MATHEMATICAL PROBLEM SOLVING IN ALL STRANDS

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AGENDA

- What makes something a problem?
- What makes something a good problem?
- Lots of problems to play with
- How much problem solving?
- How do you assess problem solving?

A PROBLEM

- is something that you've never seen before.
- It forces you to think about what you are going to do to solve it.
- The same question could be a problem for one set of kids, but not another.

FOR EXAMPLE

- Which of these is a problem to YOU?
- I went to the store. I bought a notebook that costs $6.99. I gave the clerk $10. What is my change? OR
- The sum of two numbers is 10 more than their difference. What might the numbers be?

FOR EXAMPLE

- Which of these is a problem to YOU?
- How many minutes are there in 4.5 hours? OR
- About how many words do you say in a day?

WHAT MAKES A GOOD PROBLEM?

- Not so much being complicated, but requires thinking

I AM LESS EXCITED WITH

- I bought 3 shirts that each cost $12.45.
- I bought 4 sweaters that each cost $39.95.
- I bought 5 pairs of pants that cost $9.95, $12.95, $22.95, $17.95 and $18.95.
- How much of the $500 I had budgeted for clothes do I have left?

THAN

- I bought 7 items that cost under $20 and bought 5 items that cost more than $20. I spent almost $300.

- What are possible prices for the 12 items? Explain your thinking.

THEY OFTEN LEAD TO "GENERALIZATIONS"

- So rather than:
- The sum of two numbers is 71.
- The difference is 35.
- What are they?

I WOULD PREFER

- The sum of two numbers is twice the difference.
- What could the numbers be?

STRATEGIES YOU MIGHT ENCOURAGE

- Drawing a picture

TRADITIONAL "HEURISTICS"

- Act it out
- Look for a pattern
- Make a table
- Use a model
- Guess and test, etc.

EXAMPLES OF SOME NICE PROBLEMS

NUMBER PATH

- You are on a number path made up of squares of numbers starting at 1 and continuing as far as you wish..

1	2	3	4	5	6	7	8	9	10	11	12

- You move SOME steps forward.
- Then you move SOME steps back.
- You repeat both moves
- You land at 9.
- How many steps each way?

FORKS AND SPOONS

- Sara is holding forks and spoons.
- There are 2 more spoons than forks.
- Altogether there are not even 10 things in Sara's hand.
- How many of each might there have been?

HUNDRED CHART SQUARES

- On a 100 chart, you cover 4 numbers in a square.
- The greatest number is 11 more than the smallest.
- Where might the square be?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

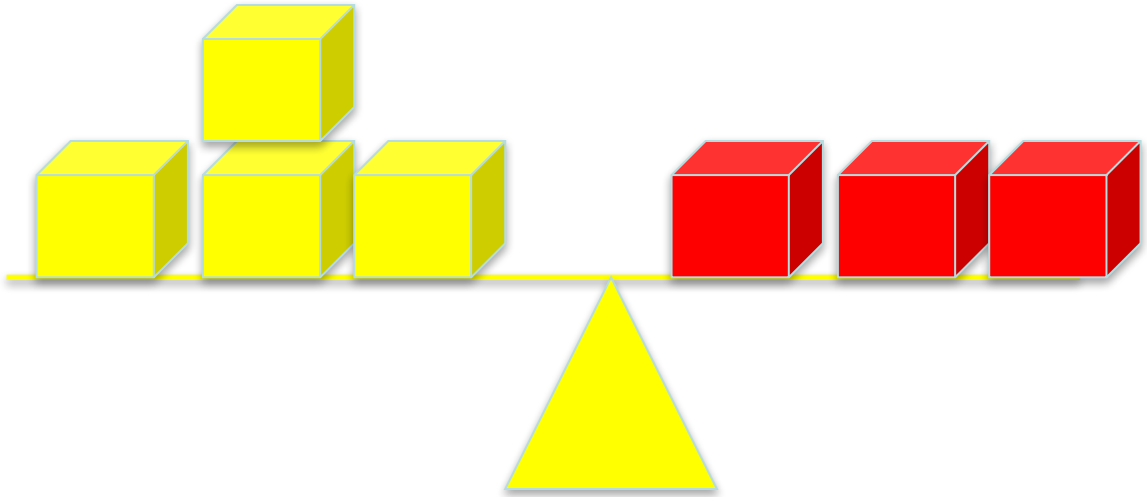
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

THEN YOU MIGHT ASK

- What square has the sum of 50?

