GROWING AS A MATH TEACHER

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AGENDA

- Number relationships
- Operations and how they relate to number relationships
- Communication
- Responding to student work
- Differentiating for IEP students

NUMBER RELATIONSHIPS

- We want students who, when they see pairs of numbers, see potential relationships between them.

I MIGHT ASK:

- Who belongs with these numbers?

- 8, 18, 82

I MIGHT ASK:

- Who belongs with these numbers?

- 2, 7, 11

I MIGHT ASK:

- Who belongs with these numbers?

- 60, 84, 100

I MIGHT ASK

- Who does not belong with the others?

- 2/3 3/4 3/8 4/5

I MIGHT ASK

- Who does not belong with the others?

- 5 x 7
- 9 x 4
- 4 x 7
- 124 ÷ 4

I MIGHT ASK

- How would you continue this pattern?
- 5, 9, 13,…
- 504, 499, 495,…
- 3, 6, 12,….

HOW ARE THESE PATTERNS RELATED?

- 3, 7, 11, 15, ...
- 4, 8, 12, 16,....

HOW ARE THESE PATTERNS RELATED?

- 3, 7, 11, 15, ….
- 6, 14, 22, 30,…

HOW ARE THESE PATTERNS RELATED?

- 1, 3, 6, 10,…
- 2, 6, 12, 20,….

OR WE COULD ASK

- How could you represent 32 as a little less than a triple?
- How could you represent 58 with 22 base ten blocks?
- How could you represent 1/3 to show it's a little MORE than ¼ ?

THE OPERATIONS

- What about the 4 operations (besides doing them) do kids need to know?
- How does it relate to number relationships?

BIG IDEAS IN OPERATIONS

- Any addition involves parts and a whole. The parts are known, but the whole is not.
- Any subtraction involves parts and a whole. One or more parts and the whole are known, but not all of the parts.

BIG IDEAS IN OPERATIONS

- Any situation involving subtraction also involves addition and vice versa.

I MIGHT ASK

- Choose numbers for the three boxes to make this true.
- Write an addition and a subtraction that go with your selection.

IN PARTICULAR

- Subtraction involves taking away OR comparing OR a missing addend.

BIG IDEAS IN OPERATIONS

- Any computation can describe a variety of situations.

I MIGHT ASK

- Create a problem you would solve by figuring out 12 – 4 BUT THERE CAN BE NOTHING TAKEN AWAY, EATEN, ETC.

BIG IDEAS IN OPERATIONS

- Performing addition or subtraction is made easier by decomposing.

I MIGHT ASK

- You need to add 24 + 38. How might you break one or both numbers into pieces to make the addition easier?

I MIGHT ASK

- You need to subtract 50 – 32. How might you break one or both numbers into pieces to make the subtraction easier?

BIG IDEAS IN OPERATIONS

- Estimation is a critical part of computation.

I MIGHT ASK

- You add two numbers and the answer is about 60. How far apart could the tens digits be?

I MIGHT ASK

- You subtract 53 – 27. Which is a good estimate? Why?
- 50 – 20
- 50 – 30
- 53 – 30
- 57 – 27

BIG IDEAS IN OPERATIONS

- There are always many strategies to add or subtract.

I MIGHT ASK

- How would you figure out 41 – 17?
- Tell another subtraction you would do a similar way.
- Tell another subtraction you would do a different way.

I MIGHT ASK

- Why can you and why would you figure out 28 + 57 by adding 30 + 55?

- Why can you and why would you figure out 28 – 9 by figuring out 29 – 10?

AN UNDERSTANDING OF X AND ÷

- Multiplication can mean different things.
- What does 3 x 82 mean?
- It can be 82 + 82 + 82.
- It can be the total in 3 groups of 82.
- It can be the amount that is three times as much as 82.
- It can be area of a rectangle 3 x 82.

AN UNDERSTANDING OF X AND ÷

- Division can mean different things.
- What does 112 ÷ 4 mean?
- It can be the number of 4s you can subtract from 112 to get to 0.
- It can be the share amount if 112 is separated into 4 equal shares.
- It can be the number of 4s you can make with 112.
- It can be length of a rectangle with width 4 and area 112 square units.

