Some of the Bigger Issues in Planning JI Math Instruction

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What matters first?

- The classroom environment.
- But today my focus will be, assuming we get this right, instruction and assessment.

What matters?

- MOST FUNDAMENTAL-
- Recognizing that math is not about doing stuff, but about thinking mathematically.
- We will readdress this later.

What else matters?

- MOST FUNDAMENTAL-
- Recognizing that different children have different needs and these must be addressed.
- This might be tasks you set as well as the type of feedback you give.

What else matters?

- MOST FUNDAMENTAL-
- Knowing why you are teaching what you are teaching.
- That means MORE DEEPLY understanding the purpose of expectations

For example…

- Grade 6:
- Represent ratios found in real-life contexts, using concrete materials, drawings and standard fractional notation
- What are the most important markers for you that the student has been successful on this expectation?

For me…

- Recognizing that whenever you see one “ratio” situation, there are a whole whack of other ones sitting there too
- Recognizing that fractions can be applied to part-part as well as part-whole situations

For me…

- Recognizing that ratios are comparisons related to multiplication/division (not addition/subtraction), e.g. if there are 12 boys and 4 girls, you think about 3 times as many boys as girls and not 8 more boys than girls

What ideas

- You need to know what ESSENTIAL UNDERSTANDINGS/BIG IDEAS to pull out of a lesson, not just what problem to do and to get kids to share.

So..

- You might create your own, or use mine or use someone else's, but you need to do this to teach with confidence and to be able to respond effectively to students.

Clustering of expectations

- By more deeply understanding expectations, you can cluster them.
- This might be a collaborative effort.
- Clustering might facilitate planning, particularly in ensuring you keep returning to important ideas.

Using Open Questions clustering

- Some of Open Questions esson for different s
- Expectation d for you.

GRADE 5

1 Representing Whole Numbers and Place Value

- Represent, compare, and order whole numbers and decimal numbers from 0.01 to 100 000, using a variety of tools
- Demonstrate an understanding of place value in whole numbers and decimal numbers from 0.01 to 100 000, using a variety of tools and strategies
- Read and print in words whole numbers to ten thousand, using meaningful contexts

GRADE 6

1 Problems Using the Order of Operations

- Use a variety of mental strategies to solve addition, subtraction, multiplication, and division problems involving whole numbers
- Use estimation when solving problems involving the addition and subtraction of whole numbers and decimals to help judge the reasonableness of a solution
- Explain the need for a standard order for performing operations, by investigating the impact that changing the order has when performing a series of operations

GRADE 7

3 Adding and Subtracting Fractions and Multiplying Fractions by Whole Numbers

- Use a variety of mental strategies to solve problems involving the addition and subtraction of fractions and decimals
- Add and subtract fractions with simple like and unlike denominators, using a variety of tools and algorithms
- Demonstrate, using concrete materials, the relationship between the repeated addition of fractions and the multiplication of that fraction by a whole number

Longer term planning

- Consider what you think are the big ideas in math.
- Make sure you keep returning to them over the course of the semester/year.

For example – Look at your grade

- **Look at the NUMBER (not Operations) expectations.**
- **What two to four concepts are most important?**

Grade 5 - maybe

- **Demonstrate and explain the concept of equivalent fractions or equivalent representations of a decimal, using concrete materials and drawings**
- **Solve problems that arise from real-life situations and that relate to the magnitude of whole numbers UP TO 100 000**

Less so

- Read and print number words
- Round decimal numbers

In Grade 7, maybe

- Represent and order integers, using a variety of tools
- Generate multiples and factors,…

Less so

- Represent perfect squares and square roots
- Explain the relationships between exponential notation and the measurement of area and volume

In the background

- **You are always focusing on sense of size of numbers.**

So you might…

- Go back and forth between strands, e.g. for Grade 5

Possible path

- Go back and forth between strands, e.g. for Grade 5

- 3-D figures
- Representing decimal numbers
- Length
- Probability
- Estimating and comparing decimals