A BALANCE

- How many might be in each yellow box? How many in each red?



COUNTERS

- I had more than 20 counters.
- I split them up into 2 small piles and 2 large piles.
- The large piles had twice as many counters as the small ones.
- How many might have been in each pile?

COINS

- I represented an amount of money with 8 coins.
- I represented the same amount with 22 coins.
- What coins might I have had each time?

DIGITS

- I choose a two-digit number.
- I reverse the order of the digits.
- I subtract.
- The answer is 36.
- What could the number be?

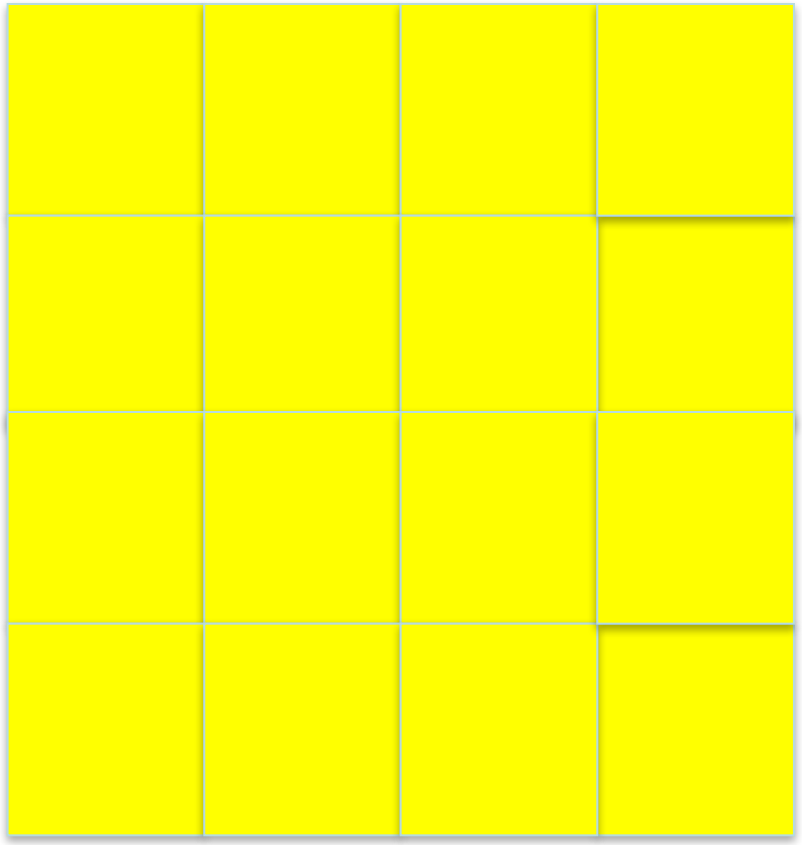
SQUARE TILES

- Available at
- http://oame.on.ca/CLIPS/swfPlayer.html?swfURL=tools/ColourTiles1.swf

