

PAM HARRIS

*equipping math teachers with content &
pedagogy for student success*

@pwharris

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pharris@byu.net

**MATH IS
FIGUREOUTABLE!**

FAKE MATH: the myth that math is a disconnected set of facts to memorize and rules and procedures to mimic.

Pam Harris

REAL MATH: using relationships and connections you own to solve problems. By so doing, learn more real math.

Pam Harris

REAL MATH

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MATH

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MATHEMATIZE

MENTOR MATHEMATICIANS

POWERFUL VISUAL MODELS

MODEL

STRATEGY

NOT THE SAME

MODEL \neq STRATEGY

Strategy

how you deal with the numbers or structure
to solve a problem

Model

representation of a strategy, of relationships;
some models can be tools

MODEL

Model



MODEL

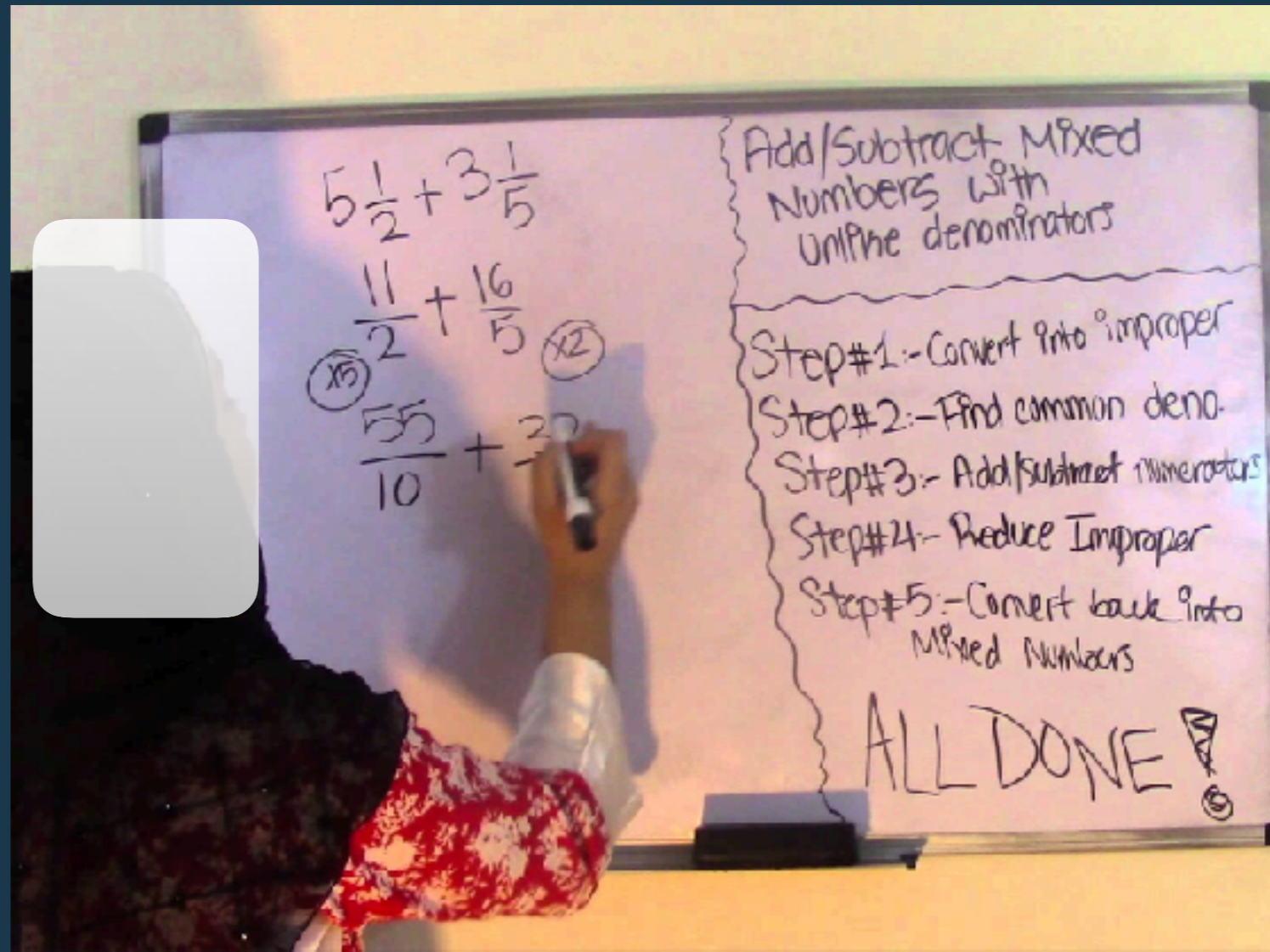
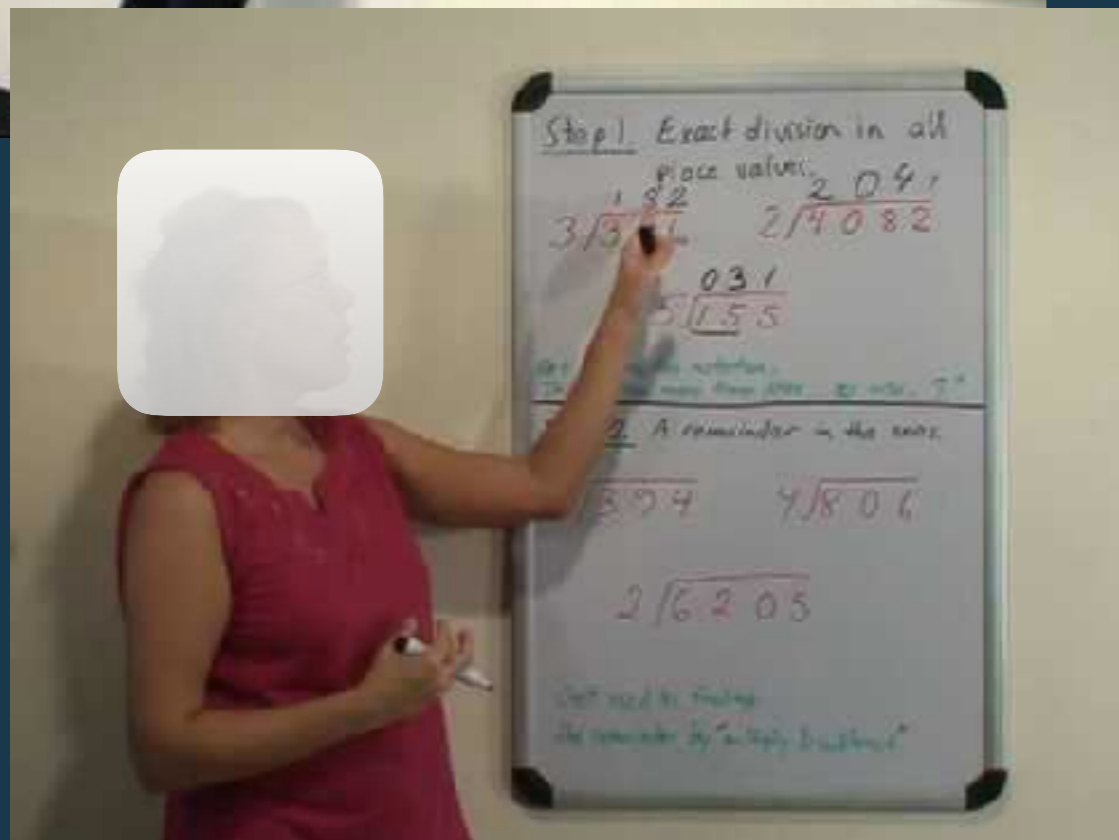
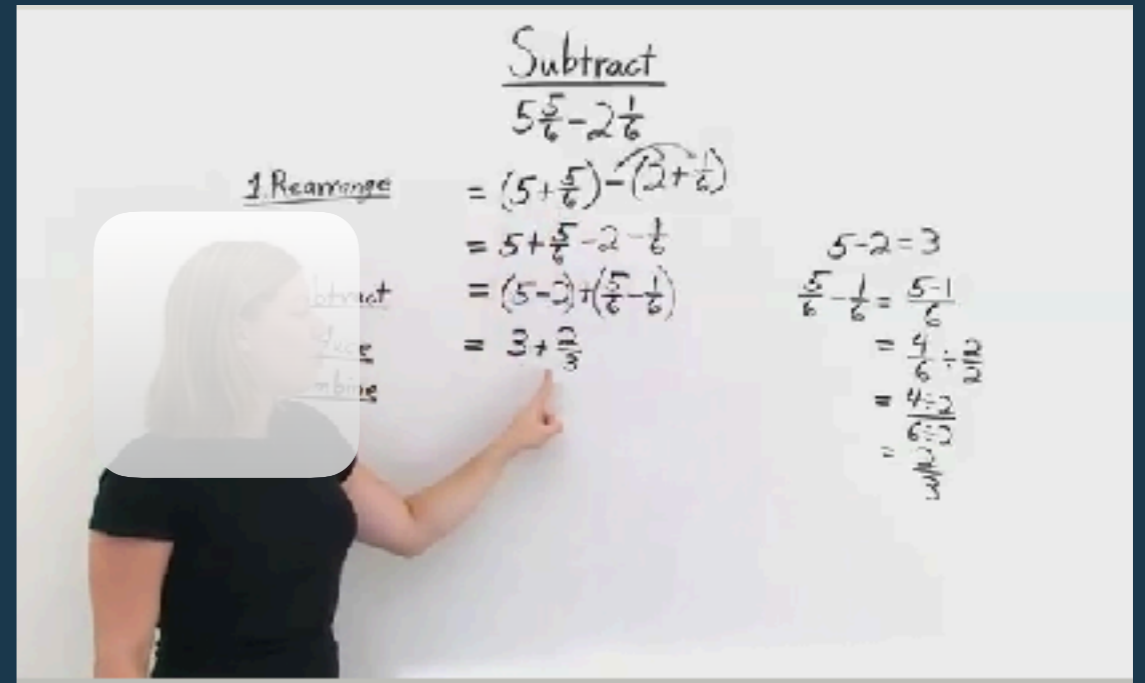
Verb

