Teaching Math through Big Ideas: What Does it Look Like

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Niagara on the Lake
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- What are **SOME** of the Big Ideas in Elementary Math?
- How does it affect planning?
- How does it impact assessment?

So..

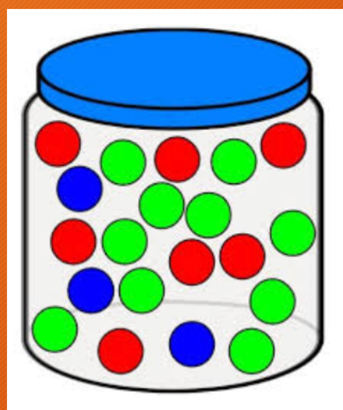
- In different situations I might ask how students might count the total and why.

How many wheels? How did you count?

How much is this worth? How did you count?

How many people responded? How did you count?

How many marbles are there?



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In terms of instruction

- I focus less on what the count is and more on why they counted the way they did and whether there are other reasonable alternatives.

Possible assessment question:

- Draw a picture of something you would probably count by 10s.

- Draw a picture of a group of things you could count without counting each thing.

Let’s consider numeration

- Numbers sometimes, but not always, describe “how much” or “how many”.

So…

- We repeatedly need to expose kids to situations where numbers do describe quantity and ones where they don’t.

Which describe quantity? Which don’t?

Thinking of assessment

- Describe a time where a number definitely tells how many.
- Describe a time where you are not as sure.

Let's consider numeration

- Every number can be represented in many ways. Each way highlights something different about that number.

So..

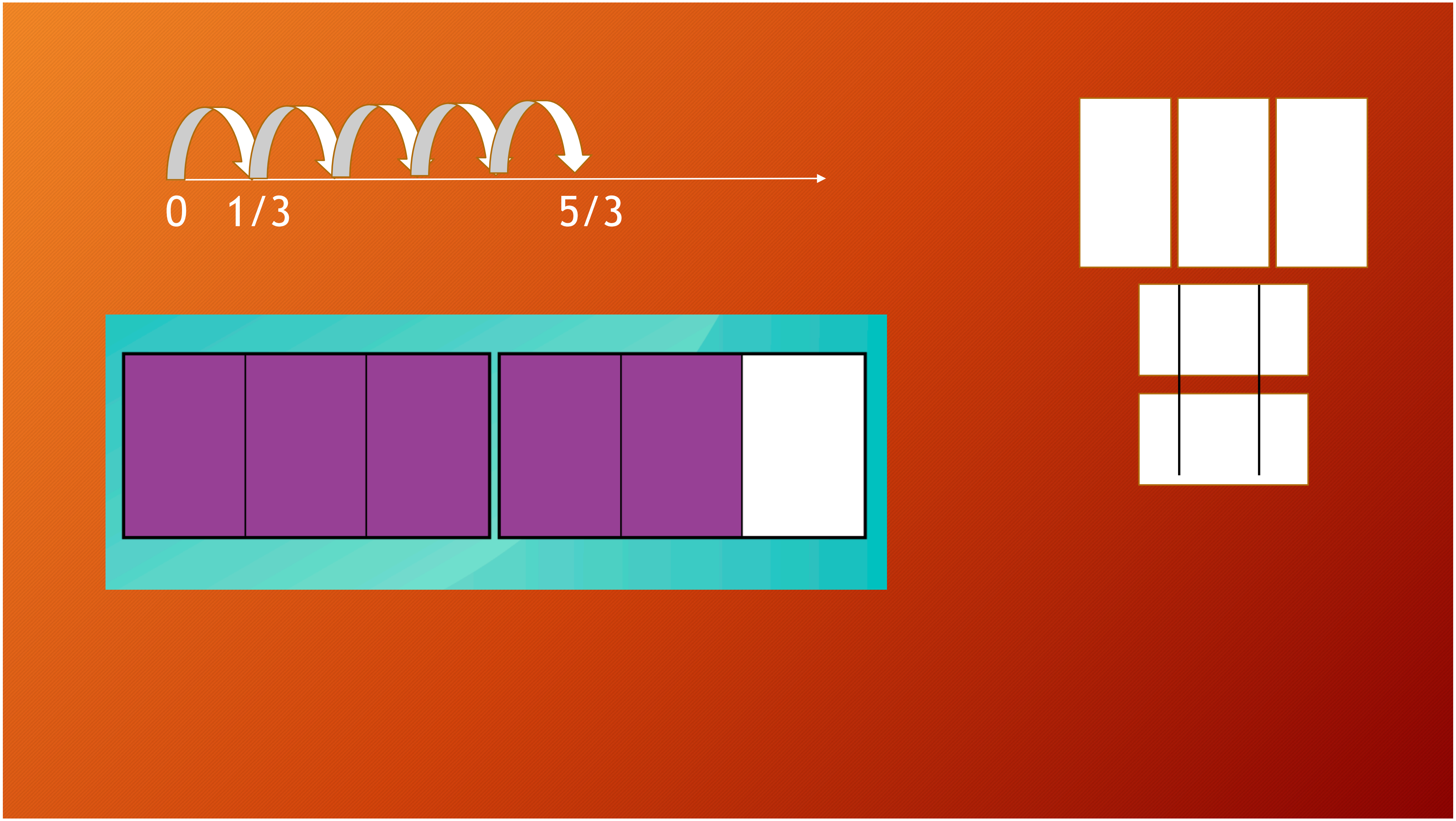
- Show 24 in a lot of ways.
- Which of your ways made it easy to see that:

- 24 is more than 20
- 24 is less than 30
- 24 is even
- is closer to 20 than to 30
- is about 25

So..

- Show 5/3 in a lot of ways.
- Which of your ways made it easy to see that:

- 5/3 is five 1/3s
- 5/3 is more than 1 ½
- 5/3 is 5 ÷ 3
- 5/3 is less than 2

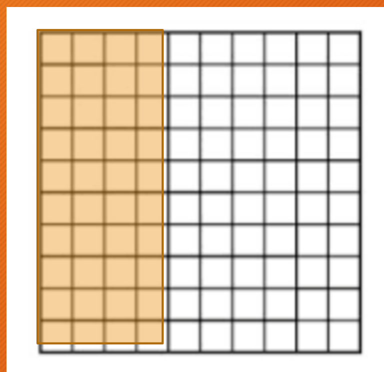

0
1/3
5/3

Or it might be

- Show 40% different ways.
- What does each way show?

Which shows

- That 40% is less than half
- That 40% is 2/5
- That 40% is 4 sets of 10%
- That 40% is 10% less than 50%
- That 40% can be a lot or a little




20%
20%
20%
20%
20%

It means that..

- Whenever you have kids do a representation in any unit, you ask what they see.

In terms of assessment

- Show how to model 88 – 17 two different ways.
- What does each way help you see better?

In terms of assessment

- What picture showing 4:5 makes it really easy to see that it is also 8:10?

Let’s consider numeration

- Every number can be decomposed and recomposed in different ways; this often makes it easier to estimate the size of the number or calculate with it.

You might ask

- How could you break 20 counters up into 3 piles so that one pile has exactly one more counter than another pile?

“Lesson”

- You use 12 base ten blocks to show a number.
- What can it be?

Probably

• 12	66
• 120	57
• 111	390
• 300	417

Or you might ask…

- How could you decompose 36 and 42 to help you figure out their GCF?

In terms of instruction

- I help students see that all of these involve decomposition:
- Adding
- Subtracting
- Multiplying
- dividing

In terms of instruction

- I help students see that all of these involve decomposition:
- Work with money
- Factoring
- Place value

In terms of assessment

- You have $100 in toonies and $5 bills.
- How many of each might you have?
- Is there a number of $5 bills you COULD NOT have?

Let’s consider numeration

- Benchmark numbers can be used to estimate, compare, and give meaning to numbers.

So.. For example

- I am thinking of a number that is:
- A reasonable number of people in a shopping mall on Saturday afternoon
- A reasonable number of people at an NHL hockey game
- A reasonable number of steps I walk in a week

So.. For example

- How do you know that 411 > 289?
- You add two numbers that are 40 apart and the total is close to 300. What could they be?

So.. For example

- Which estimate would you choose for 541 - 157?
- 500 - 100
- 500 - 200
- 550 - 150

In terms of instruction

- When we work with numbers, we talk about the fact that in different situations, we might estimate them differently and why.

In terms of assessment

- You can't just say a rule!
- How do you know that 4[][] is more than 3[][]?

Let’s consider numeration

- Addition and subtraction are related. They always involve parts and wholes.

So I might ask…

- Describe a situation where you might subtract 43 from 122.
- What addition also describes that situation? Why?

So I might ask…

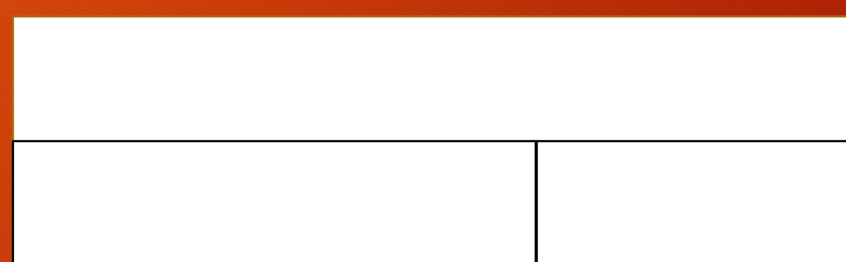
- Describe a situation where you might subtract 4.3 from 12.2.
- What addition also describes that situation? Why?

