ___ raisins altogether.
cc
34
gb
12
?
Rachel bought ___ pieces of candy.

Part – Whole

A whole is divided into 2 or more parts.

Kevin has 40 cherry and grape gumballs in all. He has 24 cherry gumballs. How many grape gumballs does he have?



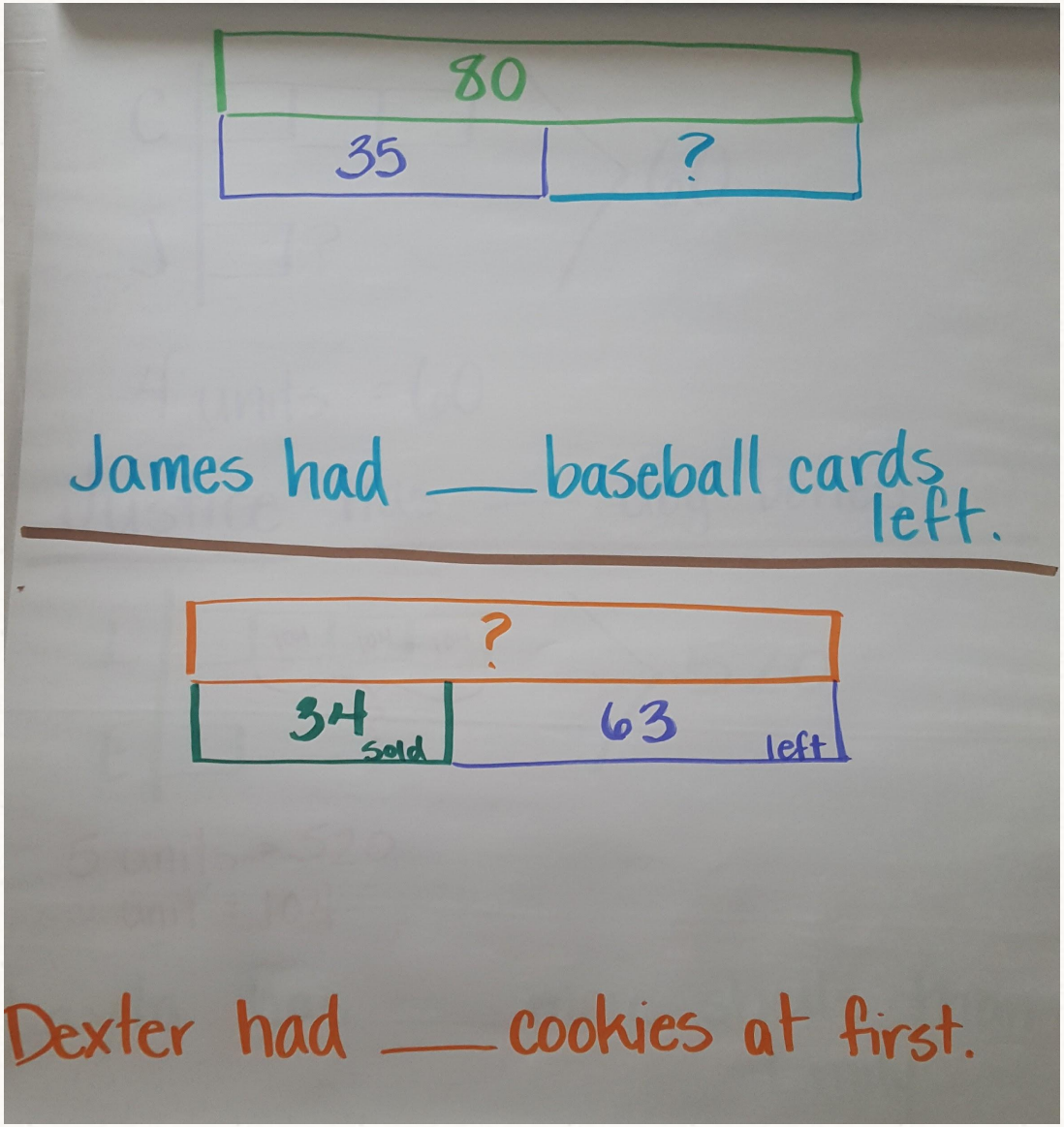
40 – 24 = 16

Kevin has ____grape gumballs.