Noun

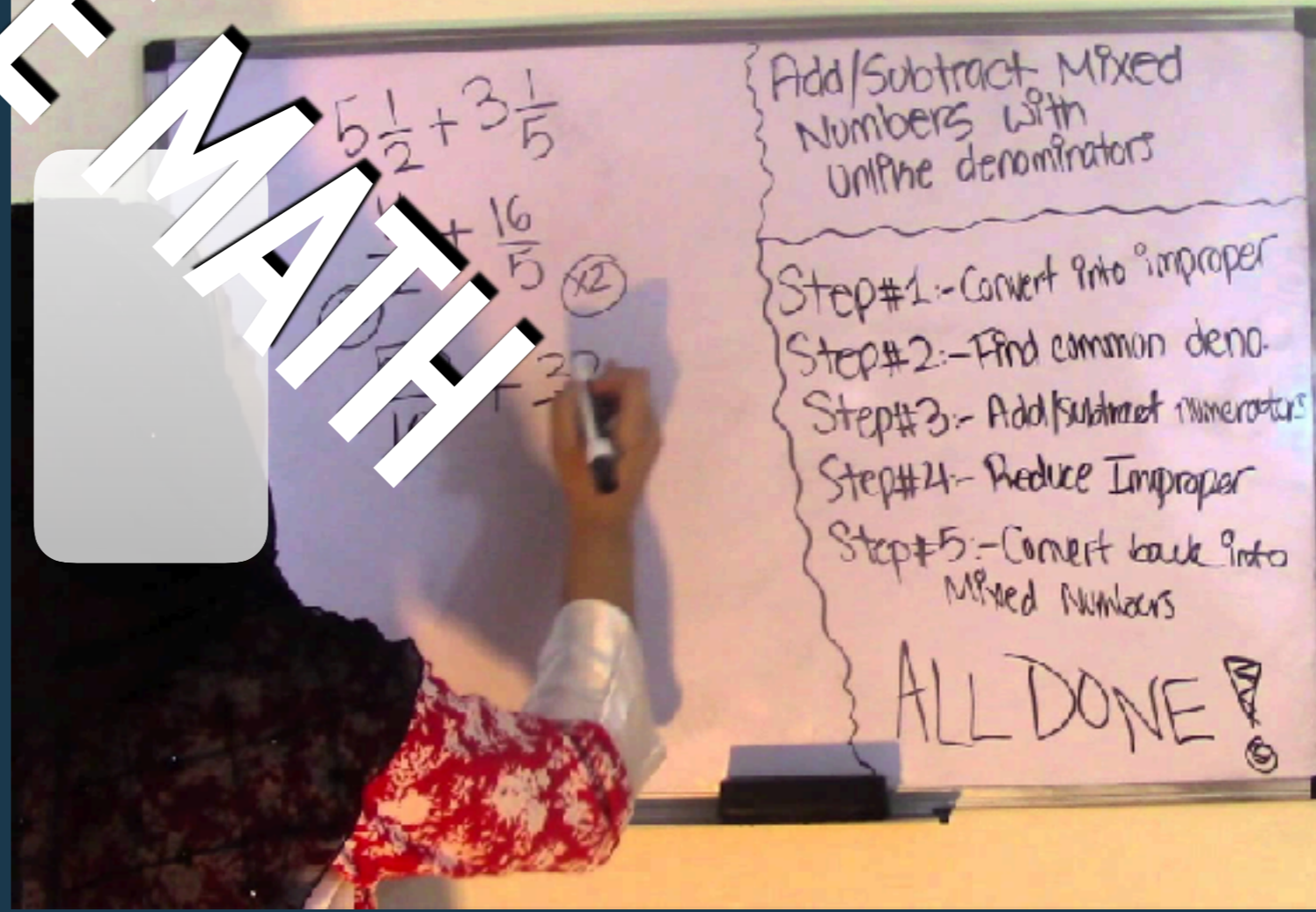
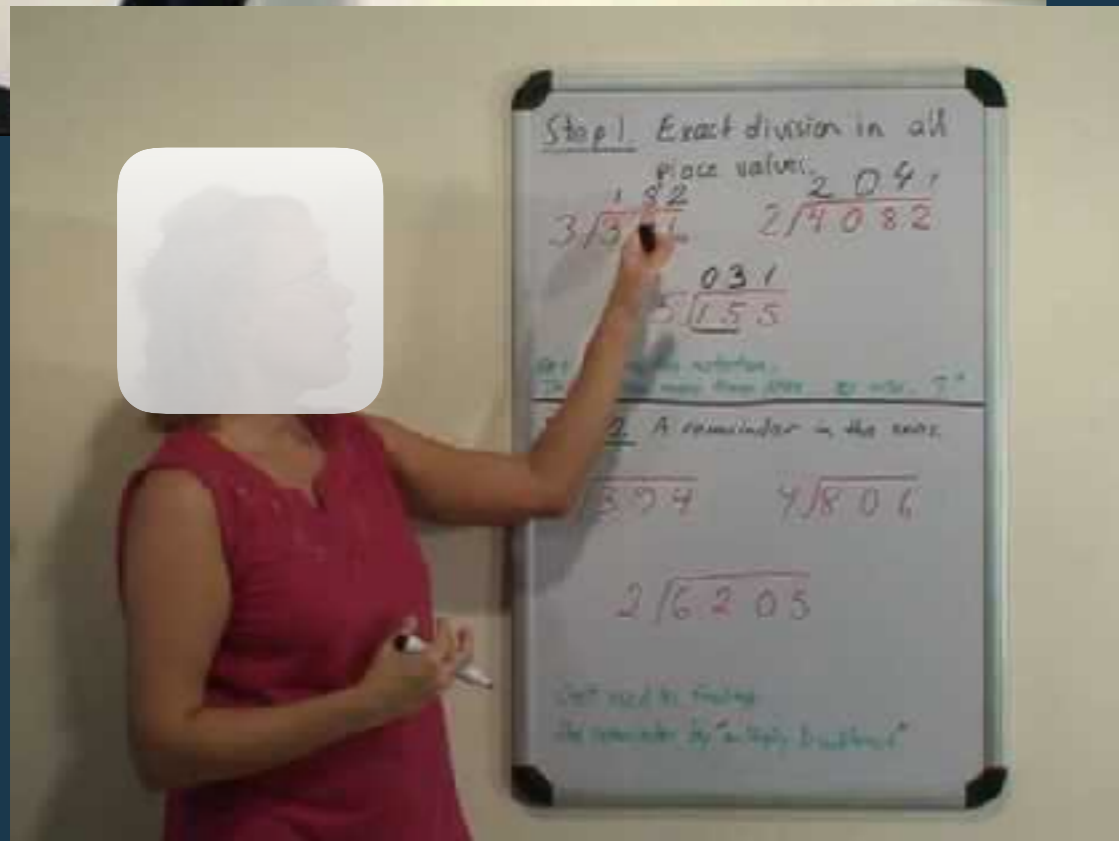
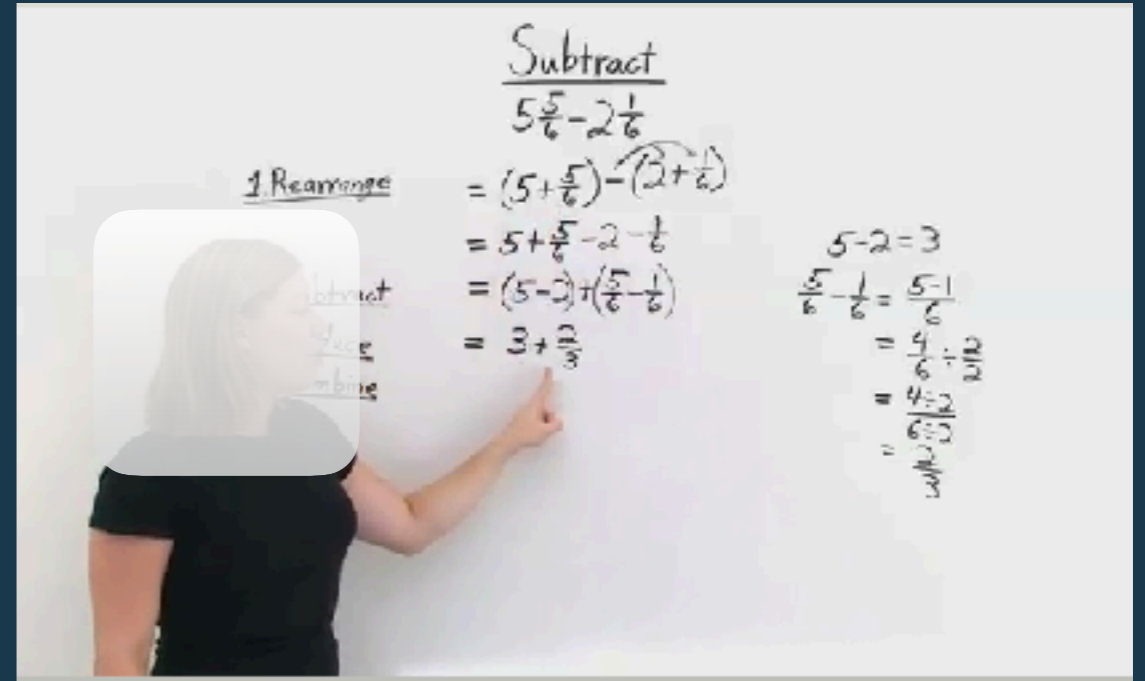
VERBS

Model - Demonstrate

Model - Demonstrate



Model - Demonstrate



Model - Represent Student Thinking

Model - Represent Student Thinking

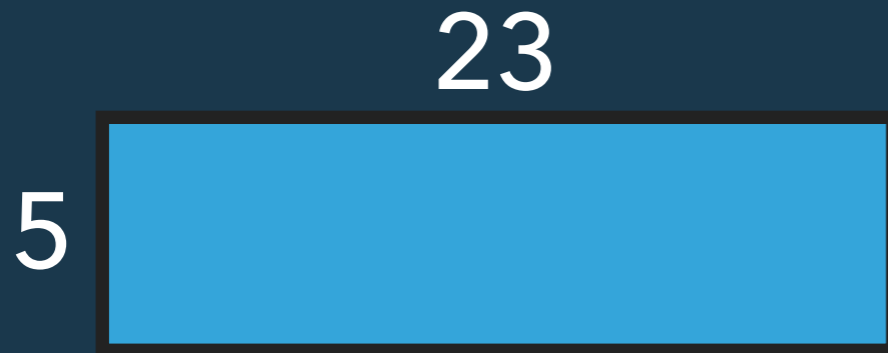


What is 5 times 23?

Model - Represent Student Thinking

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Well, I know 10×23 is
230. And 5 is half of 10,
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Model - Represent Student Thinking



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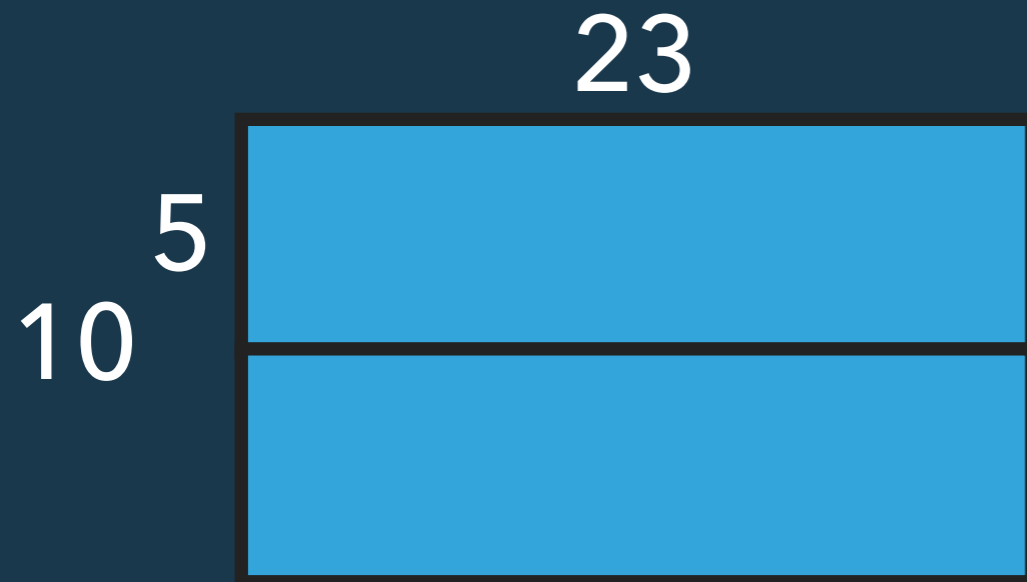
Model - Represent Student Thinking

$$\begin{array}{r} 23 \\ 5 \times \\ \hline \end{array}$$

A multiplication problem is shown with the number 23 above a horizontal line and the number 5 to the left of the line. Below the line, a question mark is centered, indicating the unknown product.

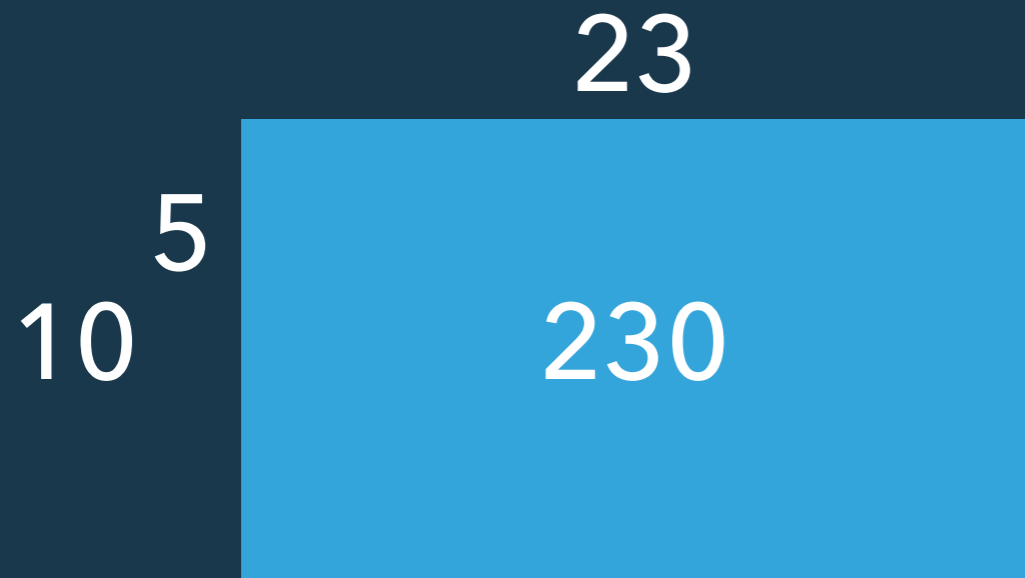
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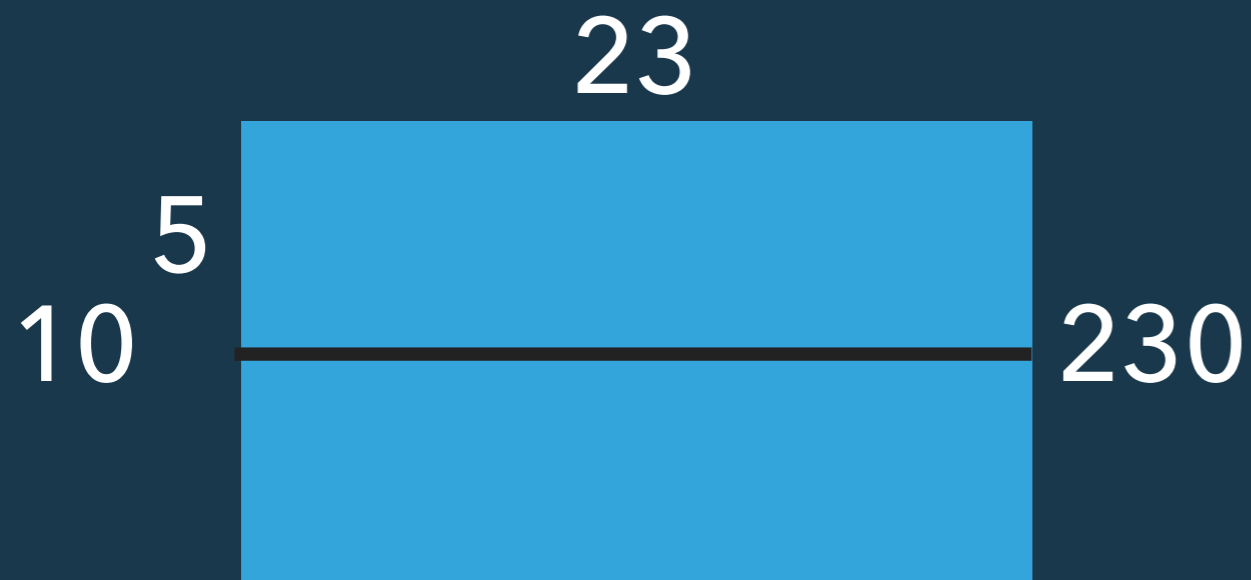
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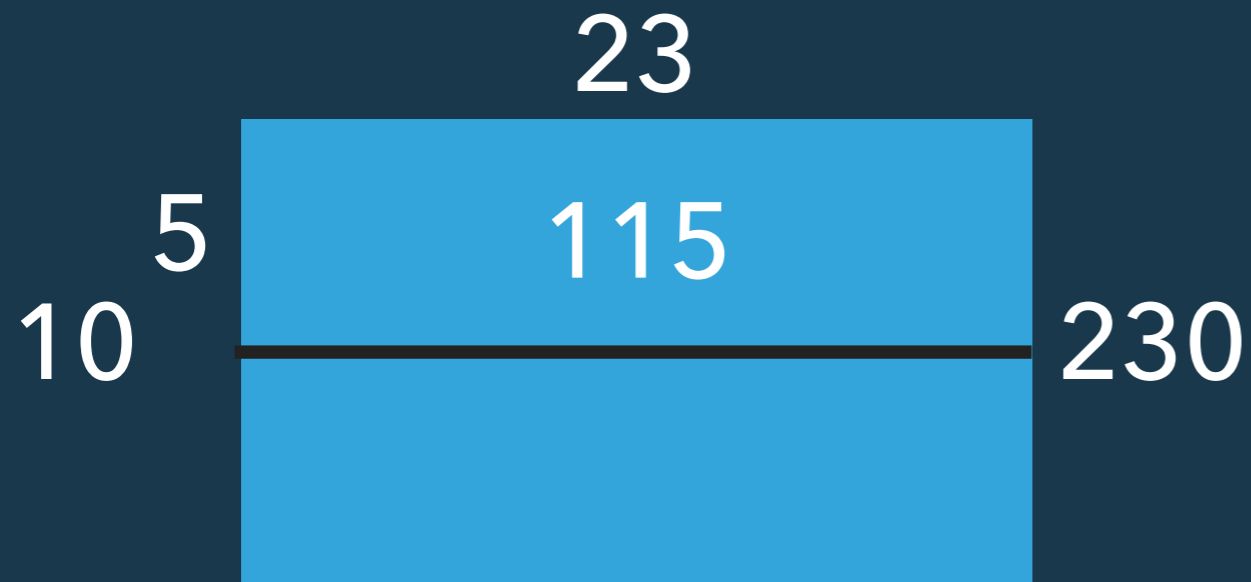
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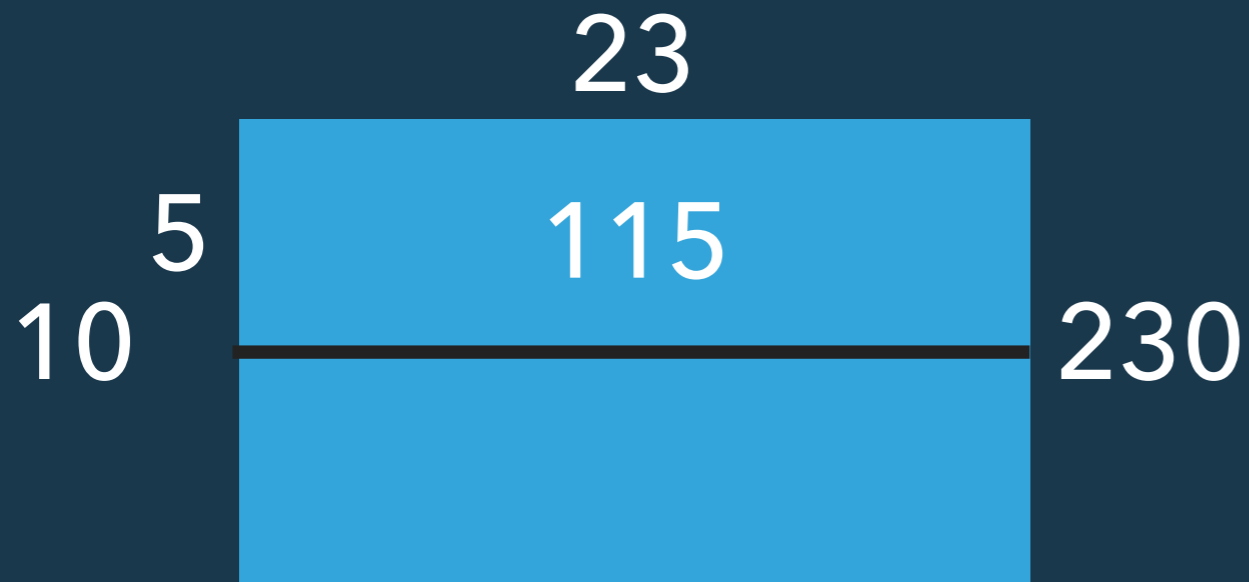
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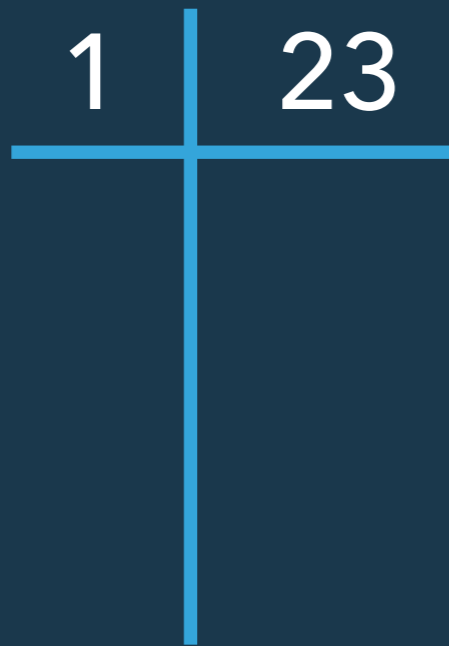