So I might ask…

- Describe a situation where you might subtract 1 2/3 from 3 1/2.
- What addition also describes that situation? Why?

So I might ask…

- Fill in one of the boxes with the number 12.4 (or 12 or 2 1/3). Then fill in the other boxes so the total lengths are the same.



So maybe

- You teach addition and subtraction together.
- You repeatedly ask for what addition is related to a subtraction situation kids are dealing with or the reverse.

Let’s consider numeration

- Multiplication and division are related to each other and to addition and subtraction.

So I might ask…

- Draw a picture or build a model that shows multiplication.
- What divisions do you see in your picture or model?
- What additions?
- What subtractions?

So I might ask…

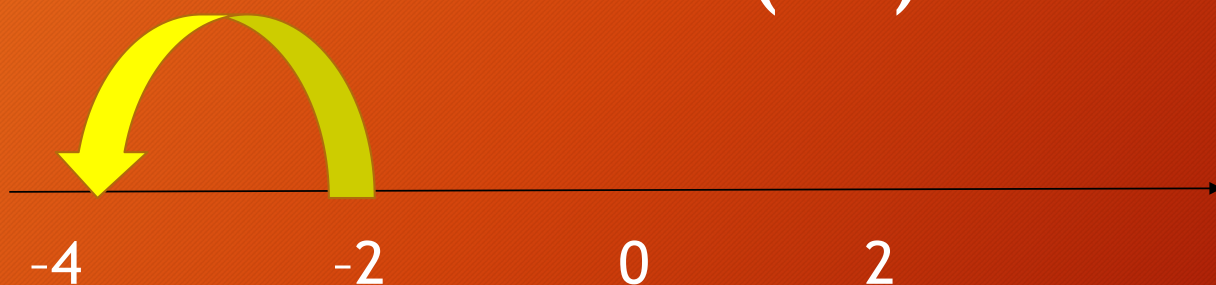
- Solve 815 ÷ 5 using only subtraction.
- Solve 3 x 422 using only addition.

In terms of assessment

- How could you use addition to figure out 3.1 – 1.7? OR
- You divided a number by 4. The answer was a 2-digit number and a remainder of 1. What could the number have been?

In terms of assessment

- How does this picture help you figure out what -4 - (-2) is?

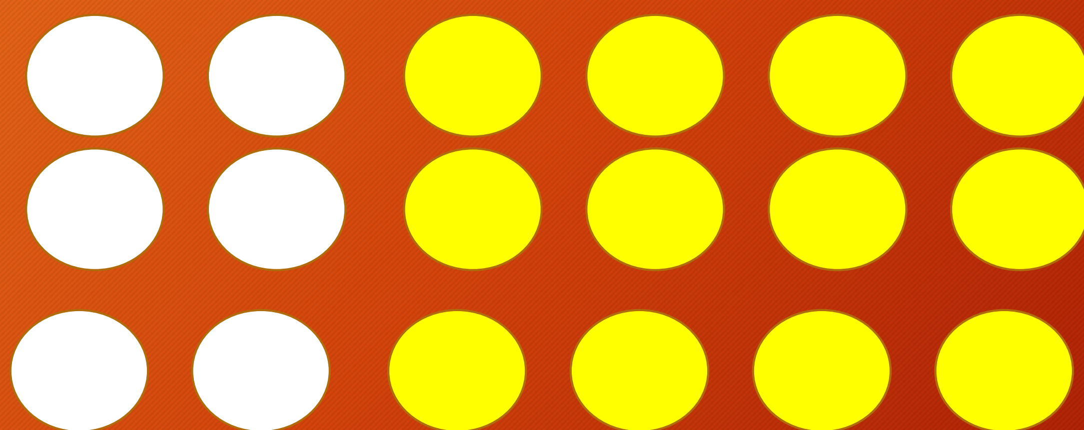


Let's consider numeration

- Whenever you see one ratio, you actually see a lot of ratios and a lot of fractions.

For example

- What ratios and fractions do you see here?



Or

- Draw a picture that shows the fractions 4/6 and 2/5 at the same time. What ratios do you see?

Perhaps

- Whenever kids are working with ratios, you bring up fractions they also see, and vice versa.

In terms of assessment

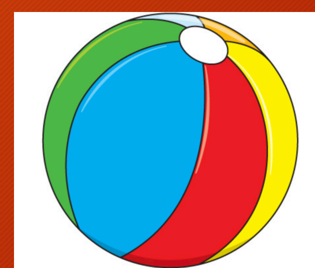
- Describe at least 4 ratios and 4 fractions in this picture.