Practice drawing a model and solving with a partner.

James had 80 baseball cards. He sold 35. How many baseball cards does James have left?

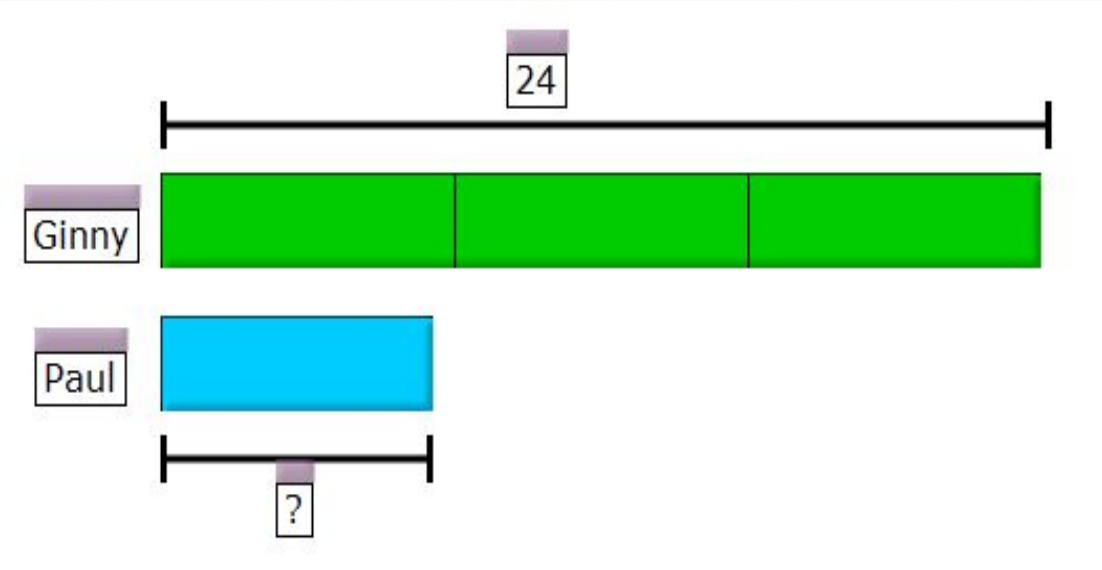
After selling 34 cookies, Dexter had 63 cookies left. How many cookies did he have at first?


80
35
?
James had ___ baseball cards left.
?
34 sold
63 left
Dexter had ___ cookies at first.

Comparison

Shows the relationship between two or more quantities.

Ginny has 24 erasers. She has 3 times as many erasers as Paul does. How many erasers does Paul have?



3 units = 24

24 ÷ 3 = 8

1 unit = 8

Paul has one unit.

Paul has __8__ erasers.