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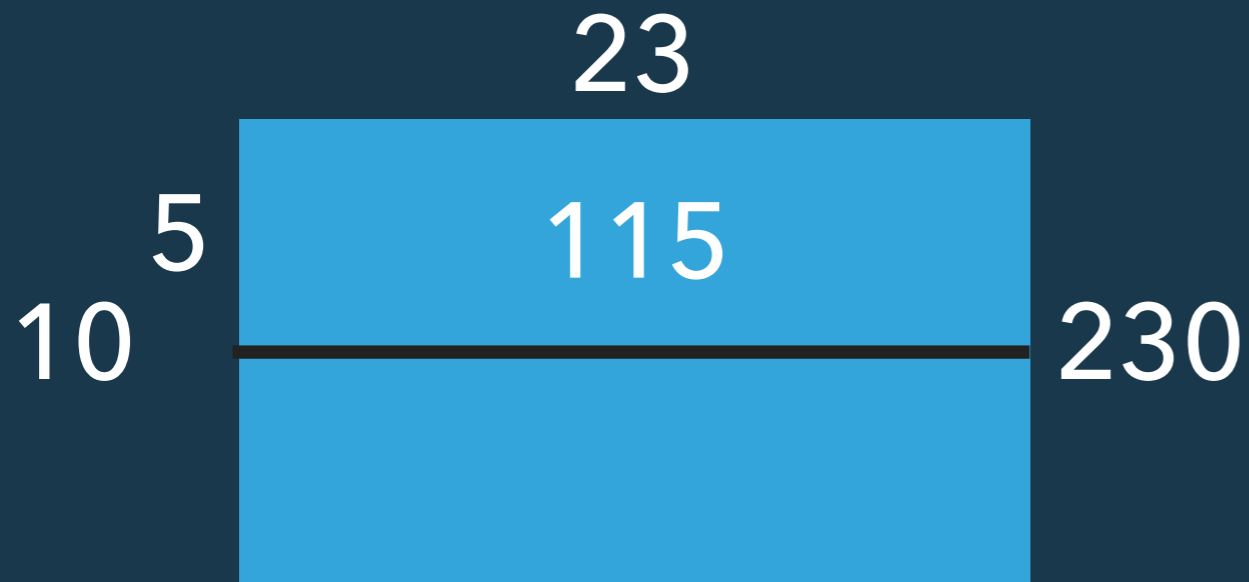
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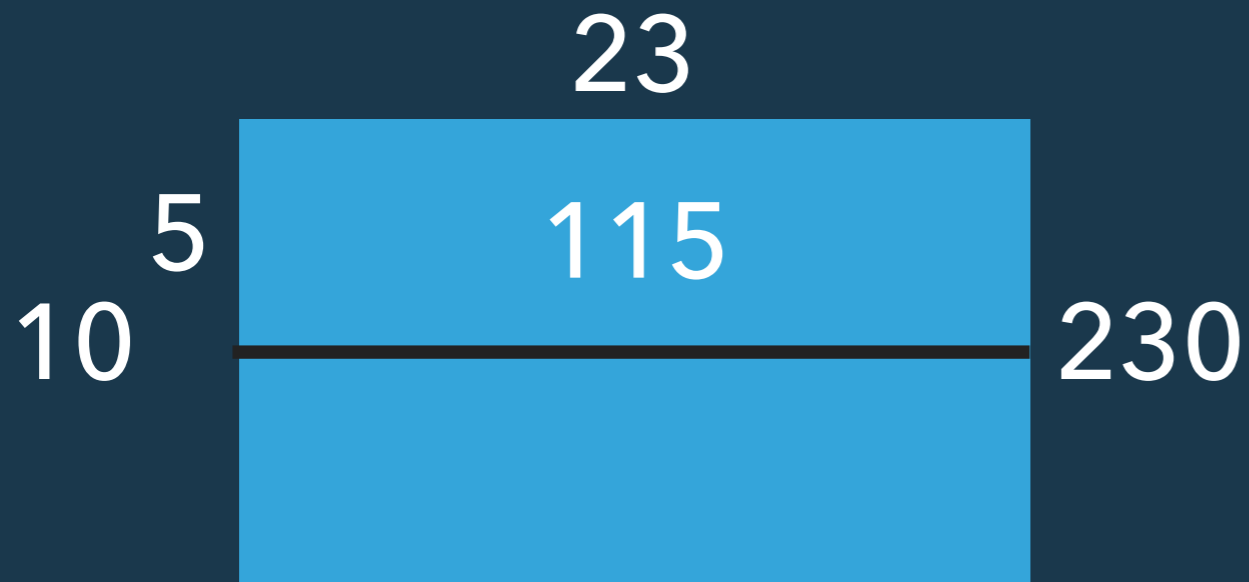
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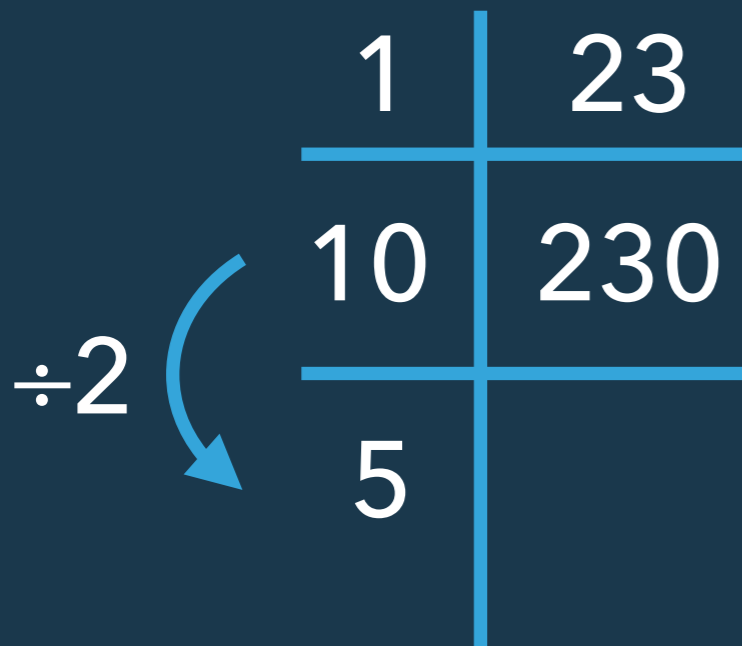
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1		23
<hr/>		
10		230