Possible path

- Patterns
- Area
- Multiplying whole numbers
- Dividing whole numbers
- Time
- Angles
- Representing whole numbers

Possible path

- Polygons
- Comparing whole numbers
- Adding and subtracting whole numbers
- Algebra
- Collecting and organizing data
- Money
- Decimal operations

Possible path

- Mass, capacity and volume
- Grid systems
- Geometric transformations
- Describing data

You need to…

- Focus and keep revisiting important expectations.
- Some are truly less critical and much less attention to them is warranted.

Notice that..

- You DO NOT have to (nor likely should you) visit the expectations in order.

You might also…

- Ensure that every couple of weeks, you do at least some small activity in pattern, or data and some in geometry or measurement.
- You might use some of the open questions minds-on activities for these, e.g.

Q Suppose the base of a prism has an area of □0 cm^2. What could the volume of the prism be?

Q Is it easier for you to predict the 100th term of Pattern A or of Pattern B? Explain.

Pattern A: Start at 1 and keep adding 5.
Pattern B: The value of a term is 2 more than 7 times its term number.

Relating strands

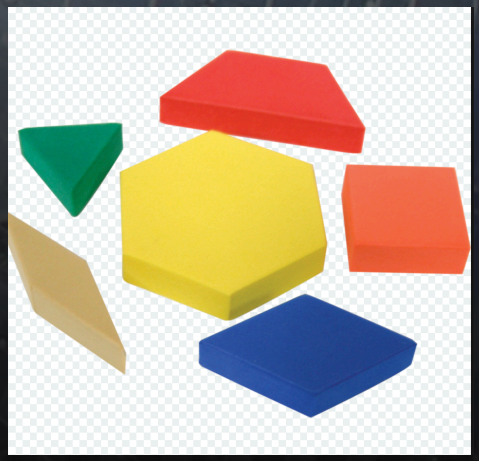
- Or you might use one topic as a context for another,

Measurement and algebra

- The number of centimetres in the perimeter of a rectangle is 8 less than the number of square centimetres in the area.
- What could the dimensions be?