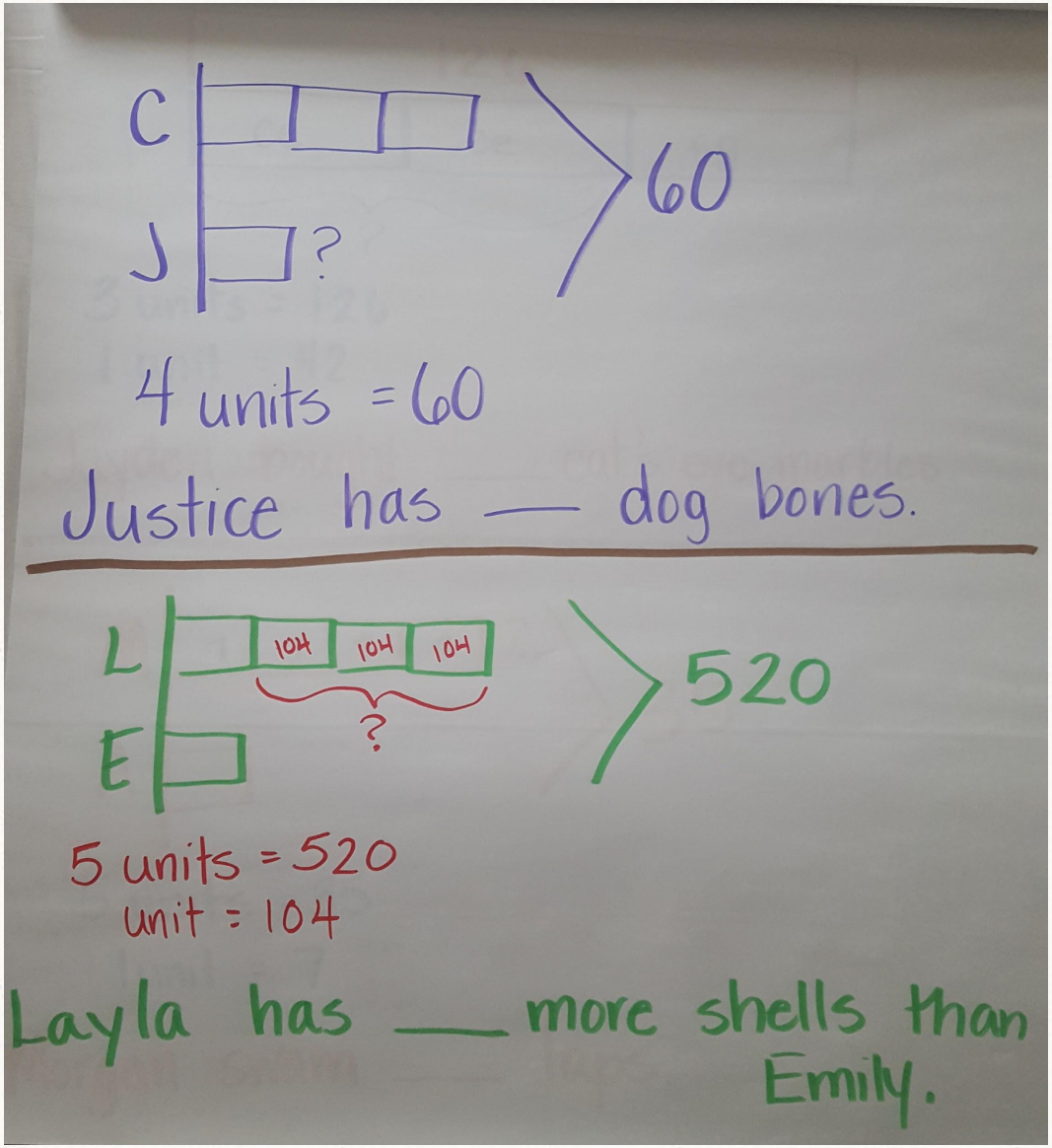
Practice with a partner

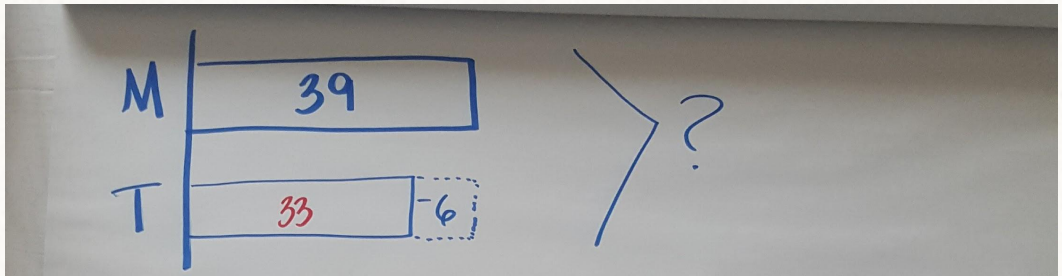
Chase had 3 times as many dog bones as Justice. If they had 60 dog bones altogether, how many dog bones did Justice have?