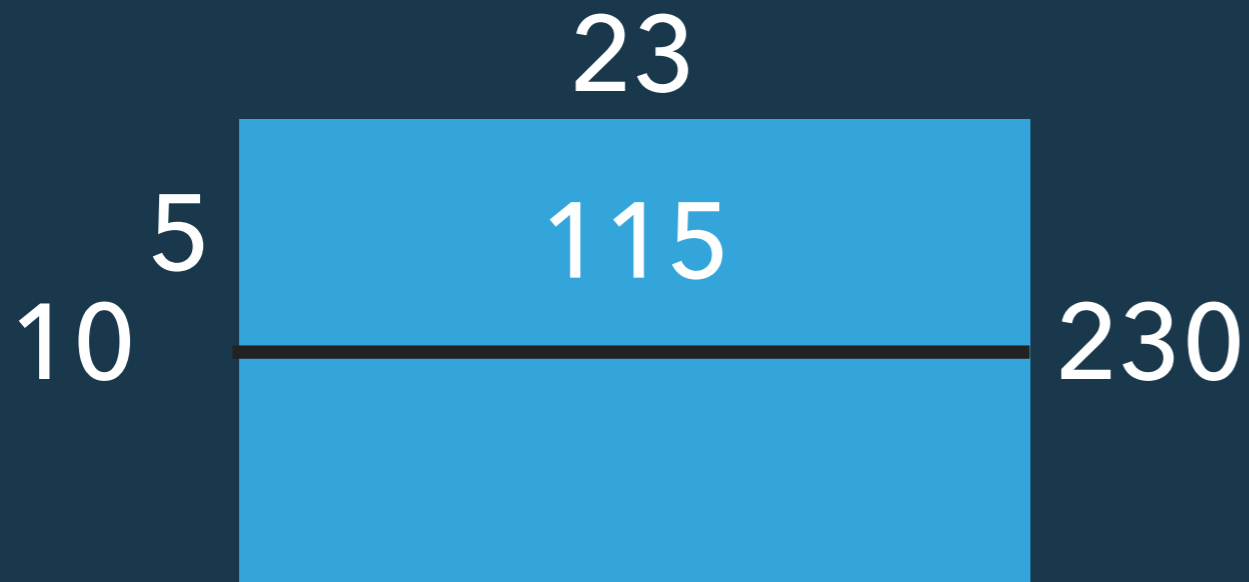
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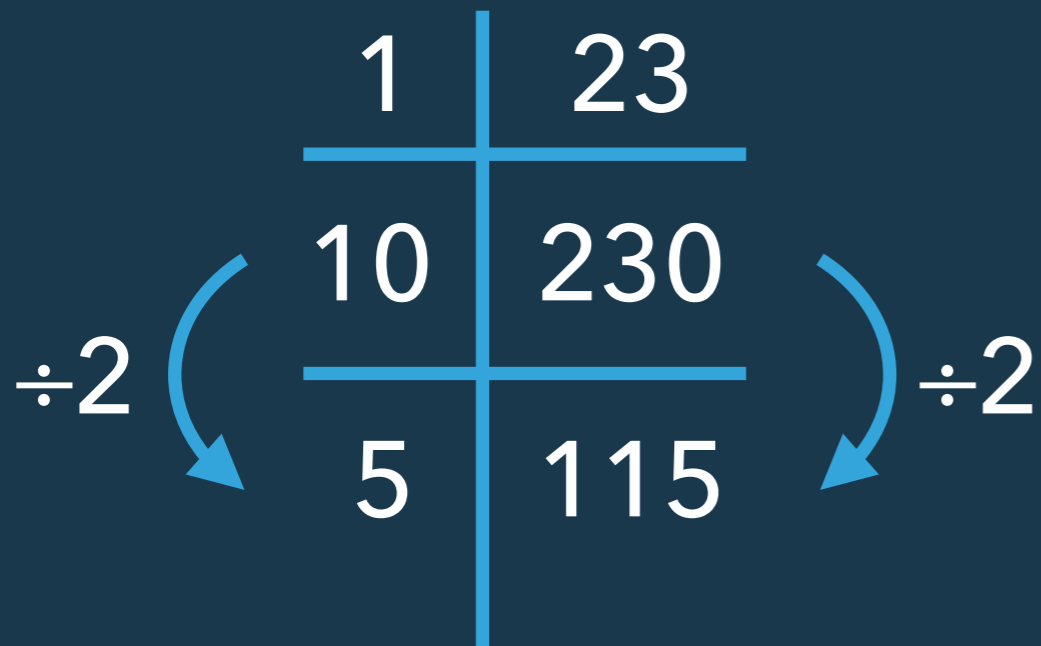
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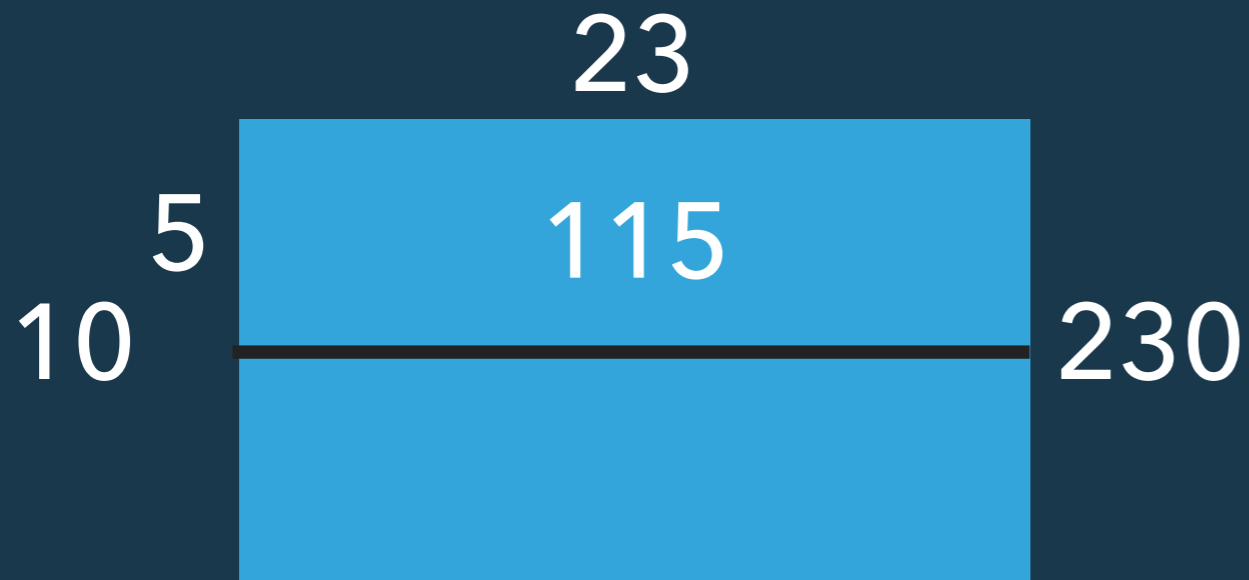
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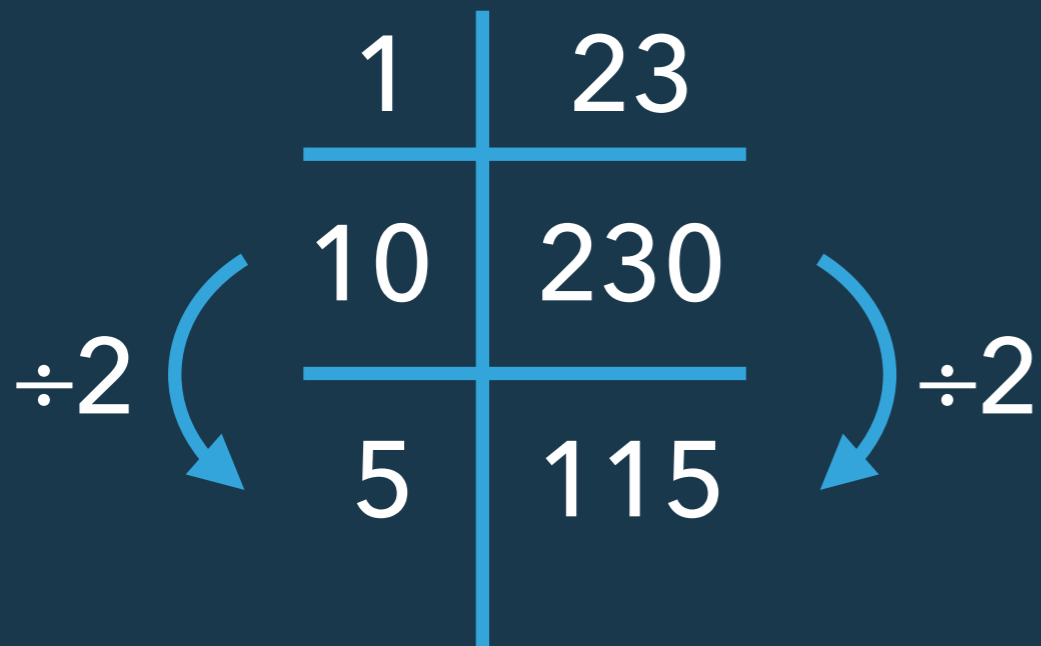
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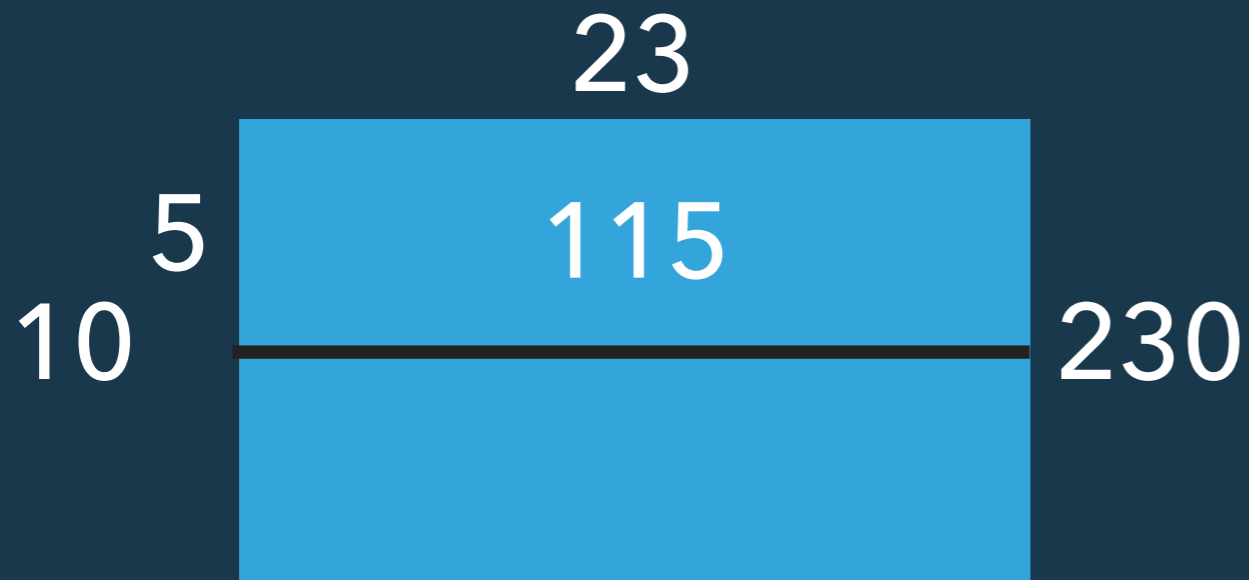


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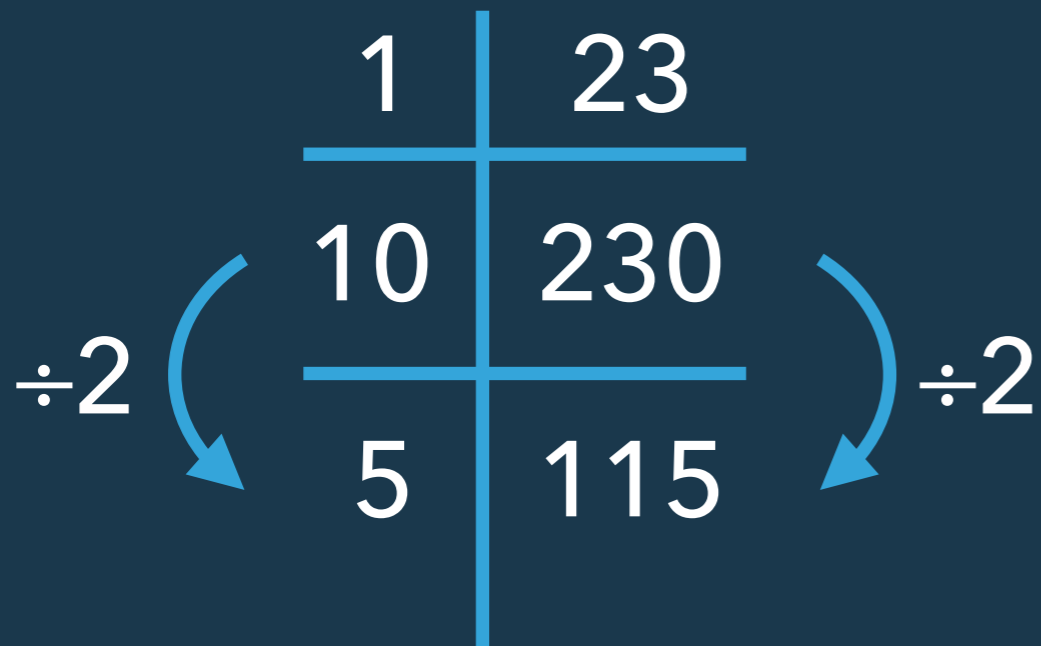


$$5 \times 23 = ?$$

Model - Represent Student Thinking



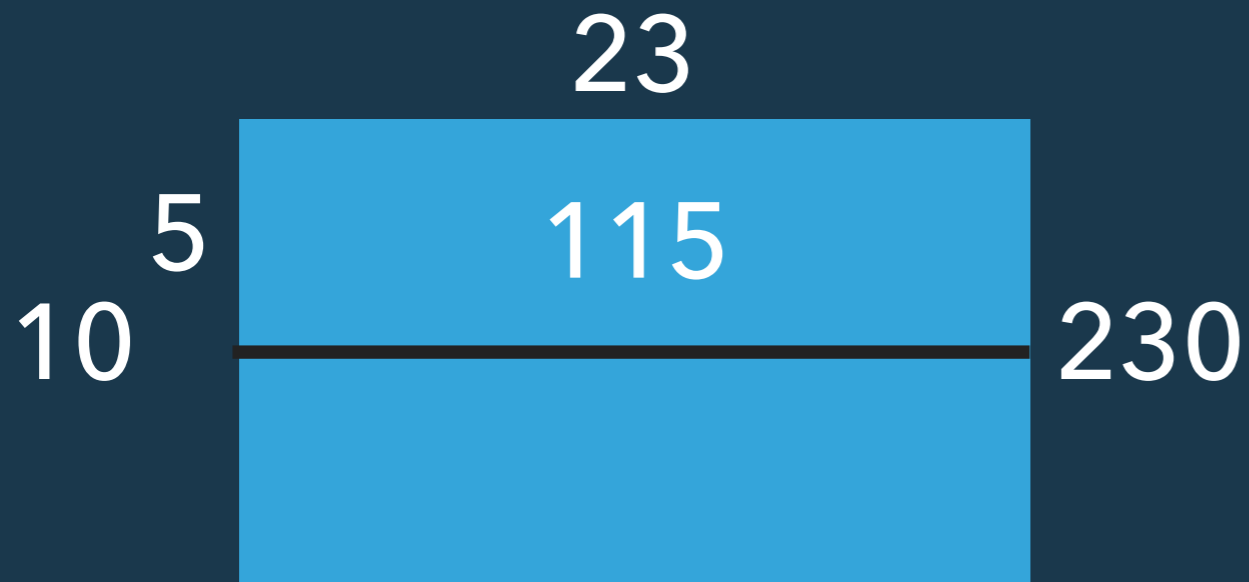
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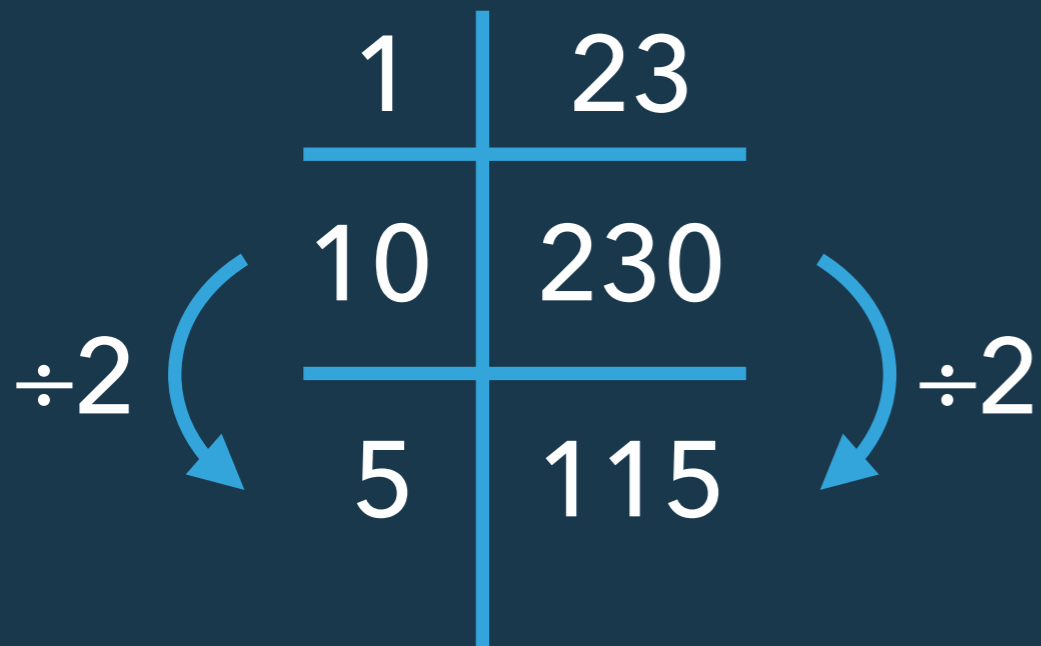
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Model - Represent Student Thinking