- Site is called Mathies
- Learning tools
- Colour Tiles

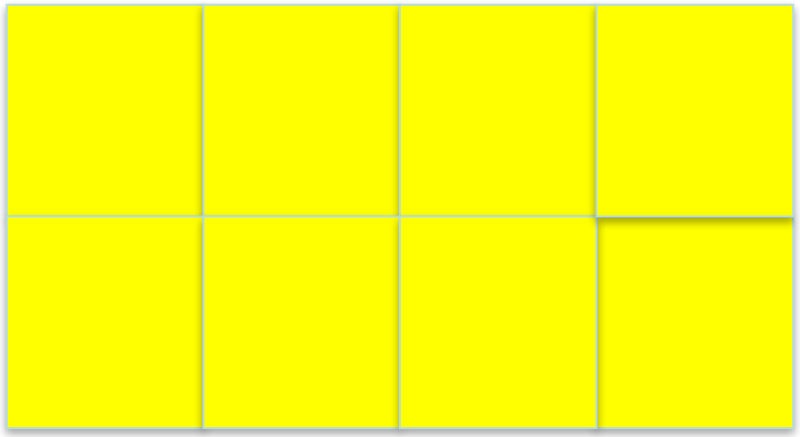
SQUARE TILES

- You build a rectangle with square tiles.
- You cut it in half (based on area).
- Could the new perimeter be half of the old one?
- Could the new perimeter be 3/4 of the old one?