Layla had 4 times as many shells in her collection as Emily did. If they had 520 shells altogether, how many more shells did Layla have than Emily?

Naseem drove 39 miles on Monday. He drove drove 6 fewer miles on Tuesday. How many miles did he drive altogether?

Gavin and Jaclyn collect coins. Gavin has 88 coins. Jaclyn has 74 more coins than Gavin. How many coins do they have altogether?

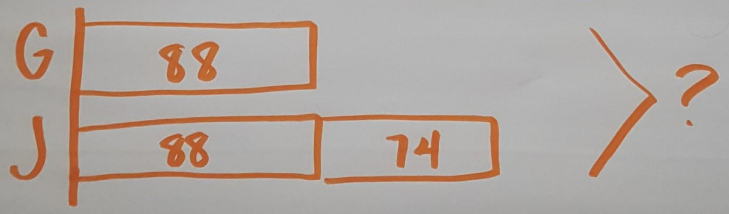

C
J
?
60
4 units = 60
Justice has ___ dog bones.
L
E
104
104
104
?
520
5 units = 520
unit = 104
Layla has ___ more shells than Emily.



① 39 - 6 = 33

② 39 + 33 = 72

Naseem drove ___ miles altogether.



They have ___ coins altogether.

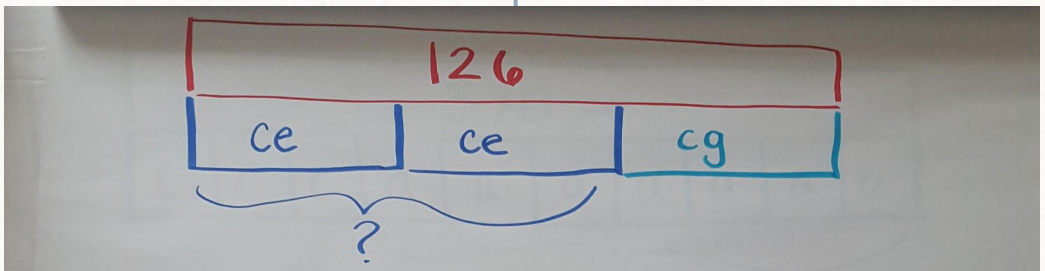
Part - Whole

Comparison

Try these on your own!

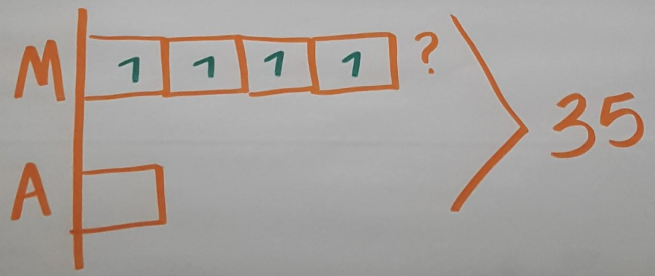
Jayden bought 126 marbles. Of those, 2/3 were cat's eye marbles and the rest were clear glass. How many cat's eye marbles did Jayden buy?

Morgan swam 4 times as many laps as Andrew did. If they swam 35 laps altogether, how many laps did Morgan swim?