Let’s consider numeration

- Knowing a relationship between between two values automatically tells you the relationship between other values.

You might ask…

- You know that the doll costs $4 more than the ball.
- If the ball costs $8, how much does the doll cost?



For example

- Suppose A is 20% of B.
- What percent of B is 2A?
- What percent of 2B is A?
- What percent of 2B is 2A?
- What percent of A is B?

In terms of assessment

- A toy costs 4 times as much as a notebook.
- How does the cost of 2 toys compare to the price of the notebook?

In terms of assessment

- A toy costs 4 times as much as a notebook.
- How does the cost of 2 toys compare to the price of 4 notebooks?

Just a tidbit into other strands

Consider measurement

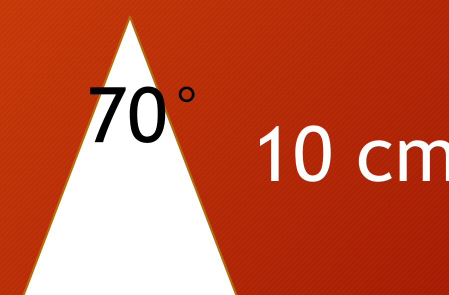
- Some measurements of an object are independent of other measurements, but some are not.

It could be…

- You know how tall a can is.
- What don’t you know about it?

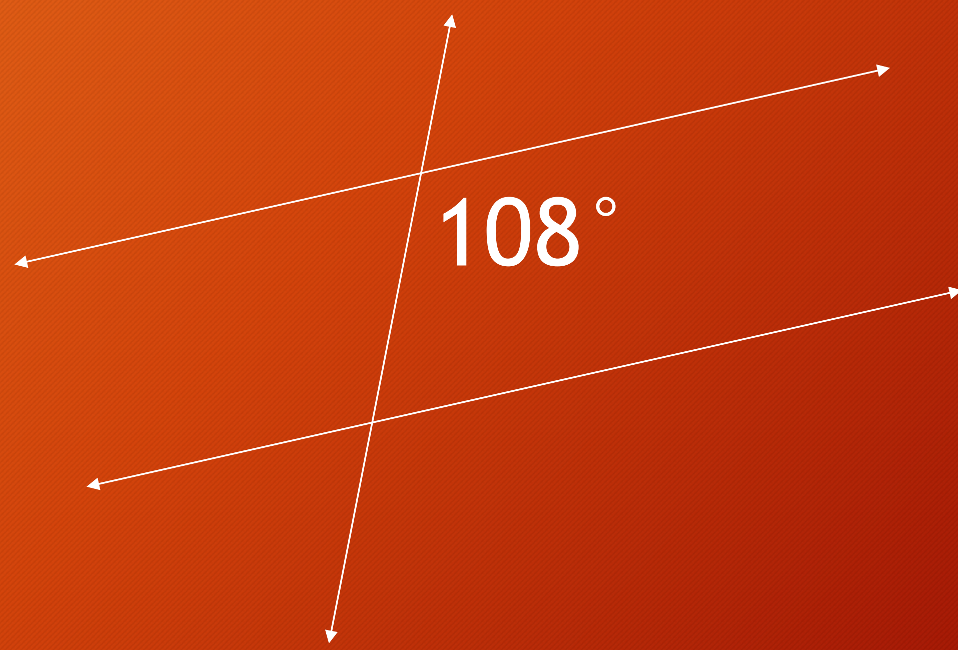
So I might ask

- You know this triangle is isosceles.
- What other measurements of it do you know now? Which not?



OR

- What other measurements are you sure of?



OR

- One measurement of a circle is 20 cm. What are other measurements associated with that circle?

Perhaps

- You frequently bring up situations where knowing one measurement of an object tells you another one and talk about how they know. You also bring up situations where measurements are independent and discuss those.

In terms of assessment

- You know the area of a rectangle and its width.
- What other measurements of it do you know?
- Are there any you are less sure of?

What about

- Patterning and Algebra

Consider algebra

- There are many things that are true about “all” numbers or all of a particular set of numbers.

You might ask

- I add two numbers.
- I subtract the same two numbers.
- The “add” answer is 10 more than the “subtract” answer.
- What numbers could they be?

For example

- When you talk about ideas like adding numbers in any order, you ask kids for other mathematical things that are “always true” .

You might ask

- Choose a number.
- Multiply it by the number that is 2 greater.
- Now multiply the number between them by itself.
- What do you notice?

For example

- When you talk about ideas like multiplying numbers in any order, you ask kids for other mathematical things that are “always true” .

In terms of assessment

- It’s true that when you add any even number to another even number, you get an even number.
- Tell me four other things about numbers that are ALWAYS true.

- Questions?

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