MOVING BEYOND CROSS MULTIPLY AND DIVIDE

DEVELOPING PROPORTIONAL THINKING

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OBJECTIVE

- Illustrate key points in the *Ratio and Proportional Relationships Progression* to develop proportional thinking related to:
  - Tables
  - Tape diagrams
  - Double number lines
  - Linear models
  - Equations

- Timed activities produce math anxiety…

RESOURCES

- commoncoretools.me
  - Tools – “Progressions”
  - Forum
- Illustrativemathematics.org
- map.mathshell.org
  - Math Assessment Project - Shell Centre

CARD SORT CONVERSATIONS

- With your partner answer these questions, be prepared to share out:

- Which card represents a part-to-whole relationship?

- Which card represents a part-to-part relationship?

TYPES OF RATIO REPRESENTATIONS

- 4 boys to 5 girls (part-to-part)
- 5 girls to all 27 students (part-to-whole)

4 boys : 5 girls

4 to 5

$\frac{4}{5}$

A ratio is often represented in "fraction" f
although it may not be a part/whole relation

Is it $\frac{4}{5}$ or $\frac{5}{4}$?

The quotient represents the "value" of the ratio. (*Progressions*, pg 3)

Number of boys = $\frac{4}{5}$ the number of girls

Number of girls = $\frac{5}{4}$ the number of boys

FOR ALL STRATEGIES…

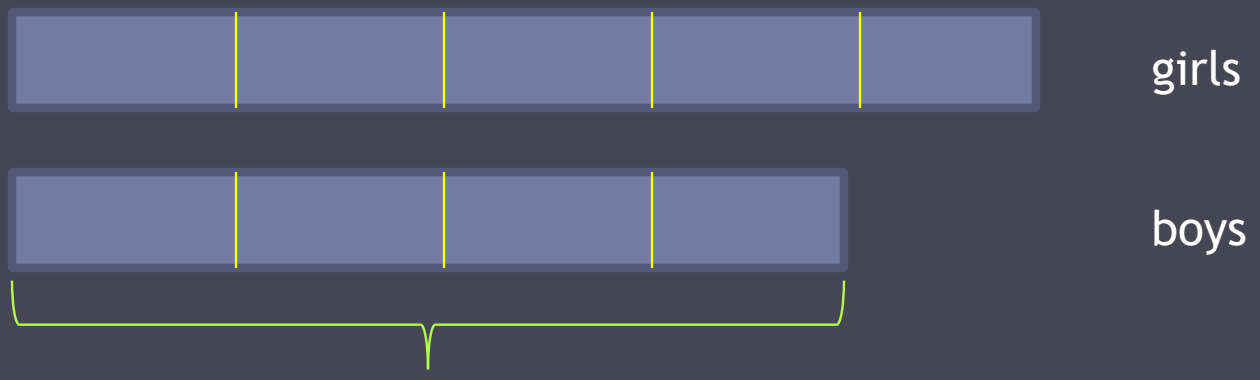
- Resist the temptation to use the “cross multiply and divide” trick!

- We will address cross-multiply/divide at the end

TAPE DIAGRAMS

- The ratio of the number of boys to the number of girls at school is 4:5

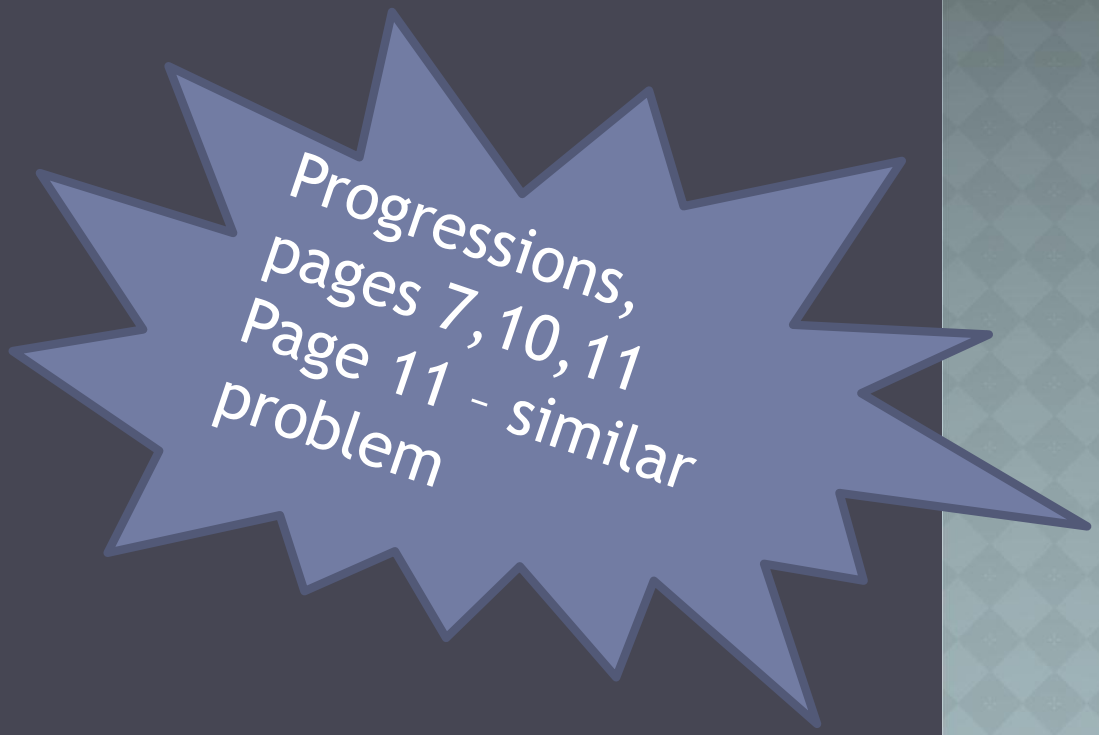
- A. What fraction of the students are boys?
- B. If there are 120 boys, how many students are there altogether?