Geometry for fractions

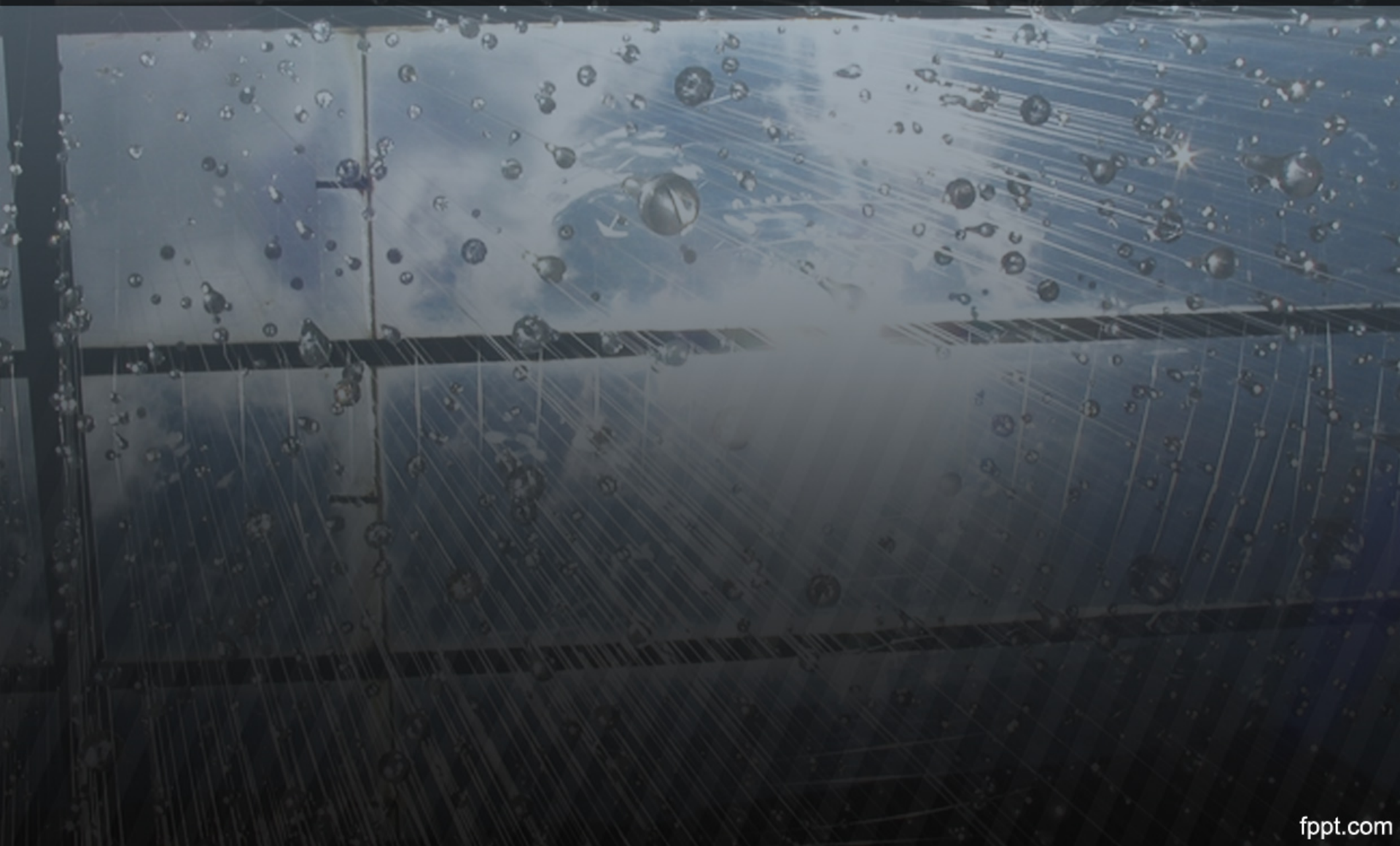
- Put together three pattern block shapes to make one full shape.
- What does the shape look like?
- What would you call it?
- What fraction of the whole area
- is each colour?



Revisiting concepts

- Some ideas are important enough to revisit, changing the task, of course, each time.
- In Grade 6, this might be relating ratio to fractions.

For an individual lesson…



Learning goals

- Learning goals for the bulk of your lessons (certainly 3-part lessons) should be about ideas, and not just performances, so that a teacher can stay focused on the IDEAS s/he is trying to get at.

For example…

- Instead of a learning goal being about multiplying two 2-digit numbers, it might be about the notion that computation involving big numbers always involves breaking up the numbers into manageable pieces.
- The lesson focuses on variations on what those manageable pieces might be.

The main teaching task…

- Is not what you start with, but is in service to getting to the IDEA learning goal you have set.

Consolidation

- What consolidation is relates to sharing, but is NOT JUST SHARING.
- You need to know what critical questions need to be asked at the end of the lesson to ensure that students really knew what math you were trying to get across

So it might look like this

- Learning goal: I can describe different real-life situations an equation might describe.

Flyer

- Shows, e.g.
- Headphones at $20
- Puzzle at $12
- Soccer ball at $9
- Washable markers box at $6
- Cribbage board at $13
- Checkers at $10

Main Problem

- Choose one, two or three items from the flyer. Decide how many of each item you want to buy and calculate the total cost.

- Write an equation to describe what you just did. Use a different variable for the price of each type of item you choose to buy.

Main Problem

- Have a classmate figure out which items you had in mind based on your equation.