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$$5 \times 23 = ?$$

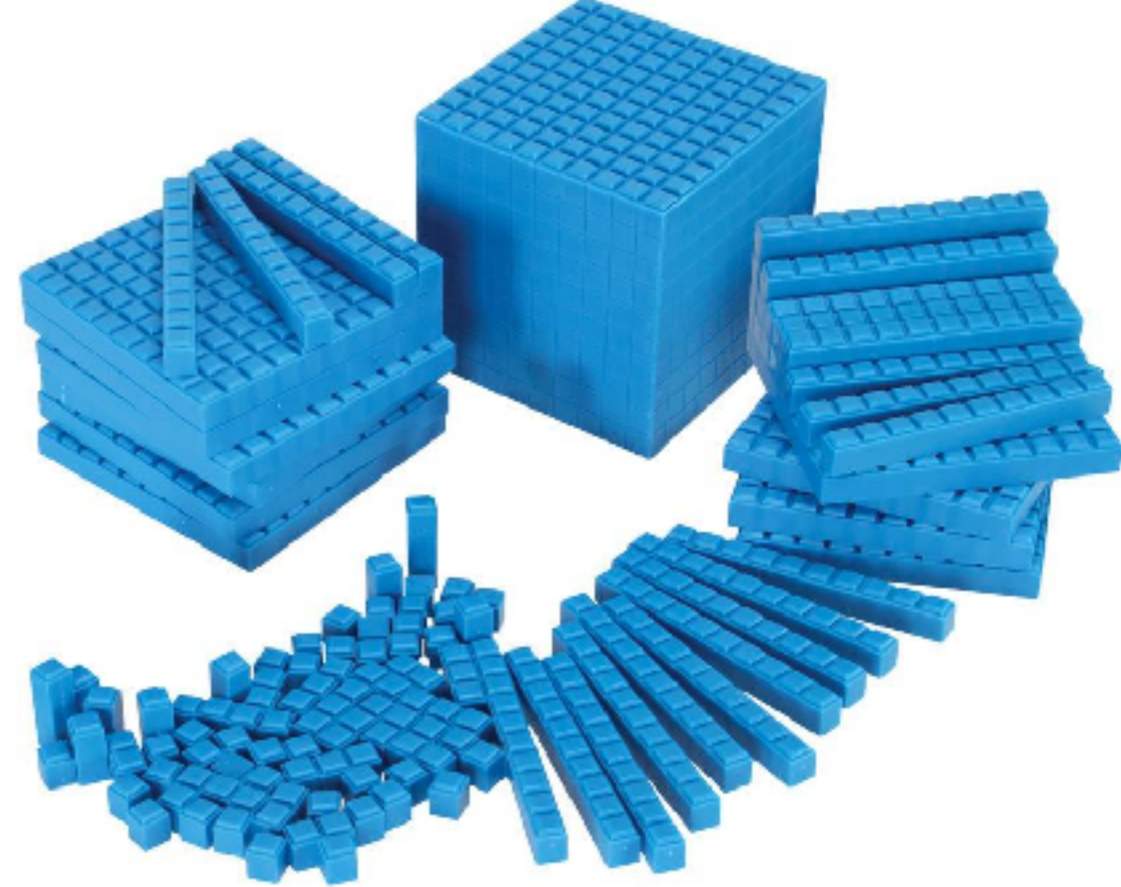
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NOUNS

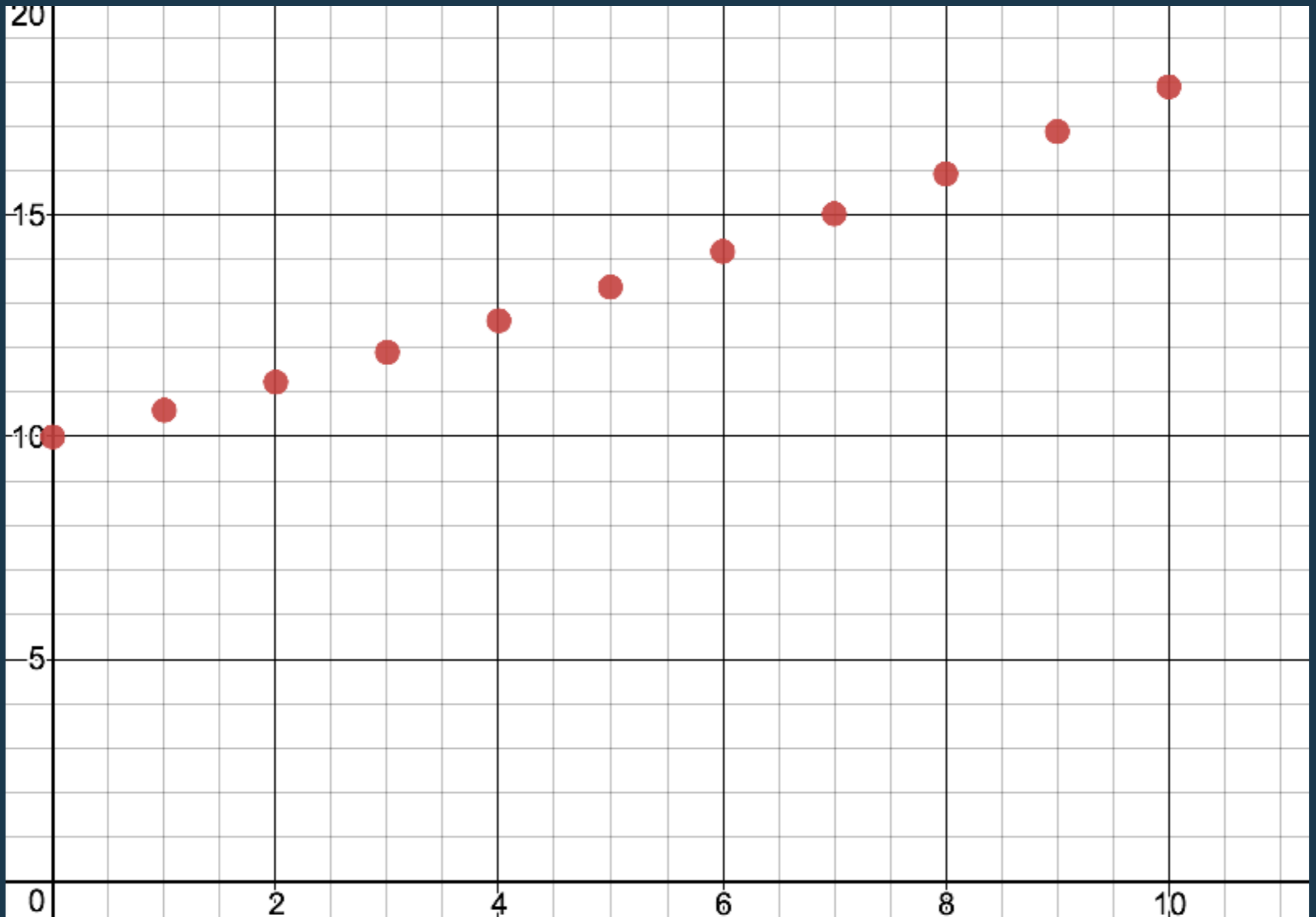
Model-Manipulative

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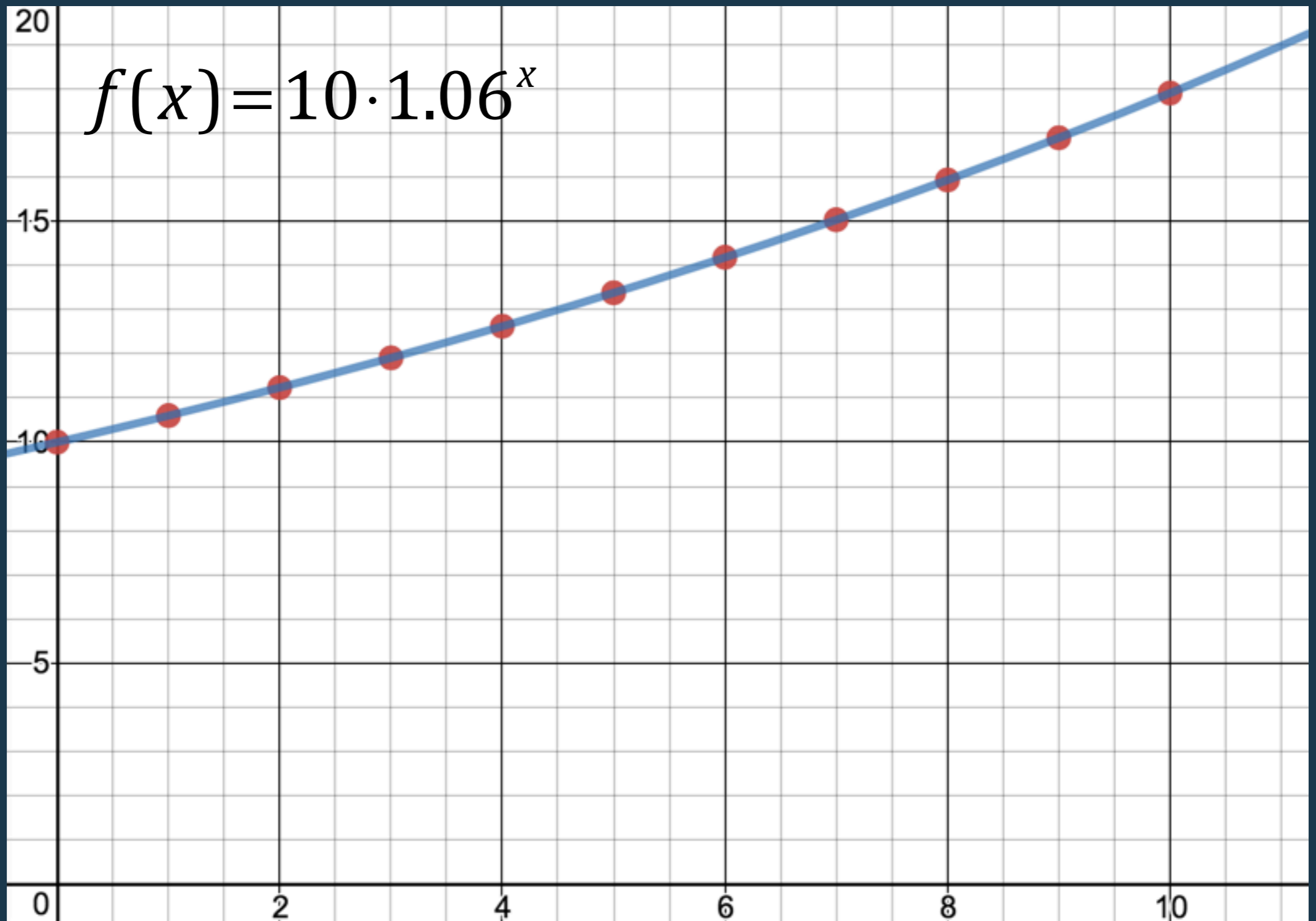


Model - Equation, Function, Predictor

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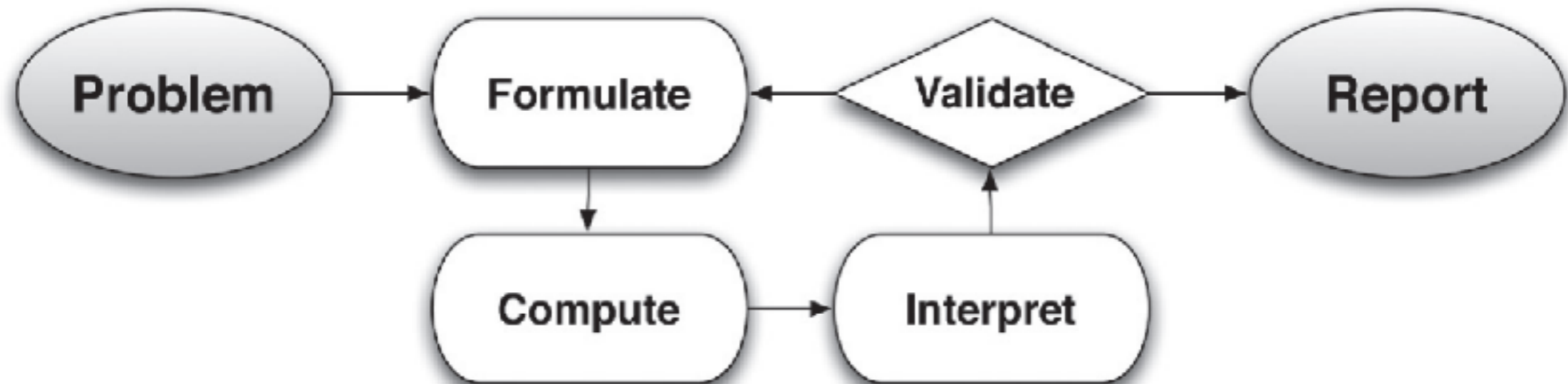


Model - Equation, Function, Predictor



Model-Process

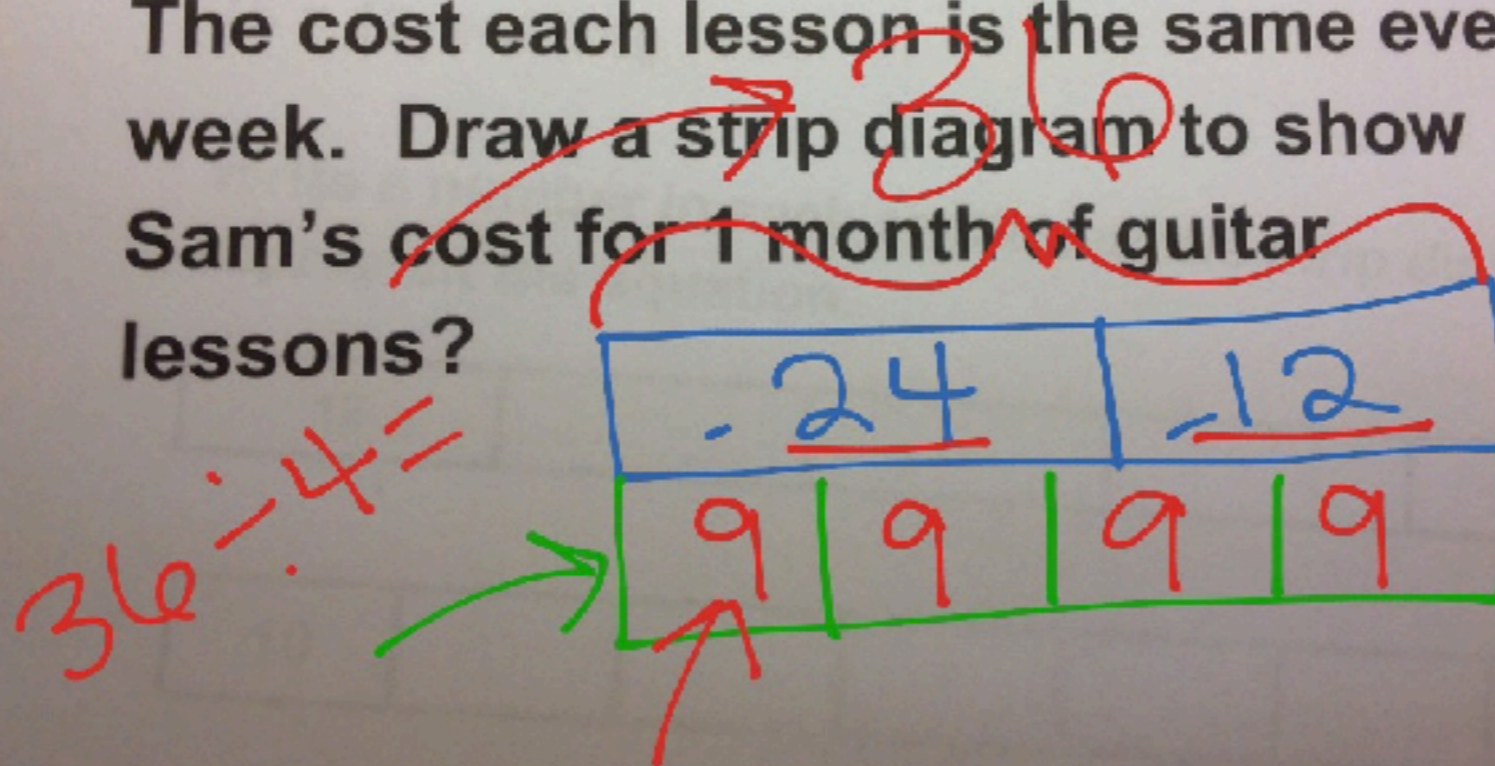
Model-Process



Model - Representation of the Situation

Model - Representation of the Situation

Sam sold his old skateboard for \$24 and some other toys for \$12. He is going to use the money to pay for guitar lessons. The cost each lesson is the same every week. Draw a strip diagram to show Sam's cost for 1 month of guitar lessons?