3 units = 126
1 unit = 42

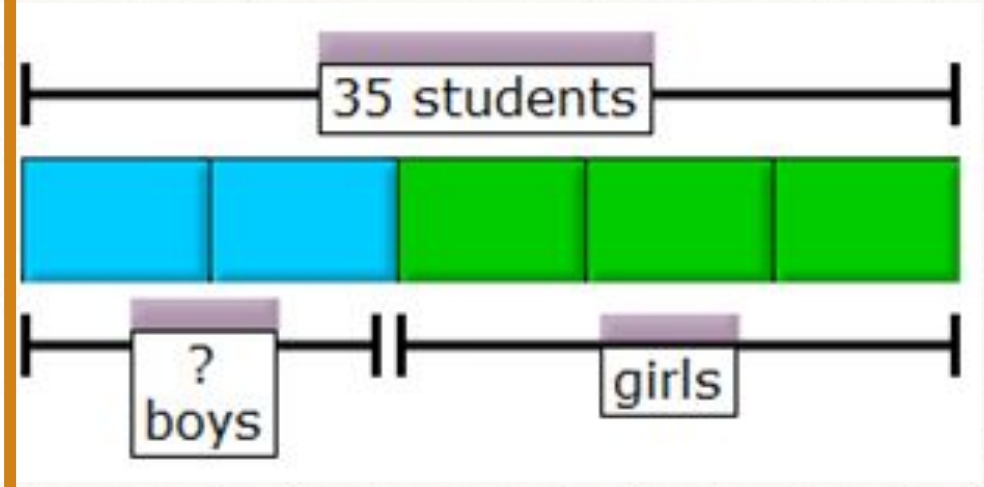
Jayden bought ___ cat's eye marbles.



5 units = 35
1 unit = 7

Morgan swam ___ laps.

Two fifths (2/5) of the students in a class are boys and the rest are girls. There are 35 students in the class. How many boys are in the class?



5/5 = the whole class

5 units = total (35 students)

35 ÷ 5 = 7

1 unit = 7 students

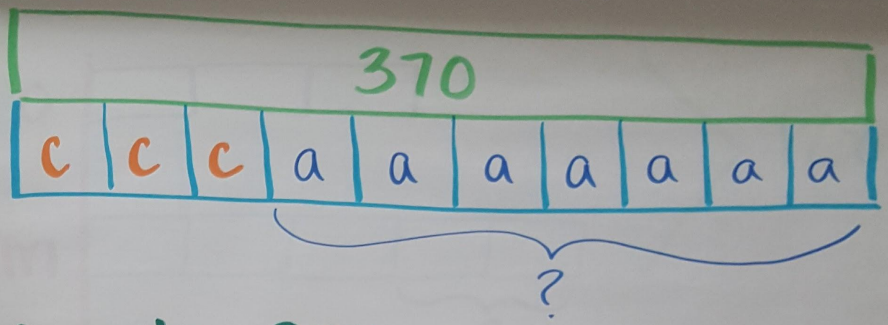
boys = 2 pieces of the 5

2 x 7 = 14

There are 14 boys in the class.

Part- Whole

There are 370 members in a hiking club. If 30% of the members are children and the rest are adults, how many adults are there?



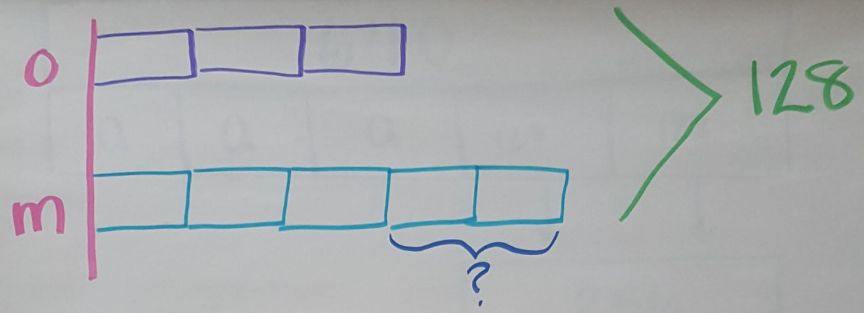
10 units = 370

1 unit = 37

There are ___ adults in the hiking club.

Comparison (fractions)

Lisa's yard has oak trees and maple trees. There are 3/5 as many oak trees as maple trees. If there are 128 trees altogether, how many more maple trees than oak trees are in Lisa's yard?



8 units = 128

1 unit = 16

There are ___ more maple trees than oak trees.