Consolidation

- After posting some of the equations students created:
- Look at some of the equations your classmates wrote. How could you tell how many different types of items they bought?
- How could you tell how many of each type they bought?

Consolidation

- What part of the equation told you how much they spent?
- What operation signs were in your equations? Why those?

Manipulatives/visuals

- There should be a lot of use of manipulatives and visuals not just in procedural ways but in service of “seeing” ideas.

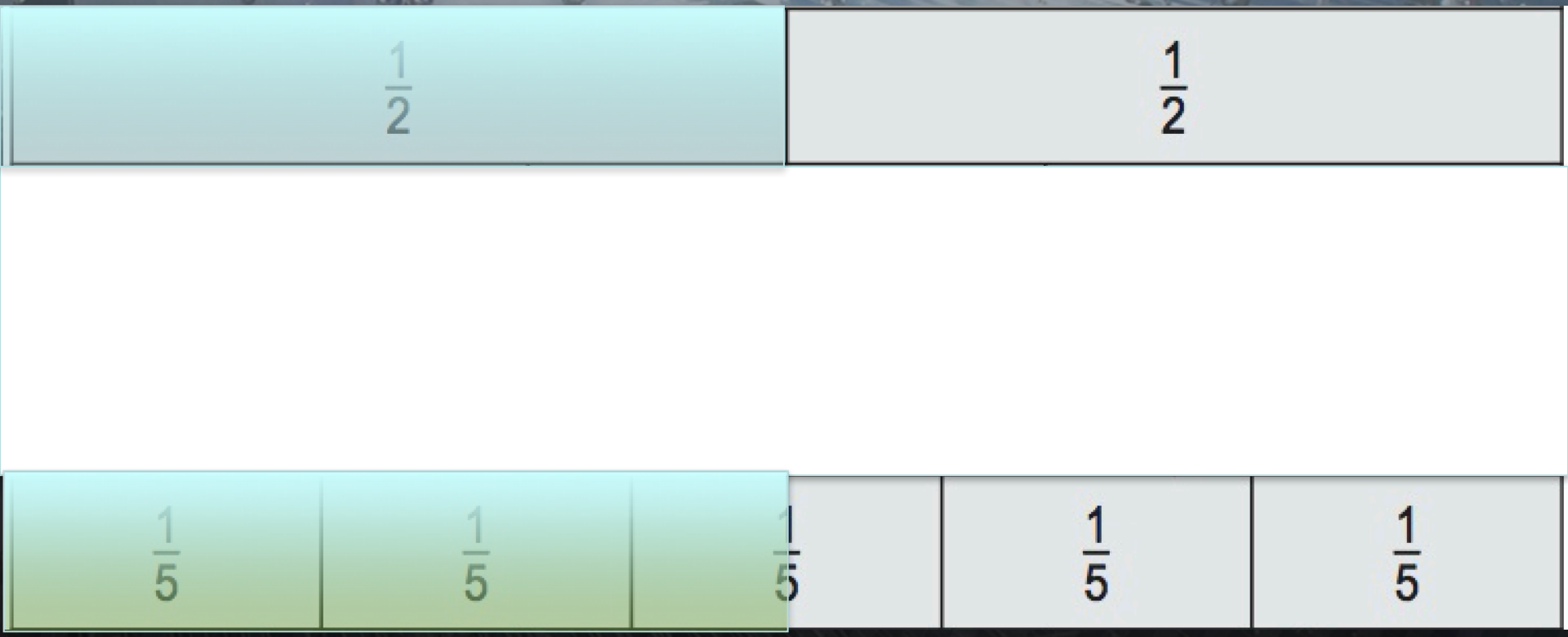
For example

- How could you use linking cubes or counters to show that 24 ÷ 6 has to have the same answer as 12 ÷ 3 WITHOUT GETTING THE ANSWER.