I MIGHT ASK

- Create a problem where it would make sense to multiply by 3.
- Create a problem where it would make sense to subtract 3.1.
- Create a problem where it would make sense to divide by 8.

I WANT STUDENTS TO KNOW THAT

- Multiplying and dividing undo each other.
- That any division can be computed by multiplying.
- That it is often useful to multiply or divide in parts.

MULTIPLYING AND DIVIDING UNDO EACH OTHER

- Suppose you had 5 times as much money as Lea.
- Then you share what you have with 4 other people.
- How much does each person have now?

ANY DIVISION CAN BE CALCULATED BY MULTIPLYING

- How could you multiply to solve 412 ÷ 4?

THAT IT IS USEFUL TO MULTIPLY OR DIVIDE IN PARTS

- Jamie solved 20 x 34 by multiplying 20 x 30 and then 20 x 4 and adding those.
- Do you agree? Explain.

THAT IT IS USEFUL TO MULTIPLY OR DIVIDE IN PARTS

- Jamie solved $417 \div 3$ as $300 \div 3 + 90 \div 3 + 27 \div 3$.
- Do you agree? Explain.

I WANT STUDENTS TO KNOW THAT

- If you multiply one number by an amount and divide the other number by that same amount, a product does not change.
- For example, 2.5 x 4 is the same as 5 x 2.
- Do you agree? Why?

I WANT STUDENTS TO KNOW THAT

- If you multiply both numbers by the same amount, you do not change the quotient.
- For example, 6.4 ÷ 5 is the same as 12.8 ÷ 10.
- Do you agree? Why?

STUDENTS NEED TO

- Relate results of computations to numbers involved.

For example---

- I multiplied a number by 4.9 and got a number close to 50. What do you know about what I multiplied by?
- I multiplied two numbers and the answer was close to double one of them. What could they have been?

STUDENTS NEED TO

Understand strategies that support computation.

- For example, why can you calculate 9 x 32 as 10 x 32 – 32?
- Why can you divide 618 by 4 by dividing 400 by 4 and then 200 by 4 and then 18 by 4?

COMMUNICATION

- Students need models of what good communication looks like-
- Both oral and written

SUPPOSE I ASKED

- When you add an even number and an odd, you get an odd. Why?

- What would you want to hear?

SUPPOSE I ASKED

- You bought two items.
- You got $3.85 change from $10.
- What could the items have cost?

- What would you expect?

DIFFERENTIATION

- It's essentially ALL about open question and/or parallel tasks.

DIFFERENTIATED CENTRES

- Rather than suggesting activities, I will talk about principles.
- One is certainly the value of using open questions, e.g.

DIFFERENTIATED CENTRES

- Choose a pair of numbers to add.
- Show how you would add them using models. Take a picture of what you did.
- Now show what numbers to add to get an answer a little more. Take a picture.

DIFFERENTIATED CENTRES

- I provide a pan balance and linking cubes and ask kids to put two groups of cubes on each side to make them balance and tell me what number pairs they used.

DIFFERENTIATED CENTRES

- I provide a walk-on number line (number path) and ask them to choose a number and think of lots of different ways to get to that number.
- They could take only two steps forward or steps forward and backward or multiple steps forward and backward.

DIFFERENTIATED CENTRES

Q Choose numbers and finish each story. Do each story two more more ways.

a) ___ frogs jumped into a pond. Then, ___ more jumped in. There were ___ frogs in the pond.

b) I need ___ spoons. First I put out ___ spoons. I needed ___ more.

c) There were ___ birds. ___ flew away. There were ___ birds are left.

DIFFERENTIATED CENTRES

Q Choose some counters. Separate them into piles so that the piles have the same number of counters in them. What number of counters can you put into equal piles? What number of counters can you not put into each piles?

DIFFERENTIATED CENTRES

$ Q Choose three or more amounts of money that you can represent using six coins. How else could you show each of those amounts?