Area = 16 squares

Perimeter = 16 side lengths



Area = 8 squares

Perimeter = 12 side lengths

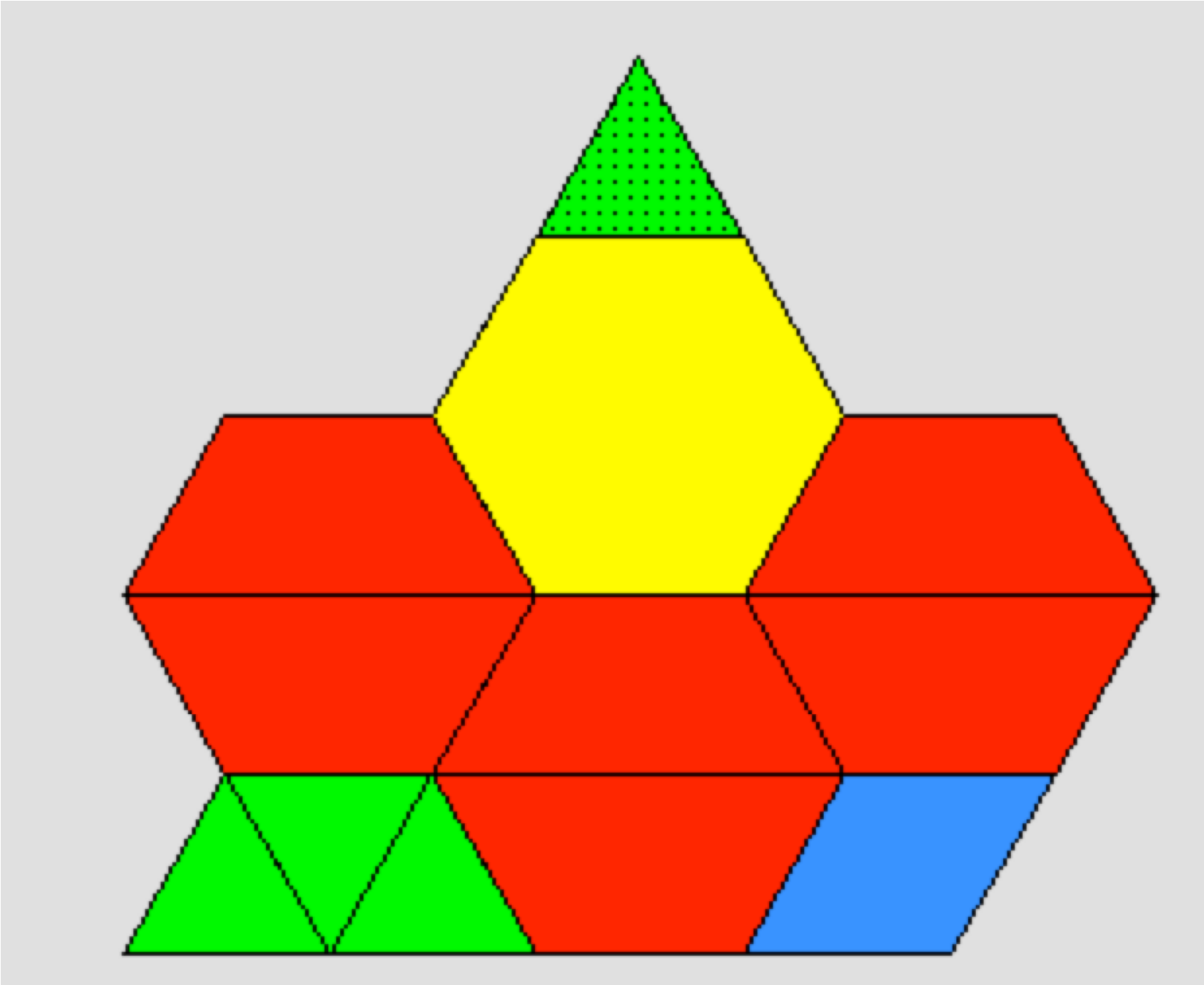
PATTERN BLOCKS

- Available at
- http://oame.on.ca/CLIPS/swfPlayer.html?swfURL=tools/ubPatternBlocksToolCreator.swf

- Mathies/learning tools/pattern blocks

PATTERN BLOCKS

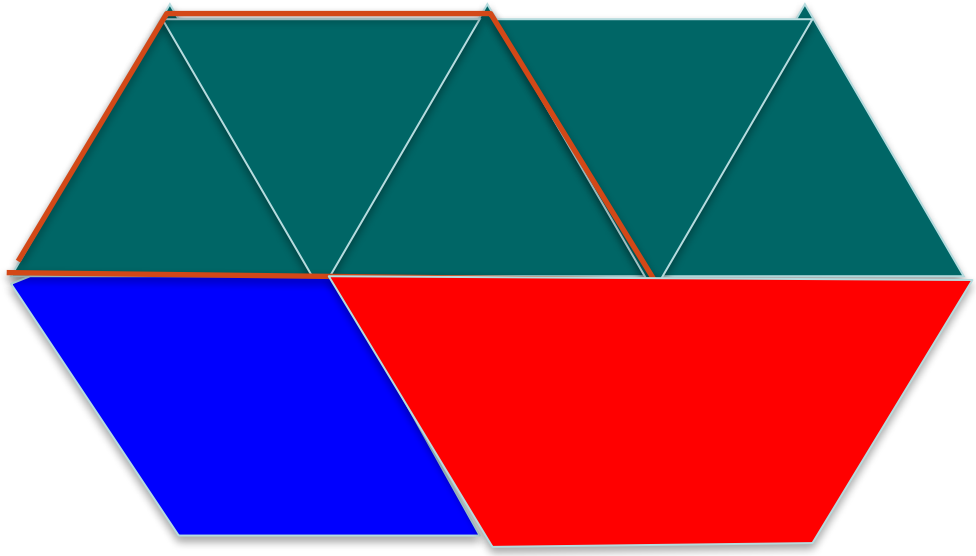
- Use pattern blocks. Build a design where:
- There is 3 times as much red area as yellow area and
- Twice as much green area as blue area.
- Tell what fraction of the area is each colour.



MORE DESIGNS

- Make a pattern block design that is 1/2 green and 1/5 blue in area.

MAYBE



MCNUGGETS

- You can add as many copies of the numbers 6, 9 and 20 as you wish.
- What are all the numbers you can get?
- What are all the numbers you cannot get?

