Visual Sense Making of Radicals and More

Marc Garneau • piman@telus.net • Surrey, BC, Canada
@314Piman • diaryofapiman.wordpress.com
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This handout contains the *hands-on paper parts* of my workshop. Visit my blog after the conference (a week or so) to view slides and technology pieces.

> "*Visualization is fostered through the use of concrete materials, technology and a variety of visual representations. It is through visualization that abstract concepts can be understood concretely by the student.*" The Common Curriculum Framework for Grades 10-12 Mathematics. WNCP (2008)

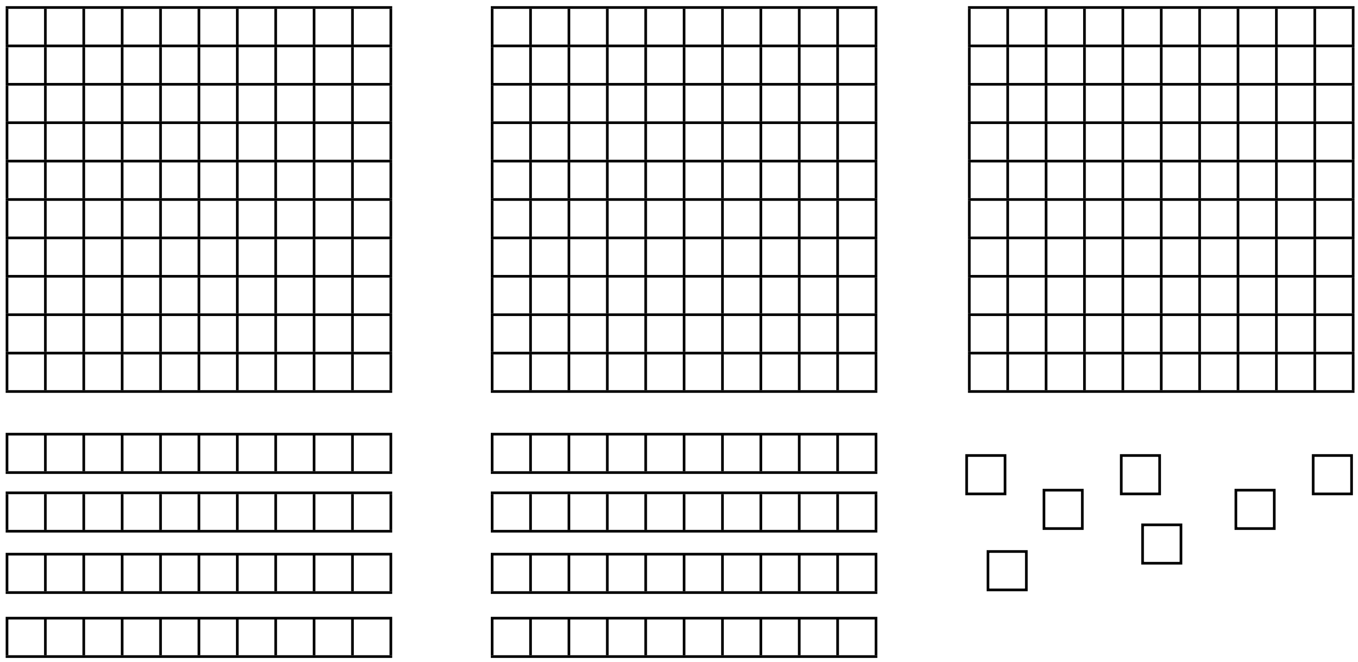
Learn↔Reflect Strand LR

NUMBER AND OPERATIONS: BE RADICAL AND GET REAL!

Reflection Session • 3:30 pm - 4:30 pm • Great Hall B/C (Convention Center)

1. What is number sense, and how can you promote the development of number sense in your students? How are fluency and understanding related in the context of number and operations?
2. How can instructional decisions facilitate the development of strategies that are meaningful and transferable for operations on all numbers?
3. How are equity and diversity promoted by developing conceptual understanding of number?
4. How can the Standards for Mathematical Practice support the development of number sense and computational fluency?
5. How are you thinking differently about your learning and teaching of number and operations as a result of participating in the Learn↔Reflect sessions?