Problem-Solving Process

Understand

Determine what the problem is asking you to do and what you are trying to find out. Restate the question as an "mmm" statement.

Plan

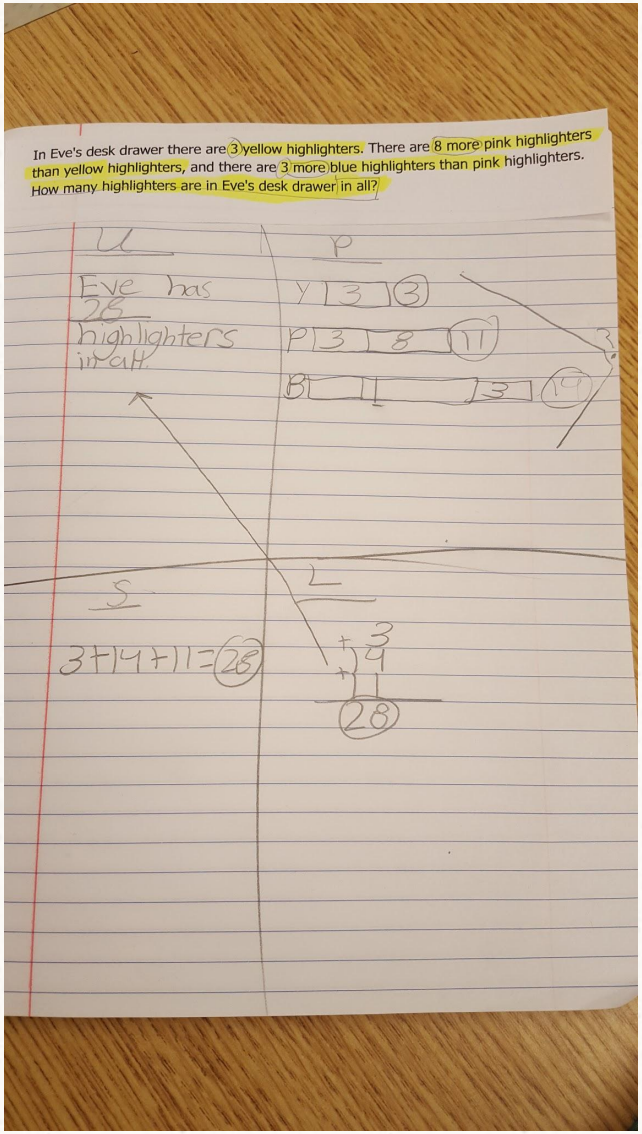
What do you need to do to solve the problem? Draw unit bars and add the question mark.