CANNOT GET

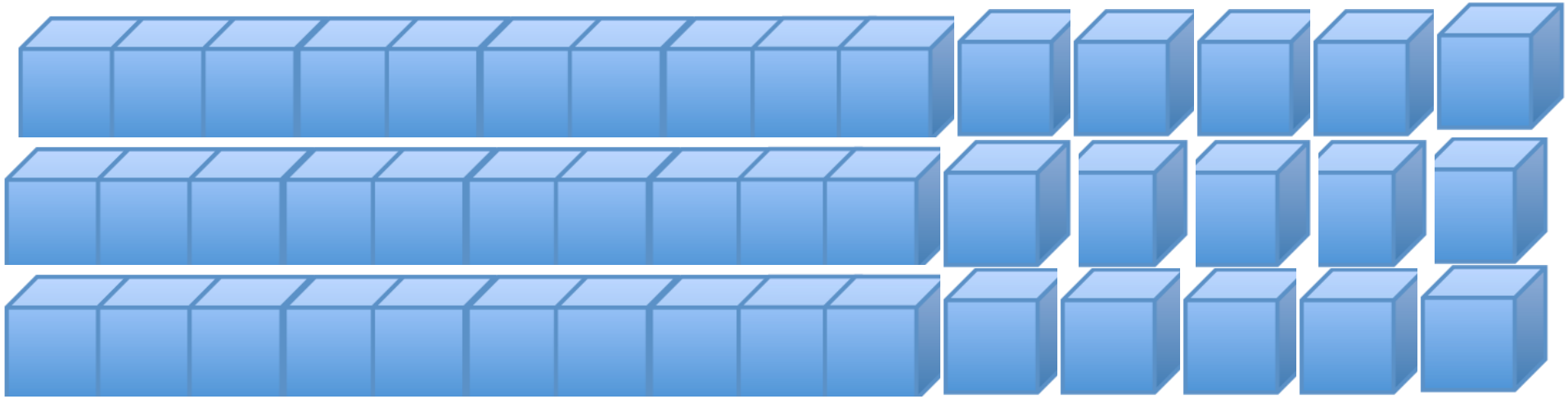
- 1, 2, 3, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 22, 23, 25, 28, 31, 34, 37, 43

BASE TEN BLOCKS

- http://www.abcya.com/base_ten.htm

MULTIPLICATION

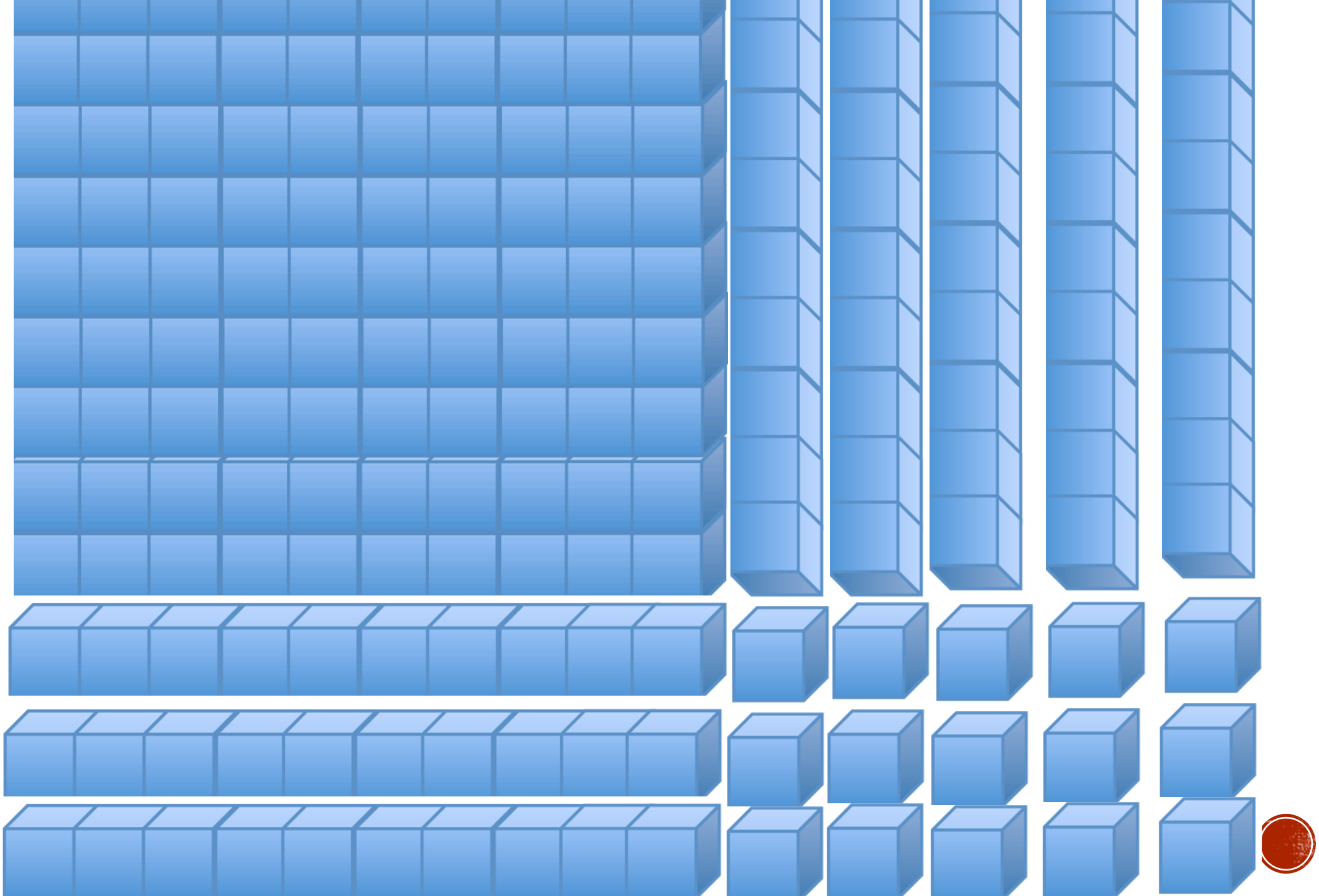
- These 18 blocks show 3 x 15.