YOUR TURN!
TAPE DIAGRAM PRACTICE PROBLEMS

- With a partner, work the problems, using tape (strip) diagrams.

- Look at question 2 – How many steps would it take to solve this without a tape diagram?



SODA MIX

Batch	Cups of lemon-lime	Cups of cola
1	2	
2		6
3		9
4	8	
5	10	15

- Keep the same ratio and find the missing quantities for each batch of soda
- Identify all the relationships

Batch	Cups of lemon-lime	Cups of cola
1	2	3
2	4 2 groups of 2 cups 2 x 2	6 2 groups of 3 cups 2 x 3
3	6 3 groups of 2 cups	9 3 groups of 3 cups
4	8	12
5	10	15

+2 X 1.5 +3

YOUR TURN!

- With a partner, complete Ratio Table #1 on your practice sheet

- Resist the temptation to use the "cross multiply and divide" trick!

RATIOS TABLE PRACTICE #1

Widgets	3	1	5	10
Cost	$2.40	$0.80	$4.00	$8.00

If 3 widgets cost $2.40, how much would 5 widgets cost? 10 widgets?

What is the unit rate?

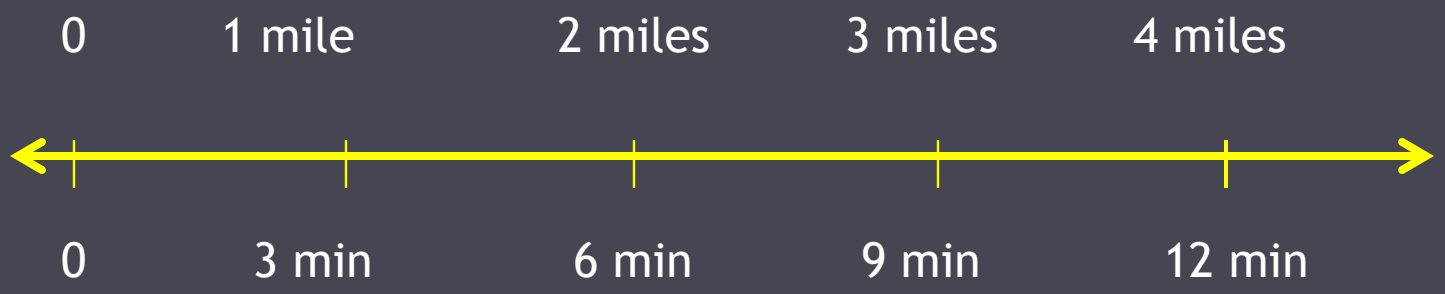
What is the scale factor?

- The unit rate is identified as the “constant of proportionality”
  - Progressions document, pages 7 and 9

DOUBLE NUMBER LINES

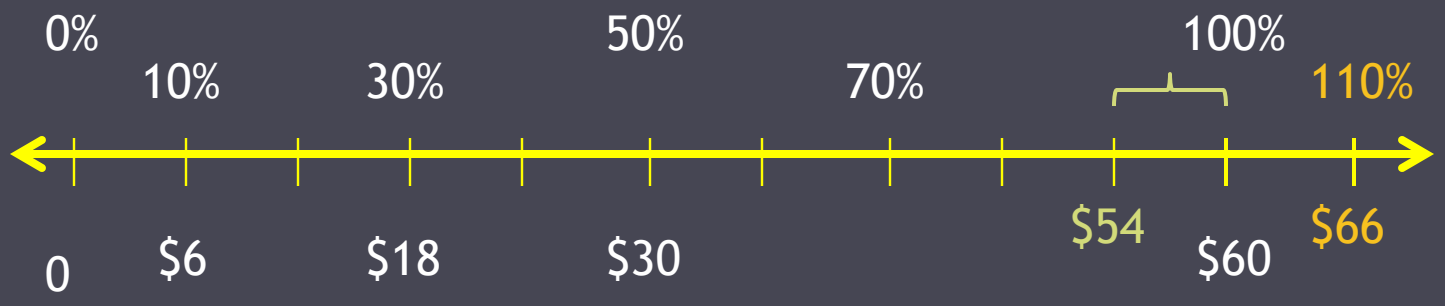
- Quantities of different measure can be partitioned into the same equal parts on a visual model.
- Useful for finding unit rates
- We can also use them to show percentages

SUPER-FAST RUNNER?