For example

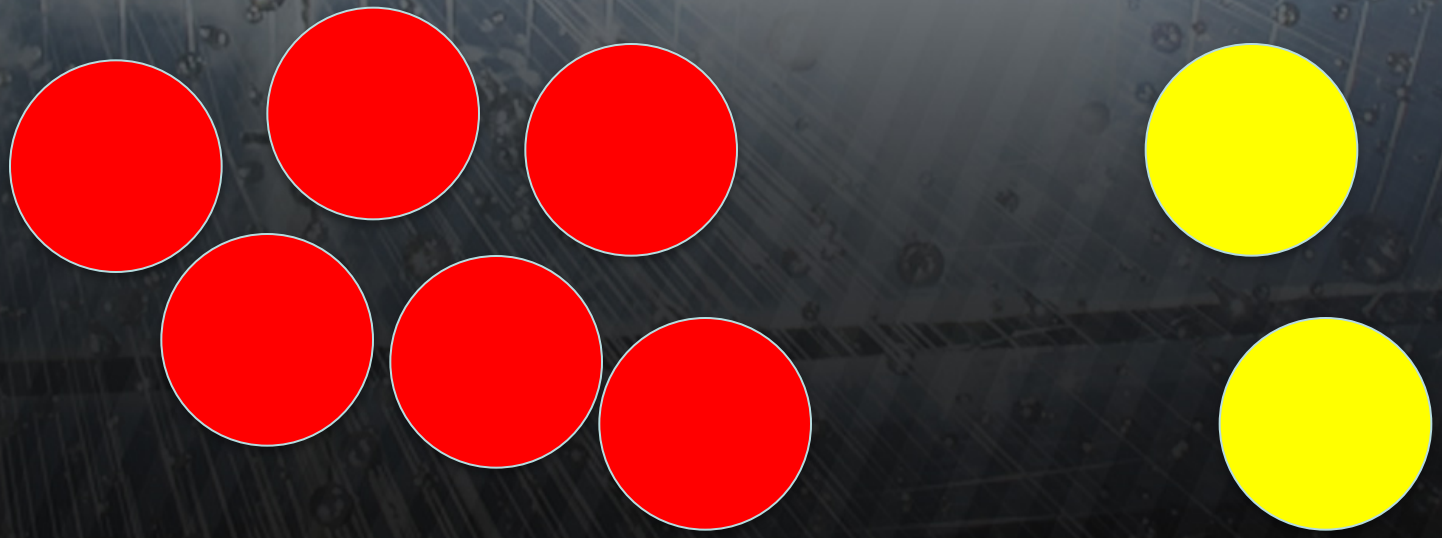
For example

- Why is 1/2 ÷ 1/5 = 2 ½ ?



For example

- You add three times as many negative counters to some positive counters.
- What could the total be?



Success criteria

- Success criteria need to focus not only on how many strategies to use but the quality of what is done and the ideas that the students show an understanding of.
- So, for example,…

Task

- Create a ratio problem where the solution is 12, but it is not quick to see that this is the solution.

Success criteria

- Some criteria should be discussed before the task is begun, but some should be discussed after consolidation.

Success criteria

1. Your problem involves ratios and you can explain how.
2. The solution is 12 and you can explain why
3. You can also explain why you had to work to figure out that the solution was 12.

Consolidate

- What makes a problem a ratio problem?
- Does the 12 have to be the amount in the whole or could it be the amount of a part?
- Why would a problem like: There are 2 girls for every boy in the reading club and there are 6 boys. How many girls are there? Not be a good choice for this task.

Consolidate

- How would you change your problem so that the solution is 24 instead. Why is it an easy change?
- Is it just as easy to change the solution to 14? Why or why not?

Success criteria

4. You recognize when a problem is a ratio problem and why.

5. You recognize that sometimes solutions are about wholes and sometimes about parts.

6. You recognize how ratio problems might be related.

Kinds of tasks you use

- You need a good blend of “3-part lessons”, game days, etc.
- You need a good blend of very focused tasks to reveal very particular math ideas and bigger, thinking tasks that apply what has already been learned.