DIFFERENTIATED CENTRES

Q Use the digits 1 to 7, using each digit only once, to fill in the blanks. Then, order the numbers from least to greatest. Try it again, putting the digits in different places.

☐3 ☐4 1☐ ☐☐ 3☐ 4☐

SAMPLE RESPONSE

23, 34, 11, 57, 36, 44 becomes 11, 23, 34, 36, 44, 57.

DIFFERENTIATED CENTRES

Q Create a number line by skip counting by 5s. Choose five numbers, not ending in 0 or 5, and place them on your number line. Explain why you placed those numbers where you did.

SAMPLE RESPONSE

I chose 9, 12, 24, 38, and 51. 9 was just a bit to the left of 10, and 12 was just a little closer to 10 than to 15. 24 was almost at 25. 38 was only a bit closer to 40 than to 35. 51 was just a bit past 50.

OR..

- On a topic, rather than rotating through all centres, you have two simple ones and two more complicated ones.

I KNOW THAT..

- I am not showing you very straightforward activities for the centres since these are probably easier for you to develop, but…
- It is critical that all students, even strugglers, get thinking activities and not just "fill in the blank" type activities.

CREATING RICH OPEN QUESTIONS

- Strategies that I often use.
- Here is the answer. What is the question?

THE ANSWER IS

- 15. What is the question?
- 4 x 3. What is the question?

ALIKE AND DIFFERENT

- How is adding like multiplying? How is it different?
- How is adding like subtracting? How is it different?
- How are 13 and 17 alike? Different?
- How are 25 and 40 alike? Different?

CHOOSE YOUR OWN VALUES

- Choose a 2-digit number and a 1-digit number so that the sum is between 30 and 50. Add them.

- Choose two numbers to subtract so the answer is close to what you subtracted.

- Choose two numbers to multiply. Multiply them.

"SOFT WORDS"

- A number is pretty close to 40. What might it be?

- A few more than ____ is a lot more than _____. What numbers might go in the blanks?

- You add a number that is almost 30 to a number close to 40. What could the answer be?

Q Choose a number up to 10. Write the numeral. Draw a picture that has that number of lines or dots. Tell a story about your picture.

Q Stand on a spot on a number line. What number are you standing on? You want to walk forward and backwards a few times and end up on the same spot. How much would you go forward and backwards each time?

Q How many forks do you think your family should have?

Q Choose a number less than 20.
Tell as many things about it as you can.

Q Fill in the blanks to create five numbers in order from least to greatest. Use each digit 1 to 5 only once.

□ □ 1□ 1□ 1□

How do you know that your numbers are in the correct order?

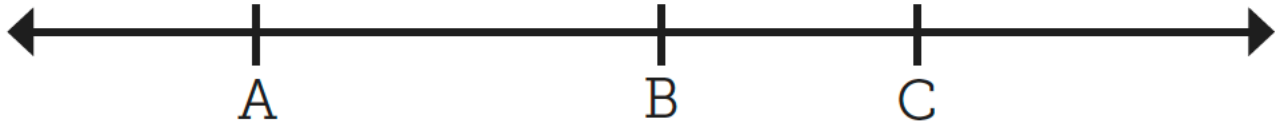
Q How many handfuls do you think you would need to hold 100 buttons? Explain your reasoning.

Q About how long would it take you to do these things?

- go to school 100 days
- read 100 books
- say 100 words

Q The two-digit numbers □9 and 4□ are about the same distance apart as 1□ and □5. What might the numbers be?

Q Choose three numbers less than 100 to put at points A, B, and C on the number line below.
Explain why those numbers make sense.
Repeat with other numbers.



Q You write a three-digit number. You switch some of the digits around, and the value of your number increases by 54. What might your numbers be? Repeat with other numbers.

$ Q You represent an amount of money with seven coins. What might that amount be? Is it sometimes possible to use fewer coins to represent that same amount? If it is, give an example.

Q Create a sentence that uses the following words and numbers:

groups greater 2 5

Q Which expression do you think does not belong?

$12 \div 3$ $4 \div 1$ $16 \div 4$ $10 \div 5$

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