Model - Representation of the Situation

Strip Diagram $\times \frac{1}{5}$

Pam has 2 pencils in her zipper pouch. Bob has 5 times as many pencils as Pam. How many pencils does Bob have?

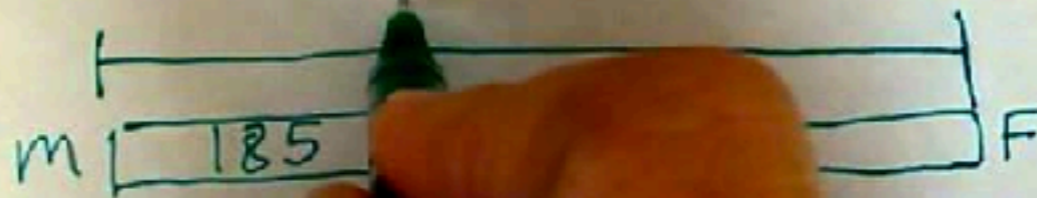
P

2			

Model - Representation of the Situation

Strip Diagram + -

On Monday, the 3rd grade students at SLE collected 185 boxes for a math project. On Friday, they collected 223 more boxes. How many boxes did they collect?



Sally brought
How many m

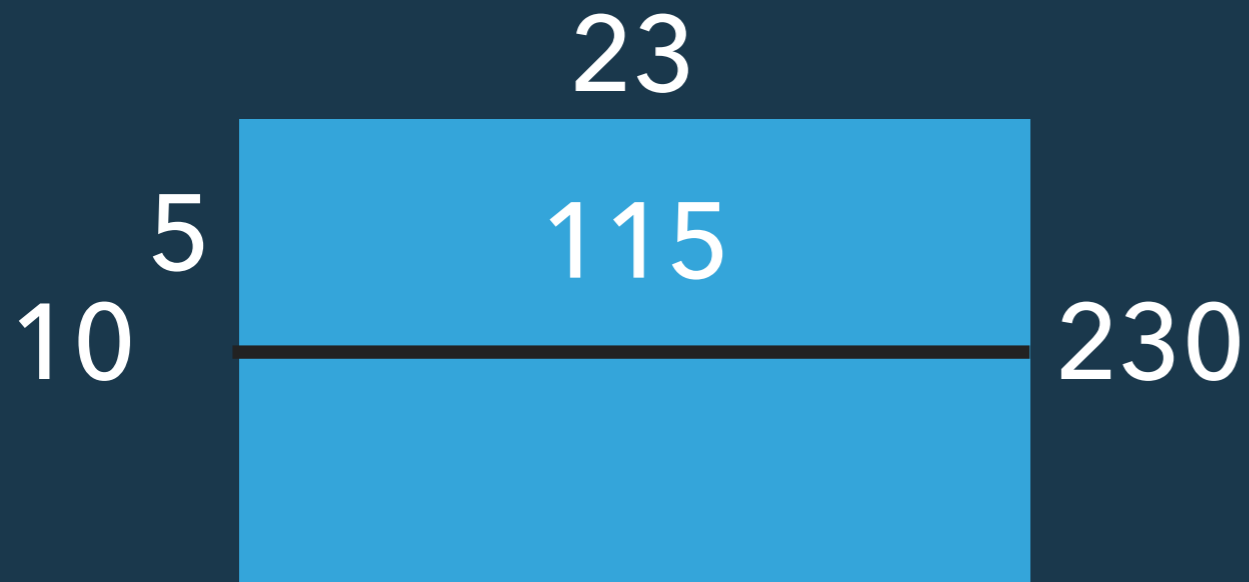
rought 18.

Model - Representation of Thinking

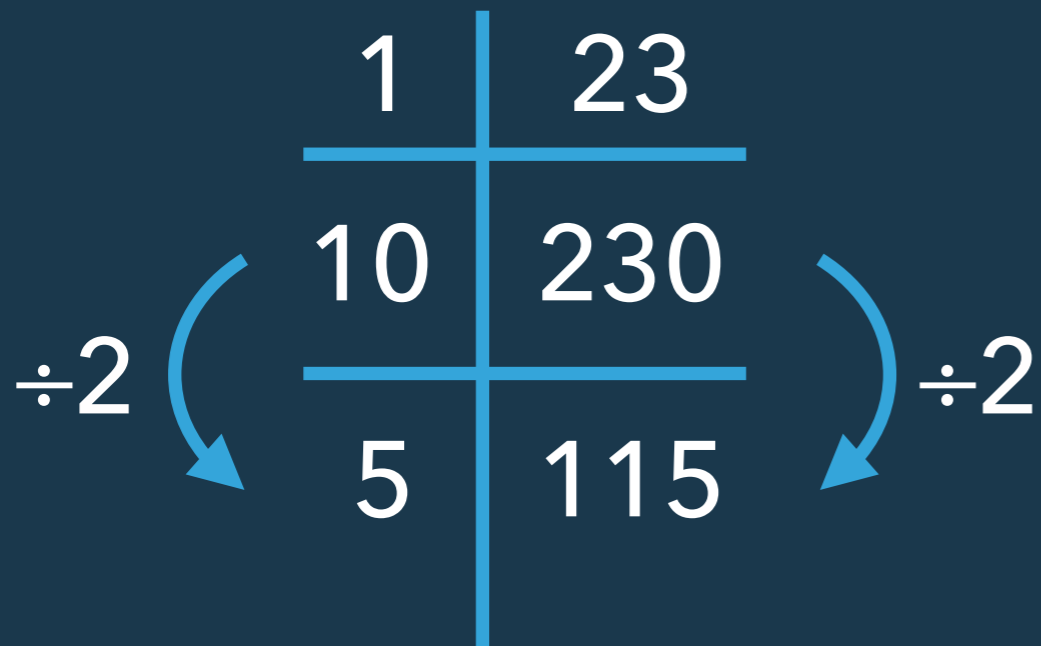
Model - Representation of Thinking

related to . . .

Model - Represent Student Thinking



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$$5 \times 23 = ?$$

$$10 \times 23 = 230$$

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Model - Representation of Thinking

503 - 399

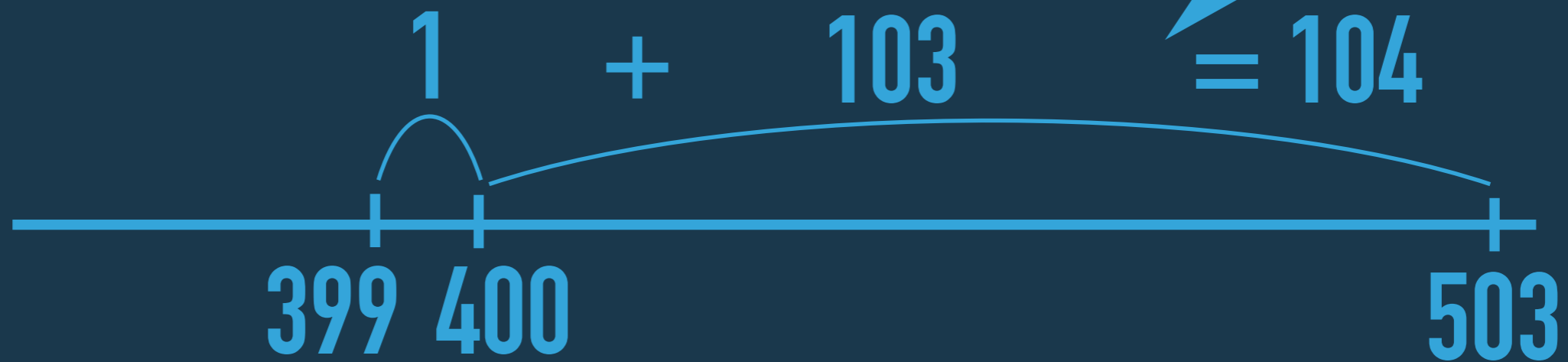
Model - Representation of Thinking

$$503 - 399$$

I'm going to find the difference. 399 to 400 is 1, then 103 more is 104.

Model - Representation of Thinking

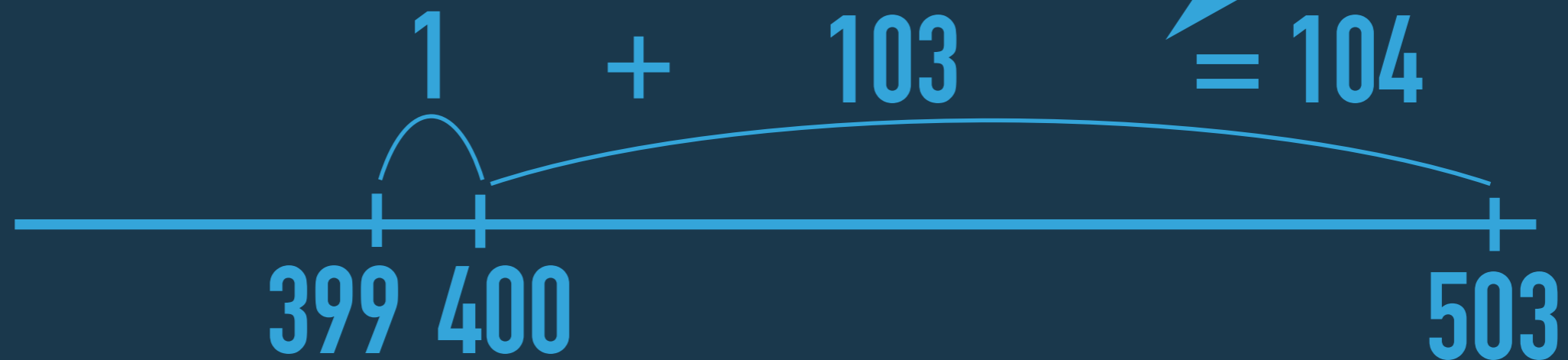
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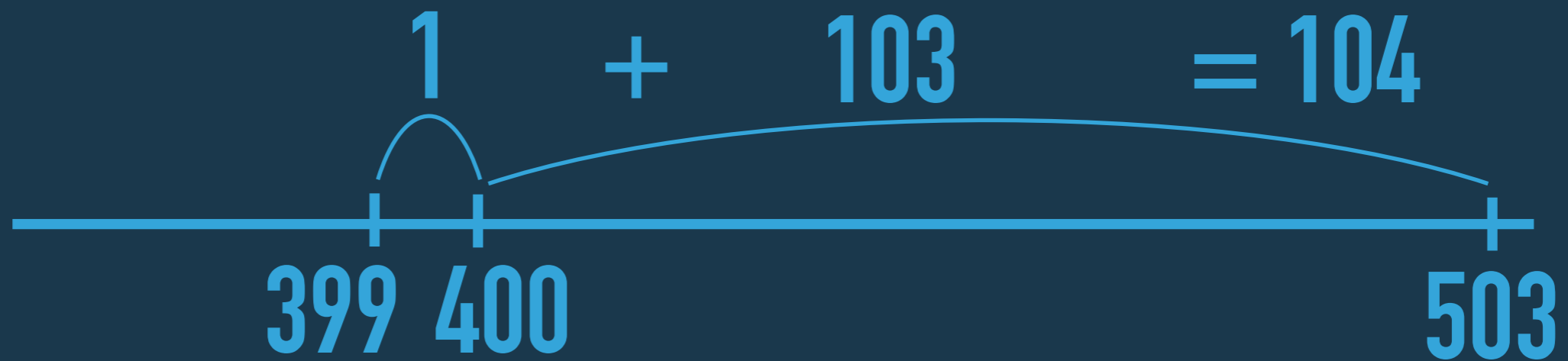


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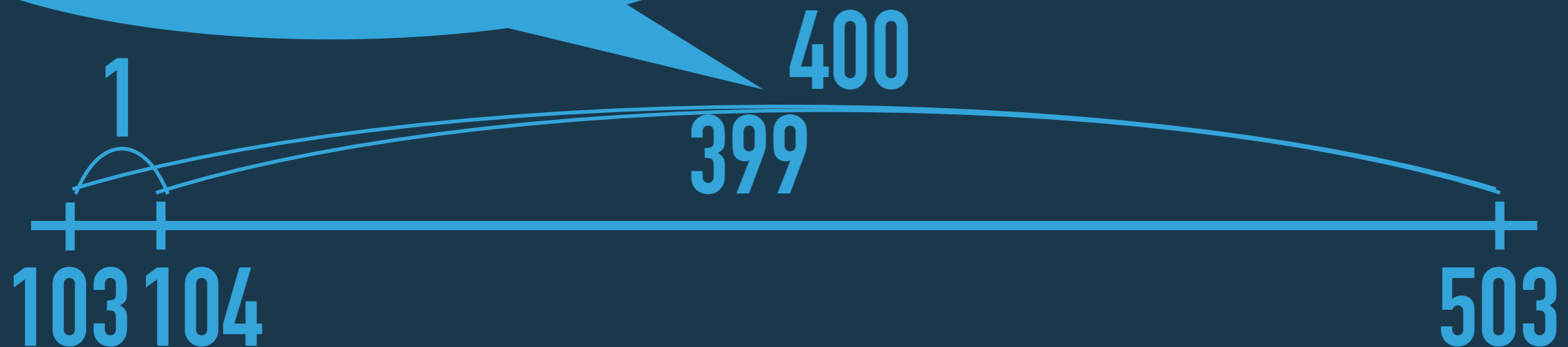
I'll subtract 400, so 503 minus 400 is 103. But I subtracted too much, so 104.