For example

- Focused task:
- 1. What fractions of a 10 x 10 grid are easy to colour besides fractions with a denominator of 100?
- 2. Why are those fractions easy ones?

For example

- Application task: A stack of magazines is about 1m tall. About how many magazines is that likely to be?

Understanding

- You need to focus more on understanding than just knowledge.

For example

- **Knowledge:** List the factors of 40.
- **Understanding:** A number has a lot of factors. Is it more likely that the number that is 2 more than it or the number that is double it has a lot of factors? Explain.

For example

- **Knowledge:** Which is greater: –17 or –35?
- **Understanding:** Which number is probably bigger? Why?
- –[]2 OR –8[]

Differentiation

- There needs to be significant use of open questions to allow for differentiation as well as parallel tasks.
- This is true in both the tasks assigned as well as assessment.

For example

- Instead of: What is 4.003 – 2.028?
- Choose two numbers involving thousandths to subtract. Subtract them.
- OR
- You subtract two numbers involving thousandths. The result is just a bit less than what you subtracted. What could they be?

Continua focused on the big stuff

- You need to be aware of what comes before and after in the curriculum, but also what comes before and after in the development of ideas.

Problems should be houghtful, not complicated

- Compare the two:

Complicated

- I bought 3 items that each cost 75¢.
- I bought 4 items that each cost $1.39
- I bought 3 other items that cost $1.21, 35¢, and 19¢.
- How much of the $10 I had do I have left?