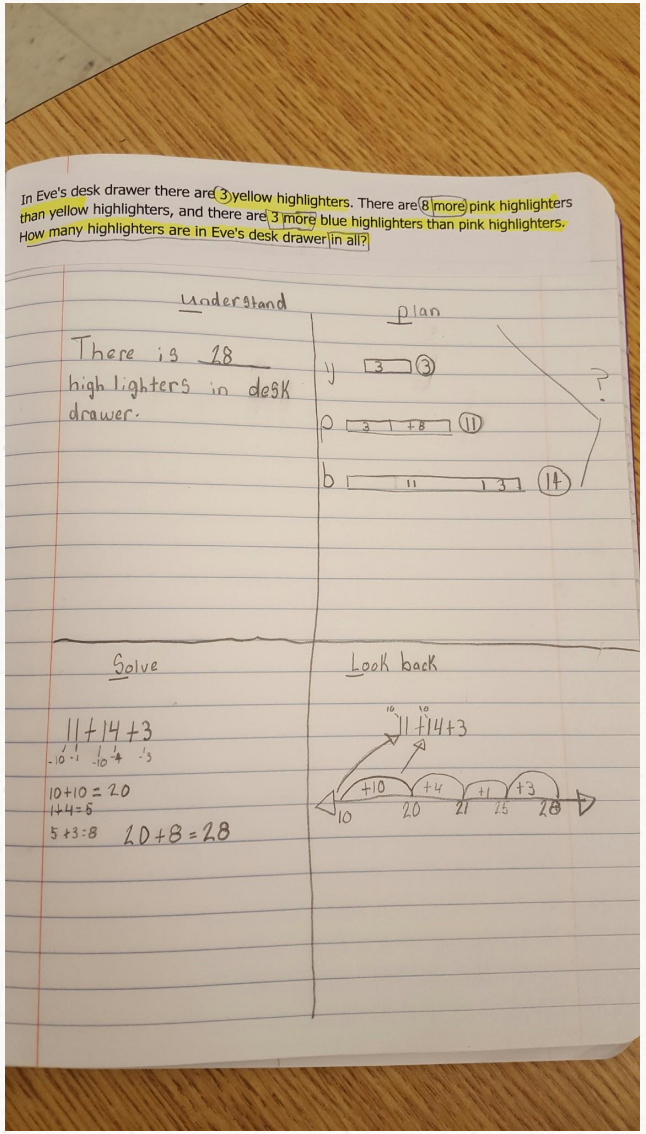
Solve

Carry out the plan. Apply mathematical skills, concepts, and strategies.

Look Back

Compare with the original question. Does the answer make sense? Write the answer in your "mmm" statement.