Model - Representation of Thinking

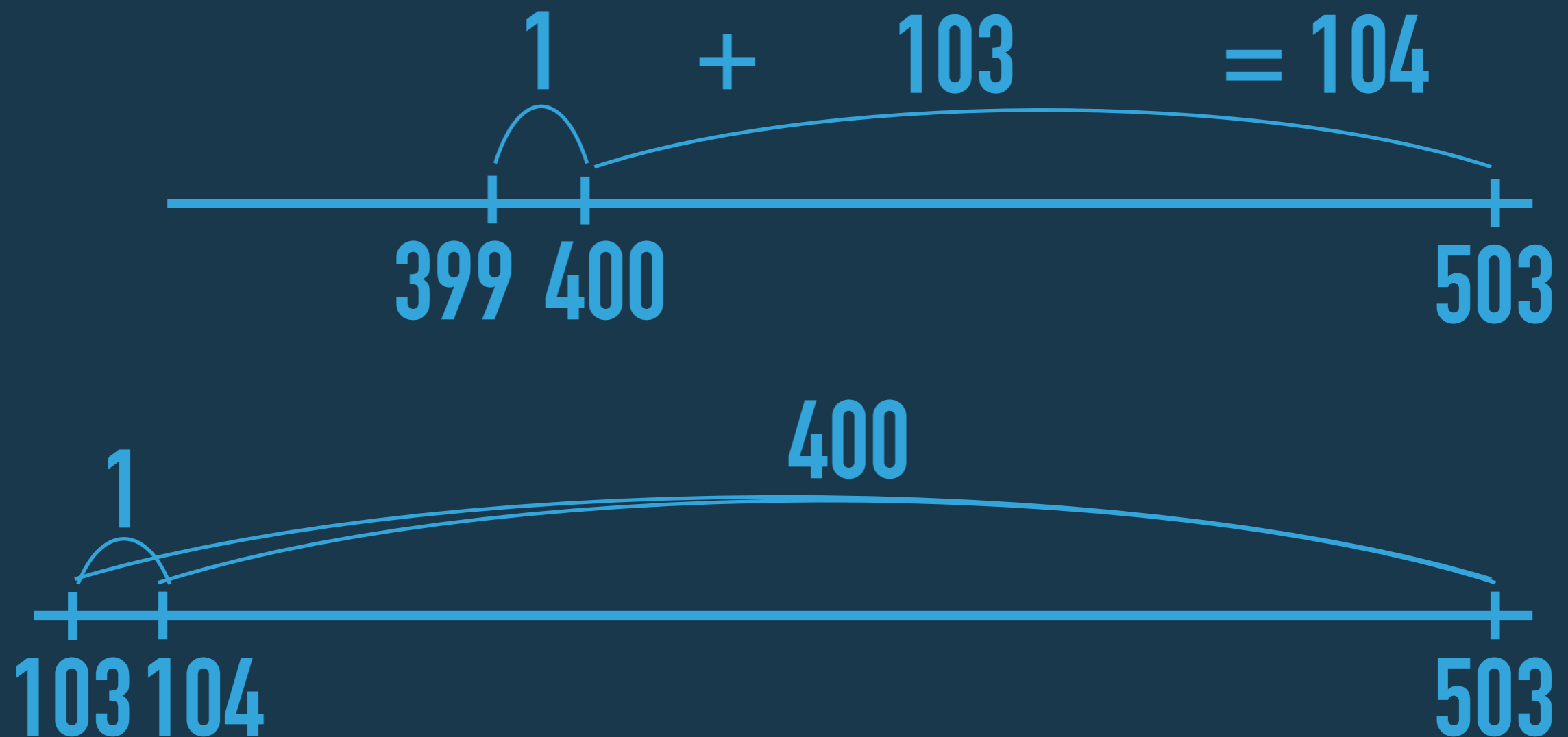
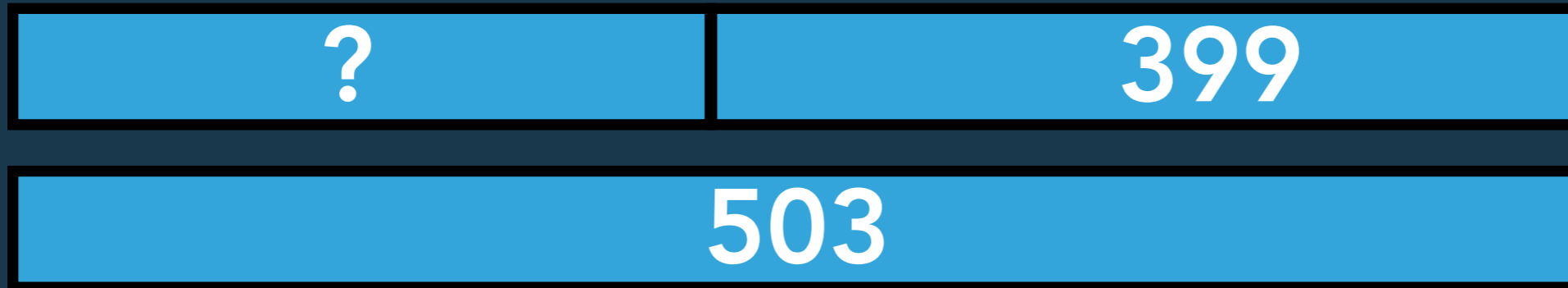
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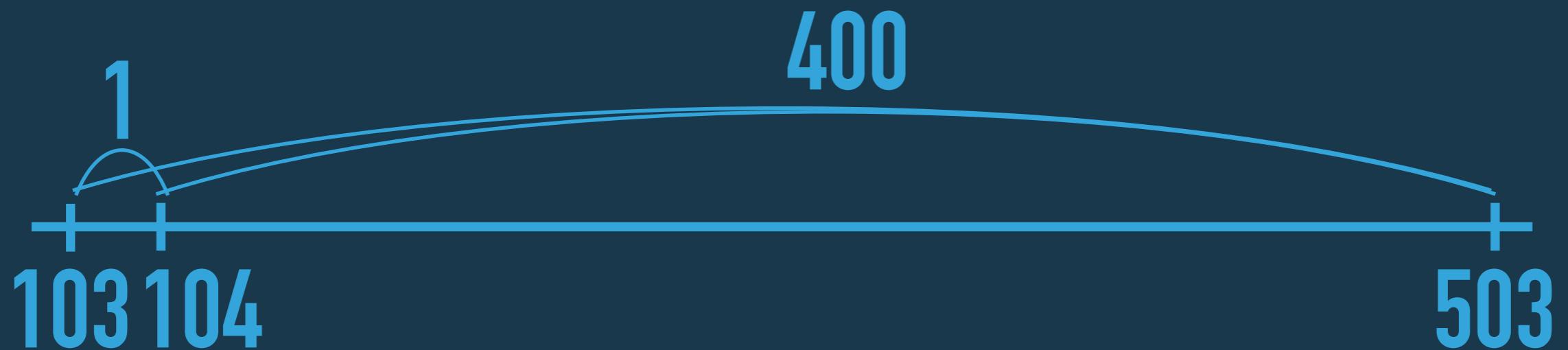
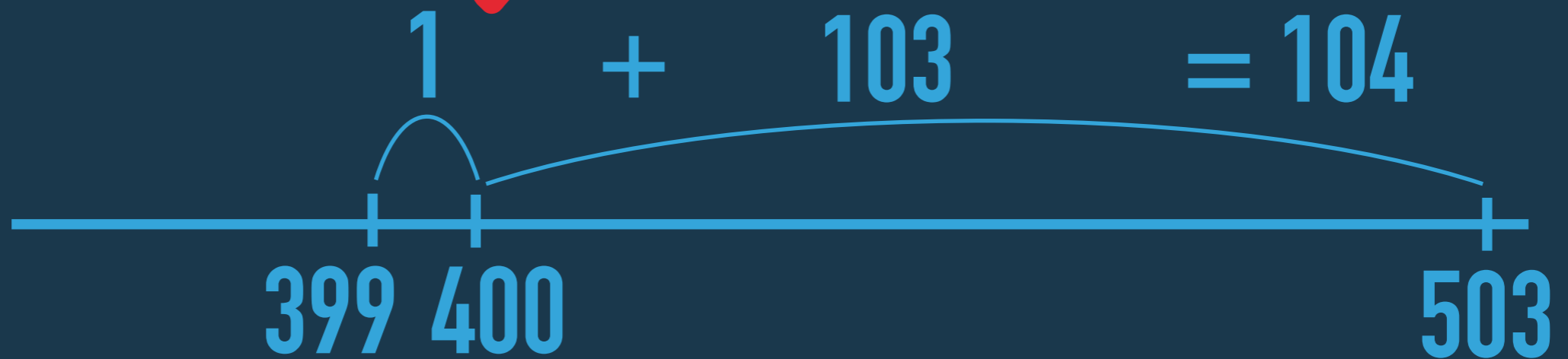
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Model - Representation of Thinking



Model - Representation of Thinking



Model - Tool for Thinking

503 - 399

Model - Tool for Thinking

503 - 399



Model - Tool for Thinking



Model - Tool for Thinking

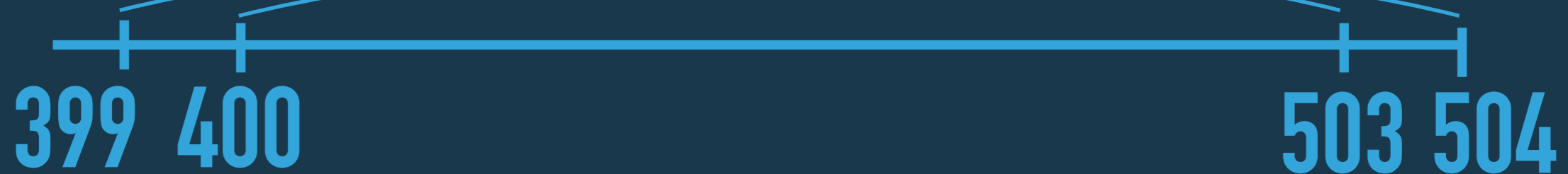


Model - Tool for Thinking

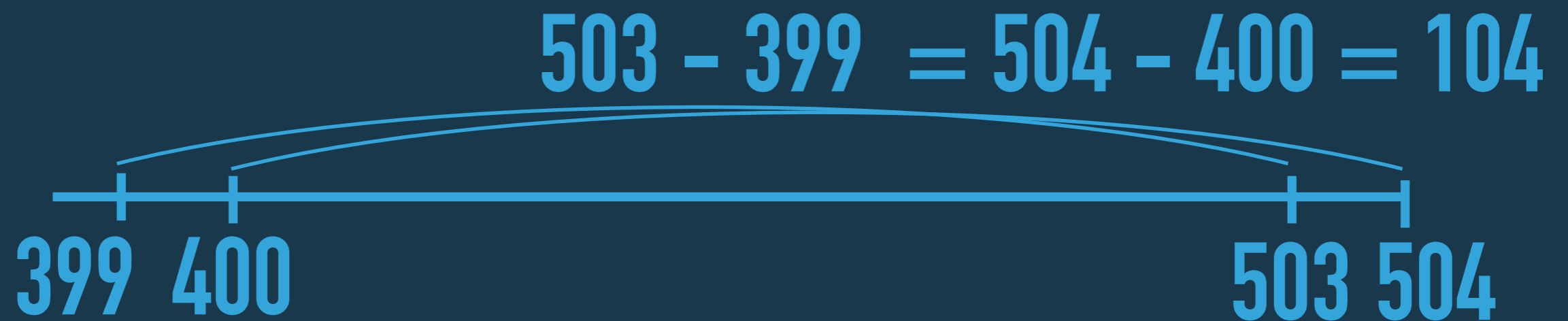


Model - Tool for Thinking

$$503 - 399 = 504 - 400$$



Model - Tool for Thinking



Verb

- Model - Demonstrate
- Model - Represent Thinking

Noun

- Model - Manipulative
- Model - Equation (function)
- Model - Modeling process
- Model - Representation of a Situation
- Model - Tool for Thinking/Computation

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- ***Model - Represent Thinking***



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Model of a Situation

Model of Thinking

Model for Thinking (as a tool)