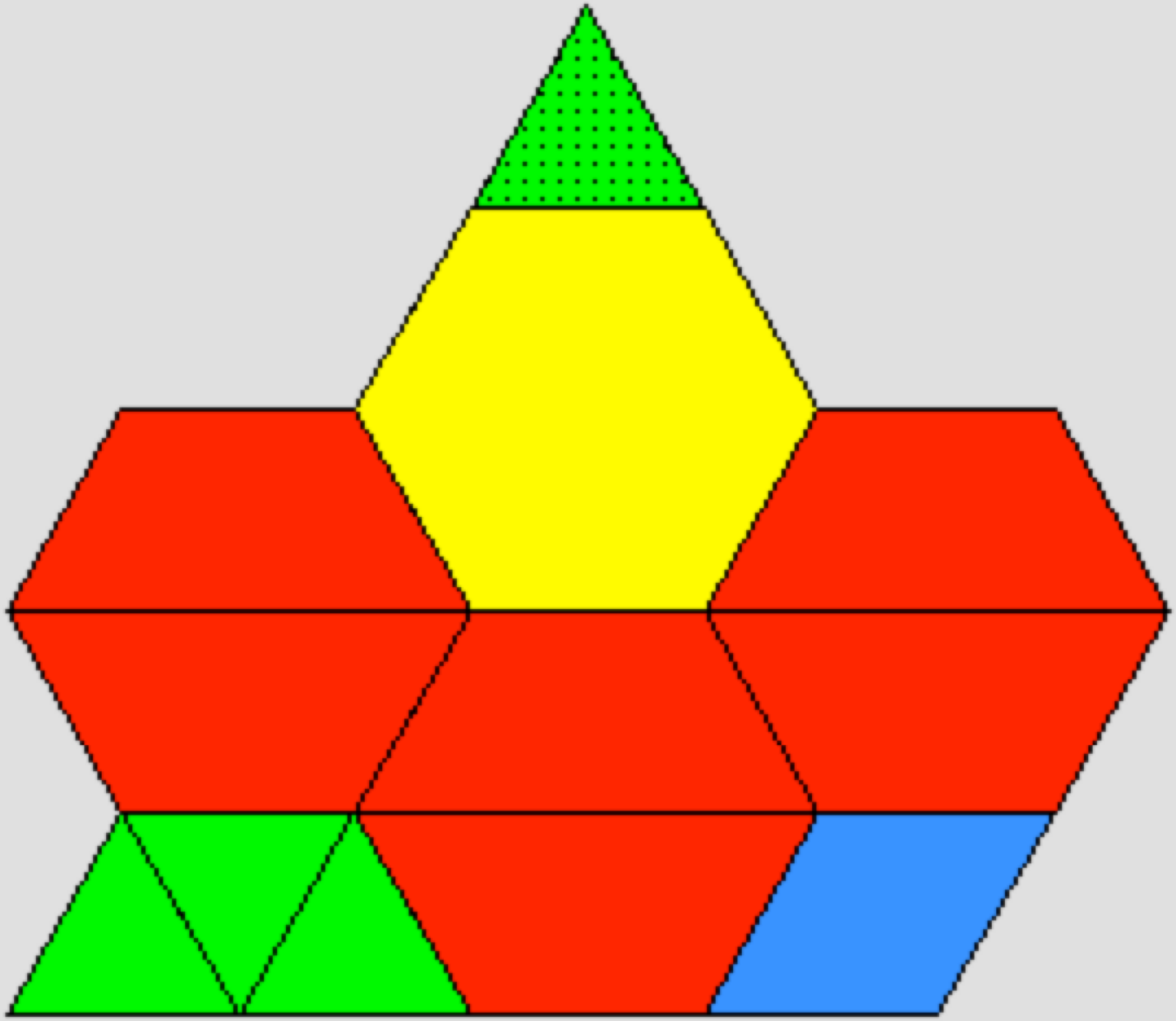
Thoughtful

- I bought 5 items that cost under $1 and bought 5 items that cost more than $1. I spent almost $10.

- What are possible prices for the 10 items? Explain your thinking.

What it might look like in JI

- Use pattern blocks. Build a design where:
- There is 3 times as much red area as yellow area and
- Twice as much green area as blue area.
- Tell what fraction of the area is each colour.



What it might look like in JI

- You multiply two 2-digit numbers using base ten blocks.
- It takes you 36 blocks to show the multiplication.
- What might you have been multiplying?

What it might look like in JI

- You multiply two fractions: a/b and c/d.
- The result is a lot more than a/b, but a bit less than c/d.
- What could the fractions be?

- Maybe 9/10 x 95/2

What it might look like in JI

- You start with the integer a.
- What integer b could you use so that a + b is:
- 12 more than a – b
- 12 less than a – b
- 3 times as much as a – b

Differentiating Instruction

- Different kids are ready for different tasks; it is not reasonable that all kids are ready for exactly the same thing on a particular day.
- This means alternate tasks or parallel tasks or open tasks.

For example

- If your plan were that all students work on adding fractions with different denominators, some kids might not be ready for it.
- So how could you handle this?

Gathering preliminary data

- You might want to gather data topic by topic to decide who is ready for what, what requires re-teaching, what can be omitted.
- Diagnostics should be focused, short and useful, and not something to make the system happy.

For example

- Grade 5 diagnostic for division
- Use these numbers to create problems as described below. You can use the same number more than once. Solve each problem.
- 8 6 72 24 4 96

For example

- Use two numbers less than 10 to create a multiplication problem.
- Use one number less than 10 and one greater than 10 to create a multiplication problem.
- Use any two numbers to create a division problem.
- Use any three numbers to create a problem solved using division and another operation.

Feedback

- Generically, it is about focusing on what the kid is thinking, not about whether or not the answer is right.
- But it is mostly about figuring out how to respond to what you see.

For example

- A child multiplies 23 x 45 and writes 815.
- What do you say?

For example

- A child adds 4/5 + 3/8 and gets 7/13.

For example

- A child is asked to solve this problem and doesn’t know where to start.

- *Keri paid $48 for a sweater on sale. The sale was 20% off. What was the original price?*

- What do you say?

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