PROBLEM 1

- What other multiplications can you show with 18 blocks?

- With 24 blocks?



BASE TEN BLOCKS

- 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?

MEANS AND MEDIANS

- The mean of a set of 10 pieces of data is double the median.
- What could the data be?

INTERESTING STYLE

- Two truths and a lie

WHICH IS THE LIE?

Two Truths and a Lie

Which of these is the lie? How do you know?

A. The number 68 can be represented with 32 base ten blocks.

B. The number 148 can be represented with 43 base ten blocks.

C. The number 502 can be represented with 142 base ten blocks.

OR

- You can add 3 numbers in a row and get the number 74.
- You can add 4 numbers in a row and get the number 74.
- You can add 5 numbers in a row and get the number 75.

OR

- 1. There is a fraction equivalent to 5/11 where the denominator is between 80 and 100.
- 2. There is a fraction equivalent to 5/11 where the numerator and denominator are 64 apart.
- 3. There is a fraction equivalent to 5/11 where the numerator is even.

CREATING PROBLEMS

- Use variations of one you like.

- For example, how could you vary this one we did?

HOW COULD YOU VARY:

- The sum of two numbers is twice the difference.
- What could the numbers be?

HOW COULD YOU VARY:

- I had more than 20 counters.
- I split them up into 2 small piles and 2 large piles.
- The large piles had twice as many counters as the small ones.
- How many might have been in each pile?

HOW COULD YOU VARY

- 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.

YOU TRY

- Choose one of these topics.
- Start with a non-problem and turn it into a problem.
- ADDITION AND SUBTRACTION
- FRACTIONS
- MEASUREMENT

HOW MUCH PROBLEM SOLVING

- frequent

ASSESSMENT

- If you are thinking "assessment of learning", you might want to assign levels to the work students do.

EARLIER OUR PROBLEM WAS

- 4 piles- 2 of same size and 2 of double that size– what numbers are possible.

DOWNLOAD

- www.onetwoinfinity.ca
- Recent presentations
- WinnipegMarch