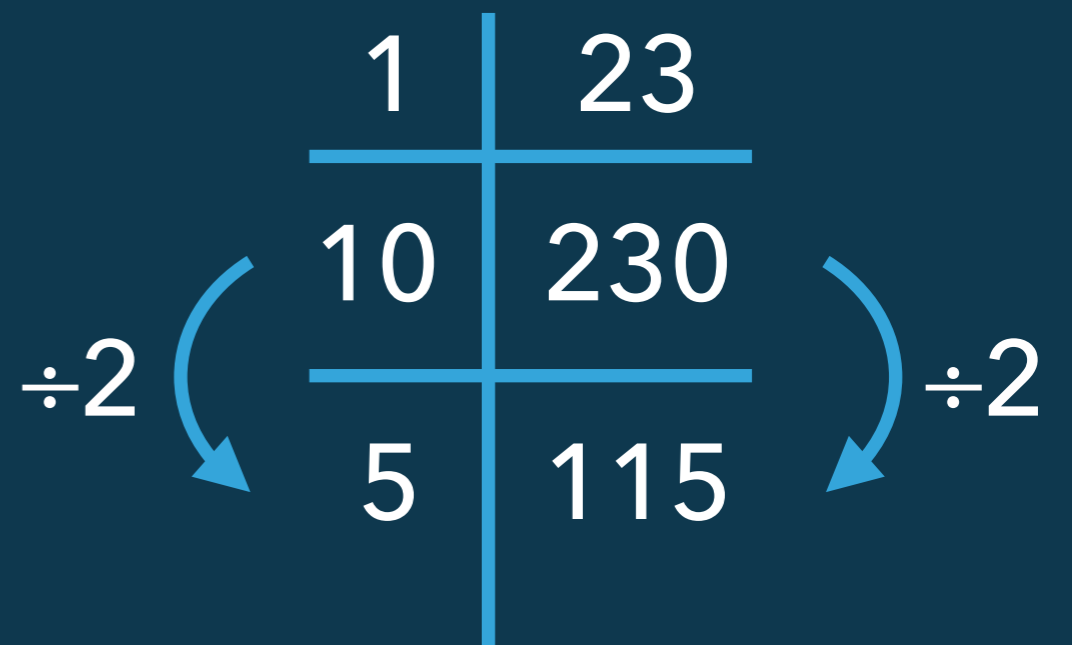
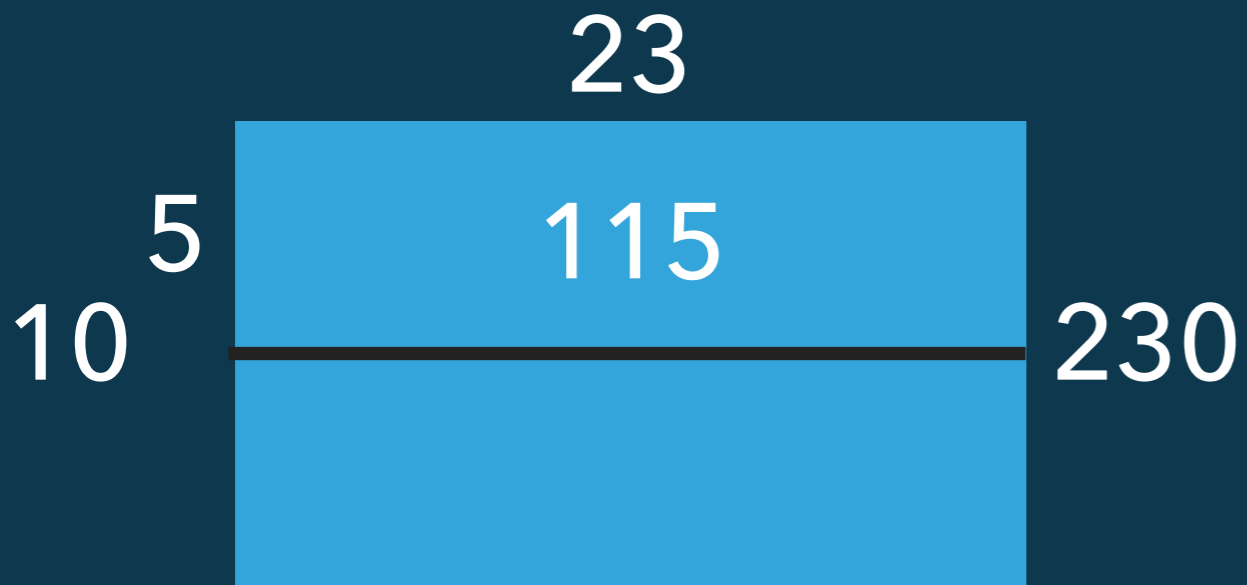
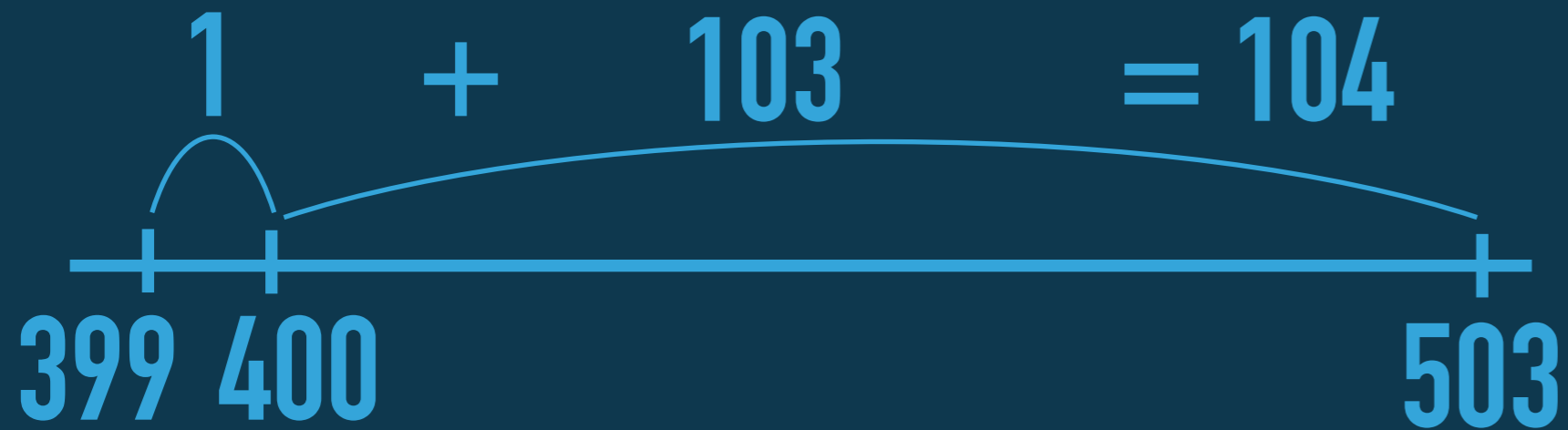
Fosnot & Dolk

DO

EXPRESS

REPRESENT

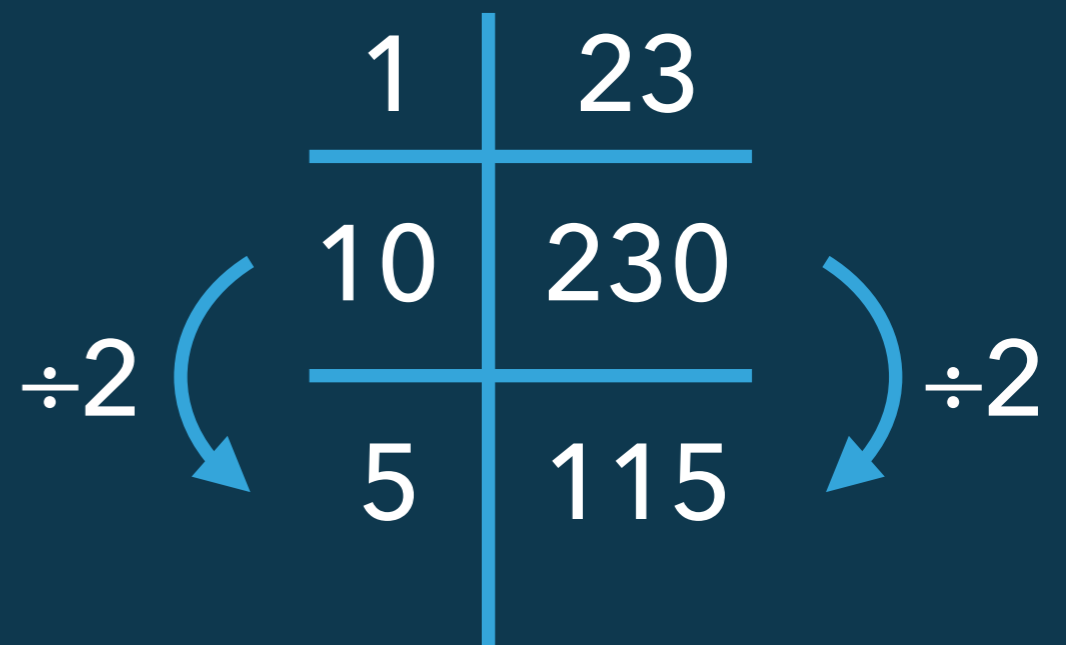
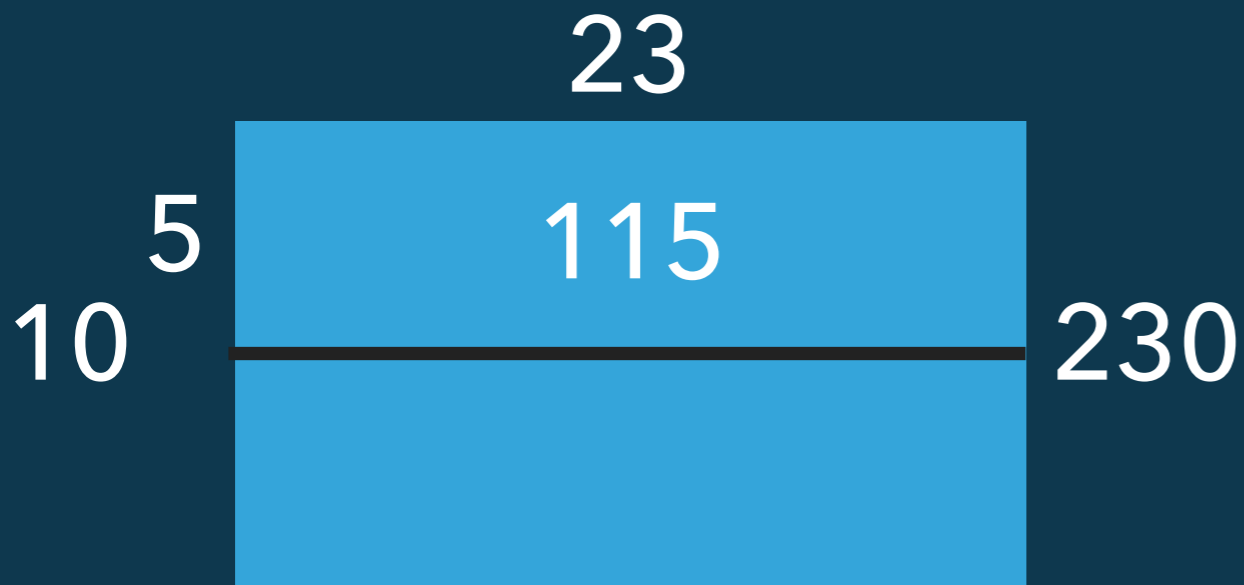
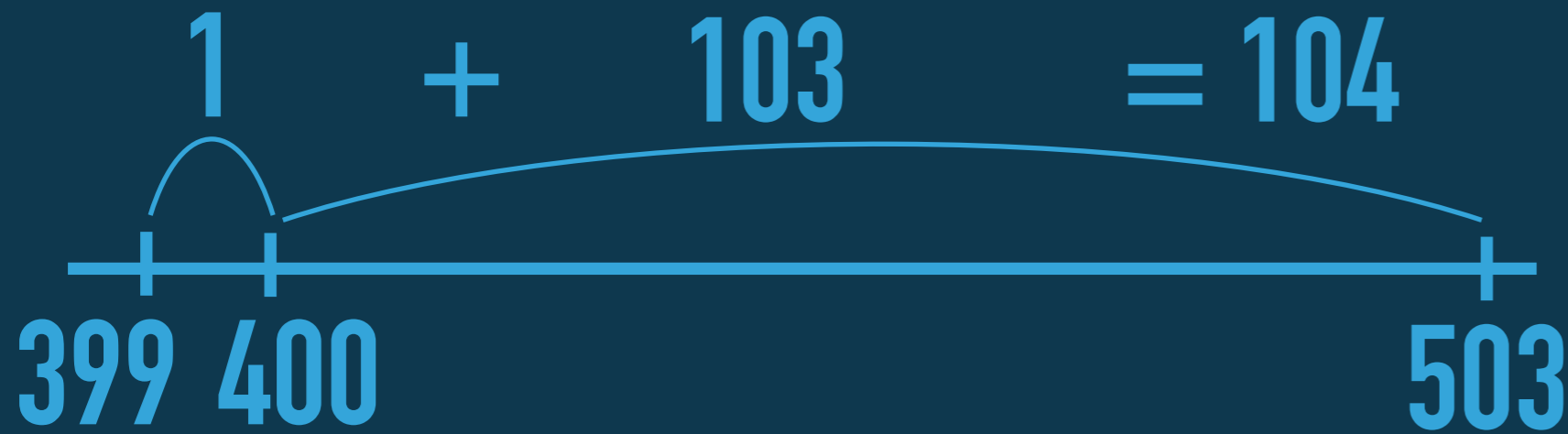
Models for Thinking



@pwharris

PAM HARRIS

Models for Thinking (as tools for reasoning)



Strategy

how you deal with the numbers or structure
to solve a problem

Model

representation of a strategy, of relationships;
some models can be tools

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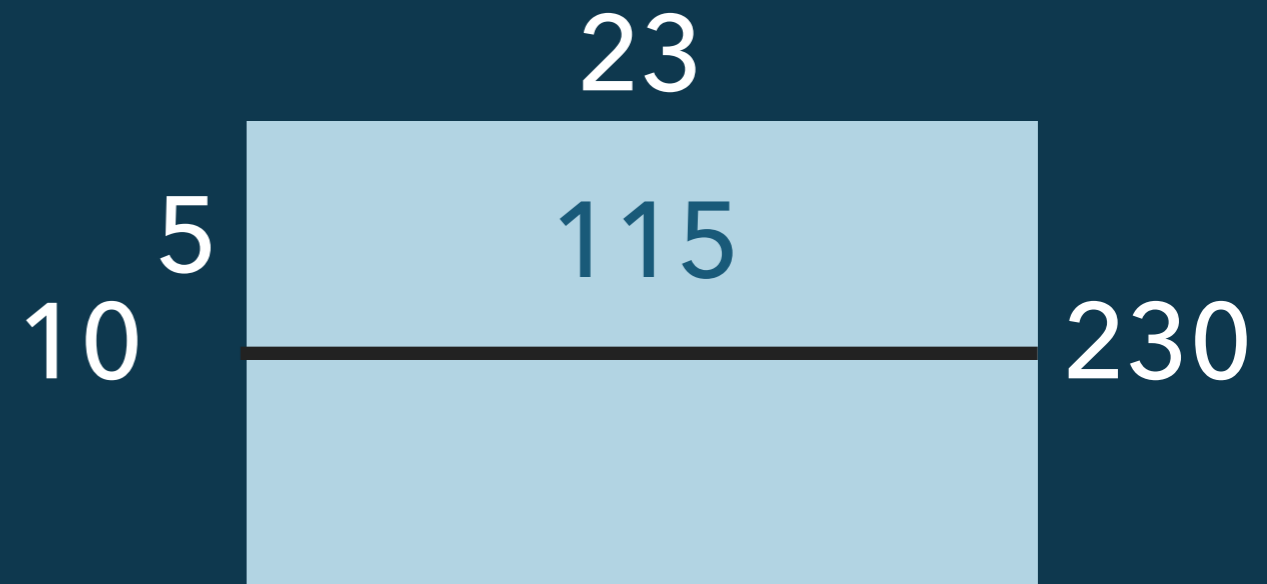
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1	23
10	230
5	115

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$$10 \times 23 = 230$$

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representation of a strategy, of relationships;
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- Mistakenly think that all strategies are equal

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- Mistakenly think that all strategies are equal
- There's a vast, unlimited, unknowable number of "strategies"

Strategy

how you deal with the numbers or structure
to solve a problem

Model

representation of a strategy, of relationships;
some models can be tools

- Mistakenly think that all strategies are equal
- There's a vast, unlimited, unknowable number of "strategies"
- Students forced to find "another way" often use less sophisticated strategies.

MODELS & MODELING MATH

MAKE THE RELATIONSHIPS VISIBLE

TEACH REAL MATH

@pwharris

PAM HARRIS

TELL REAL MATH

EXPERIENCE REAL MATH

MATHEMATIZE

~~MIMICRY~~ ~~TRICKS~~

TRANSPARENT

MENTOR MATHEMATICIANS

**MATH IS
FIGUREOUTABLE!**

It's About Relationships

- Among the numbers and structures to solve problems
- Between teachers and students to mentor and nurture young mathematicians

QUESTIONS?

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