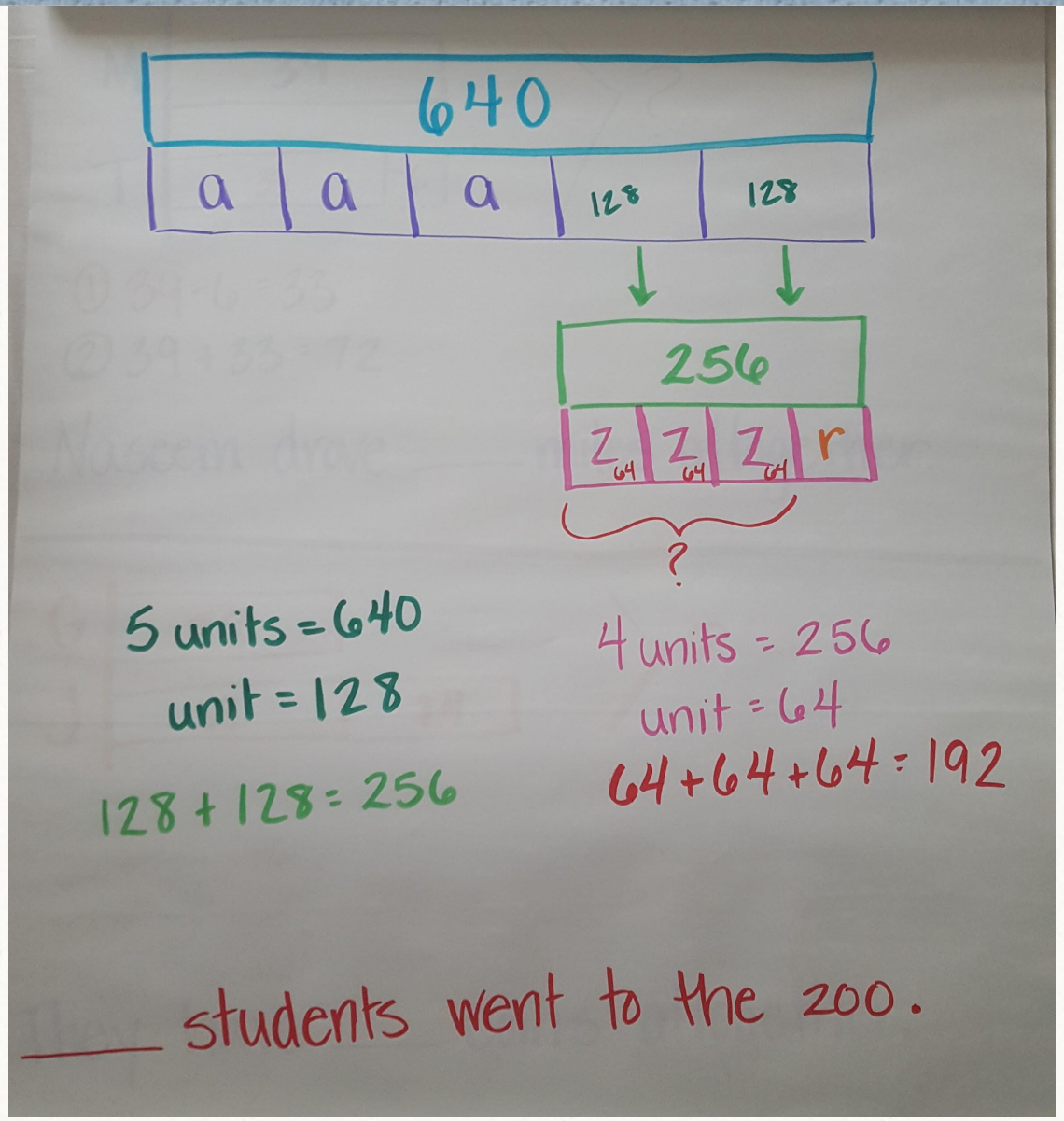

In Eve's desk drawer there are 3 yellow highlighters. There are 8 more pink highlighters than yellow highlighters, and there are 3 more blue highlighters than pink highlighters. How many highlighters are in Eve's desk drawer in all?
U
Eve has 28 highlighters in all.
P
Y 3 3
P 3 8 11
B 1 3 14
S
L
3+14+11=28
+3
14
28


In Eve's desk drawer there are 3 yellow highlighters. There are 8 more pink highlighters than yellow highlighters, and there are 3 more blue highlighters than pink highlighters. How many highlighters are in Eve's desk drawer in all?
Understand
There is 28 high lighters in desk drawer.
plan
y 3 3
p 3 +8 11
b 11 +3 14
?
Solve
11+14+3
-10 -1 -10 -4 -3
10+10=20
1+4=5
5+3=8
20+8=28
Look back
10 10
11+14+3
+10 +4 +1 +3
10 20 21 25 28

Exit Ticket

Now, how do you feel about this word problem? Do you want to give it a try?

Of all the students at Watson Elementary School, 3/5 went on fieldwork to the aquarium, 3/4 of the remainder went on fieldwork to the zoo, and the rest stayed at school to do research online. If there were 640 students who attended Watson Elementary School, how many went to the zoo?


640
a
a
a
128
128
256
64
64
64
r
?
5 units = 640
unit = 128
128 + 128 = 256
4 units = 256
unit = 64
64 + 64 + 64 = 192
____ students went to the zoo.

NCTM Process Standards

Problem Solving

- Apply and adapt a variety of appropriate strategies to solve problems
- Solve problems that arise in mathematics and in other contexts

Reasoning and Proof

- Select and use various types of reasoning and methods of proof

Communication

- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to others

-National Council of Teachers of Mathematics

NCTM Process Standards

Connections

- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole

Representation

- Create and use representations to organize, record, and communicate mathematical ideas
- Select, apply, and translate among mathematical representations to solve problems

-National Council of Teachers of Mathematics

Learning Targets:

- I can apply my understanding of model drawing to solve word problems.
- I can implement model drawing in my classroom as a strategy to help students solve word problems.

Resources:

http://www.mathplayground.com/thinkingblocks.html

Interactive website for learning and practicing model drawing

www.thesingaporemaths.com

Problem solving with model drawing solutions

www.SDE.com/crystalsprings

Supplemental materials and books including the model drawing steps poster, 8 Step Model Drawing (book), Step by Step Model Drawing (book) and Model Drawing for Challenging Word Problems (book).

www.nctm.org

National Council of Teachers of Mathematics

Presentation adapted from workshop presented by Trina Thomson, EL National Conference Oct. 2015