Divisibility by 9: Is the number 387 divisible by 9?



How *are* they the same?

✷ BIG IDEA ✷
The operations of addition, subtraction, multiplication, and division hold the same fundamental meaning no matter the domain to which they are applied.

Evaluate, or simplify, each set of expressions.

Make as many connections as you can:
• conceptually & procedurally
• pictorially & symbolically

$6 \div 3$	$(-6) \div (+3)$	$\frac{6}{5} \div \frac{3}{5}$

Without calculating an answer, tell why $\frac{3}{5} \div \frac{3}{8} > 1$. (Source: Marian Small)

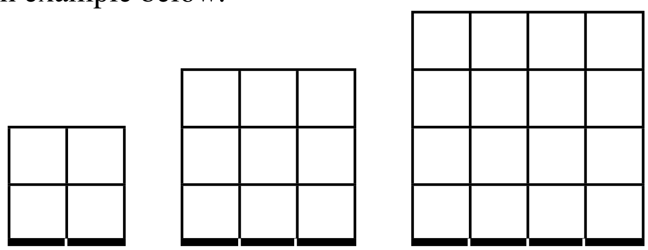
What is $\frac{2}{3} \div \frac{1}{4}$?

Note: Check out *http://fawnnguyen.com/2013/05/21/20130518.aspx* for an excellent post on using rectangles to make sense of dividing fractions.

Exploring Radicals

Use a calculator and notice, $\sqrt{20} = 2\sqrt{5}$. When $\sqrt{20}$ is said to be **simplified**, the result is $2\sqrt{5}$. How do we get this result? This lesson explores a way to simplify radicals.

Given a square of area *n*, the length of the side of that square is $\sqrt{n}$.
Complete the information for each example below.



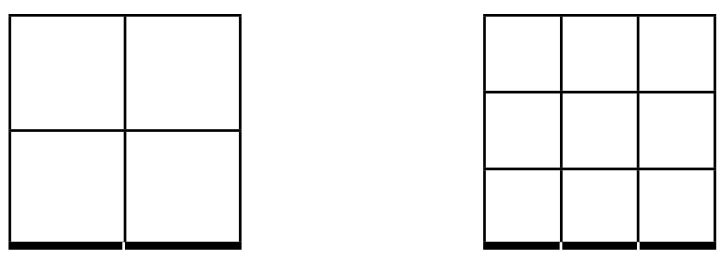
Area = ______ ______ ______

Side Length = ______ ______ ______

But what if the area is not a square number? For example, consider $\sqrt{18}$.
Estimate the value of $\sqrt{18}$? What reasoning did you do to come up with your estimate?

Suppose the area of each large square below is 18. For each one:

- What is the area of each small square?
- Represent the length of <u>each side</u> of the small square using $\sqrt{\ }$.



Area (small square): ______ ______

Side length (small square): $\sqrt{\quad}$ ______ $\sqrt{\quad}$ ______

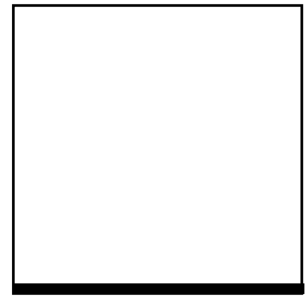
Of the two ways to express the side length of the small square, which one is the simplest? ______

How many of these side lengths does it take to make up the side length of the larger square? ______

Considering your answers to the past 2 questions, what is another way to write $\sqrt{18}$? ______

Would it make sense to divide this square into more squares (16, 25, 36, etc.)? Explain.

Suppose the area of the square on the right is 75.
What do you think is the best choice for the number of small squares? Why?



Sketch the small squares. What is the area of each small square? __________

What is the side-length of each of the small squares, and how many side lengths make up the base of the larger square?

What is another way to write $\sqrt{75}$? __________

Describe a general strategy for simplifying radicals.

Applying the same strategy, what is another way to represent each of the following radicals?

$\sqrt{8}$ $\sqrt{12}$ $\sqrt{54}$

$\sqrt{32}$ $\sqrt{50}$ $\sqrt{72}$