How many minutes per mile? 3 minutes

How many minutes would it take to travel ½ mile? 1 ½ minutes



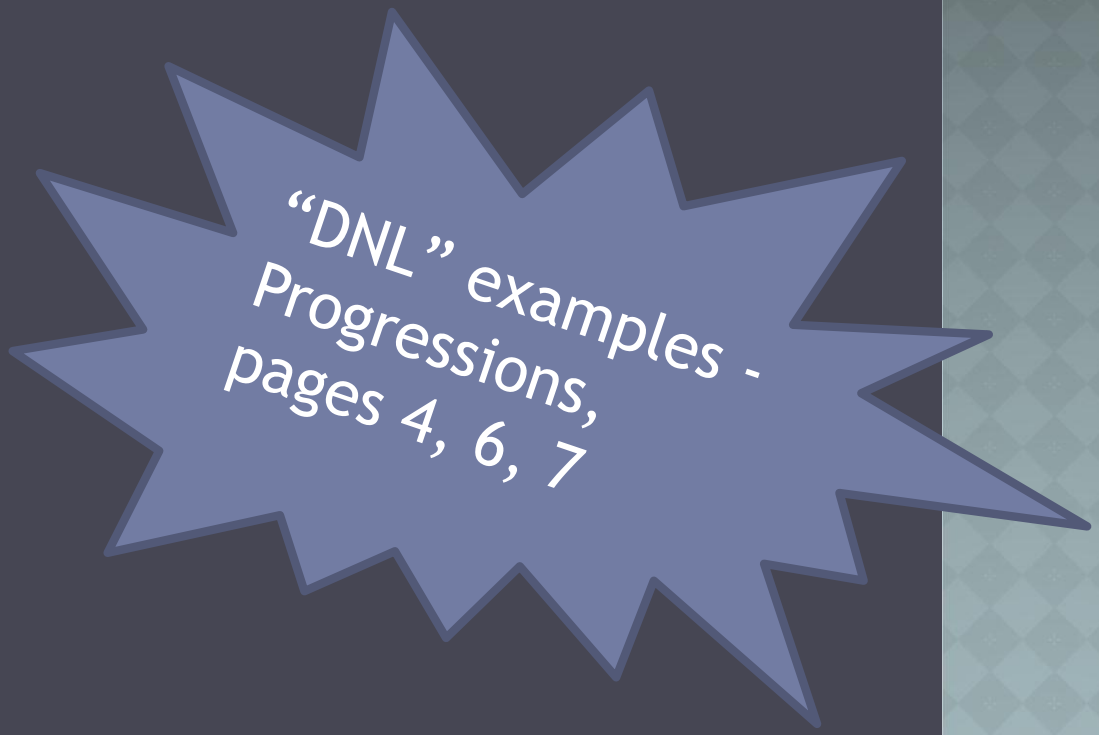
10 equal sections, each worth 10%
Each of the 10 parts is worth $6.

10% beyond 100% would be $6 extra, for a total of $66

What is 90% of $60? It is $60 less $6, or $54

YOUR TURN!
PRACTICE PROBLEMS

- Use double number lines to model and solve the practice problems, with your partner.



PUTTING IT ALL TOGETHER

- Complete the “Soda Mix – Revisited” using the table of values
- Equation:

EQUATION

- (2:3) A:B → $y = \frac{b}{a}(x)$

Progressions Appendix, page 13

$$\text{Cola} = \frac{3}{2}(\text{LL})$$

OR:

$$y = 1.5\,(x)$$ "unit rate"

When the input is 1 cup of lemon lime, the amount of change in cola is 1.5 cups.

UNIT RATES

- A unit rate is established when the input is 1.

- In a proportional relationship:
  - Unit rate is the "constant of proportionality" from *Progressions* page 9
  - The unit rate is the slope of the graph of a proportional relationship (8.EE.5)
  - $y = kx$

A VS. B

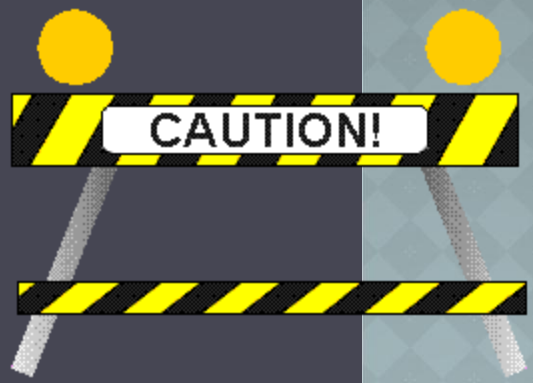
Linear?

Proportional?

How do you know?

CAUTION!

- All proportional relationships are linear but not all linear relationships are proportional



CAUTION!

- Cross-multiply and divide does not develop proportional thinking – it should only be introduced after students develop proportional reasoning through other methods [tables, tape diagrams and number lines].
  - (Van de Walle, *Teaching Student-Centered Mathematics Grades 5-8*, page 157)

Thank you!