

$$I = \frac{6 \times 10}{50T}$$

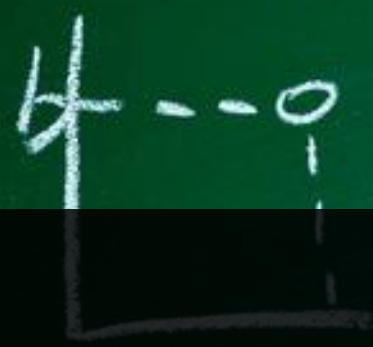
$$\sum_N \frac{1}{39} (Y+A) = \frac{2}{3}A$$

m+n

$$E = mc^2$$

$$9 \text{ grad } \phi(x,y) \quad M = \sqrt{\frac{3 \cdot 6 \cdot 10^3}{3 \cdot 18 \cdot 10^6}}$$

$$\nabla \phi(x,y,z) = \frac{\partial \phi}{\partial x} i + \frac{\partial \phi}{\partial y} j + \frac{\partial \phi}{\partial z} k$$
$$\int \sqrt{a^2 - x^2} dx = \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} + C$$



# SMP 4: Model with Mathematics

HALEY, JESS, JASEY, KALLIE

$$ax + bx + c = 0$$
$$\Delta = b^2 - 4ac$$



$$y = uv$$

## What does SMP 4 Cover?

Standard Mathematical Practice 4 refers to modeling with mathematics. Students who are proficient in this skill can: solve problems, explain how they solved the problem, and further apply these problem-solving skills in everyday life.

In referring to the PA Standards, we found that SMP 4 does not really change or grow much throughout the grade levels, but instead, it is integrated into every grade level. The content level changes, but students should *always* be encouraged to show their work and explain how they solve their problems.

**PA Core Standards  
Standards for Mathematical Practice  
Grade Level Emphasis\***

| Mathematical Practices  | 3  | 4  | 5   |
|---|--|--|---|
| <b>Students at this level will exhibit the following:</b>               |  |  |   |
| <b>Construct viable arguments and critique the reasoning of others.</b> | <ul style="list-style-type: none"> <li>• Construct arguments using concrete referents, such as objects, pictures, and drawings.</li> <li>• Refine their mathematical communication skills as they participate in mathematical discussions involving questions like “How did you get that?” and “Why is that true?”</li> <li>• Explain their thinking to others and respond to others’ thinking.</li> </ul>   | <ul style="list-style-type: none"> <li>• Construct arguments using concrete referents, such as objects, pictures, and drawings.</li> <li>• Explain their thinking and make connections between models and equations.</li> <li>• Refine their mathematical communication skills as they participate in mathematical discussions involving questions like “How did you get that?” and “Why is that true?”</li> <li>• Explain their thinking to others and respond to others’ thinking.</li> </ul>  | <ul style="list-style-type: none"> <li>• Construct arguments using concrete referents, such as objects, pictures, and drawings.</li> <li>• Explain calculations based upon models and properties of operations and rules that generate patterns.</li> <li>• Demonstrate and explain the relationship between volume and multiplication.</li> <li>• Refine their mathematical communication skills as they participate in mathematical discussions involving questions like “How did you get that?” and “Why is that true?”</li> <li>• Explain their thinking to others and respond to others’ thinking.</li> </ul>                          |
| <b>Model with mathematics.</b>  | <ul style="list-style-type: none"> <li>• Experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc.</li> <li>• Need opportunities to connect the different representations and explain the connections.</li> <li>• Use all of these representations as needed.</li> <li>• Evaluate their results in the context of the situation and reflect on whether the results make sense.</li> </ul> | <ul style="list-style-type: none"> <li>• Experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc.</li> <li>• Need opportunities to connect the different representations and explain the connections.</li> <li>• Use all of these representations as needed.</li> <li>• Evaluate their results in the context of the situation and reflect on whether the results make sense.</li> </ul> | <ul style="list-style-type: none"> <li>• Experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc.</li> <li>• Need opportunities to connect the different representations and explain the connections. Use all of these representations as needed.</li> <li>• Evaluate their results in the context of the situation and whether the results make sense.</li> <li>• Evaluate the utility of models to determine which models are most useful and efficient to solve problems.</li> </ul> |

\* This document is adapted from the Common Core State Standards for Mathematics.

# Misconceptions about SMP4

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When people hear "model with mathematics" people normally jump to the conclusion of modeling THE mathematics and not using the mathematics to DO the modeling.



This standard focuses on the idea that elements of real life can be explained with math – not that math should be explained through real life examples.

### Item Types Frequently Mistaken for Modeling Mathematics:

- 1) A 500 gallon fish tanks is emptied at a rate of 20 gallons per minute. Sketch a graph to **model** this scenario.
- 2) Use an array to **model** the following multiplication problem:  
 $5 \times 7 = \underline{\quad}$

### Example of Modeling with Mathematics

- 1) Your Aunt Jane wants to host a party for 18 people. She wants everybody to sit at the same rectangular table. Each person needs 2 feet of space at the table to sit and eat comfortably. Aunt Jane is asking for your help to design the table.
  - a) What would be the perimeter of the table?
  - b) What dimensions could you use for the design of the table?



## Compare the three-digit numbers

# Grade 2:

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### Standard Area: Numbers and Operations

- Standard - CC.2.1.2.B.1: Use place value concepts to represent amounts of tens and ones and to compare three-digit numbers.

### Activity Recommendation:

- The students would be given a number and must put under each place value how many ones, tens, and hundreds there are.
- The student would then be given a second number to do the same as the first bullet, and then compare the numbers

$$\begin{array}{|c|c|c|} \hline 8 & 3 & 5 \\ \hline \end{array} \bigcirc \begin{array}{|c|c|c|} \hline 8 & 1 & 9 \\ \hline \end{array}$$

 Compare hundreds first

$$\begin{array}{|c|c|c|} \hline 8 & 0 & 0 \\ \hline \end{array} \bigcirc \begin{array}{|c|c|c|} \hline 8 & 0 & 0 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline 3 & 0 \\ \hline \end{array} < \begin{array}{|c|c|} \hline 1 & 0 \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline 5 \\ \hline \end{array} > \begin{array}{|c|} \hline 9 \\ \hline \end{array}$$

=

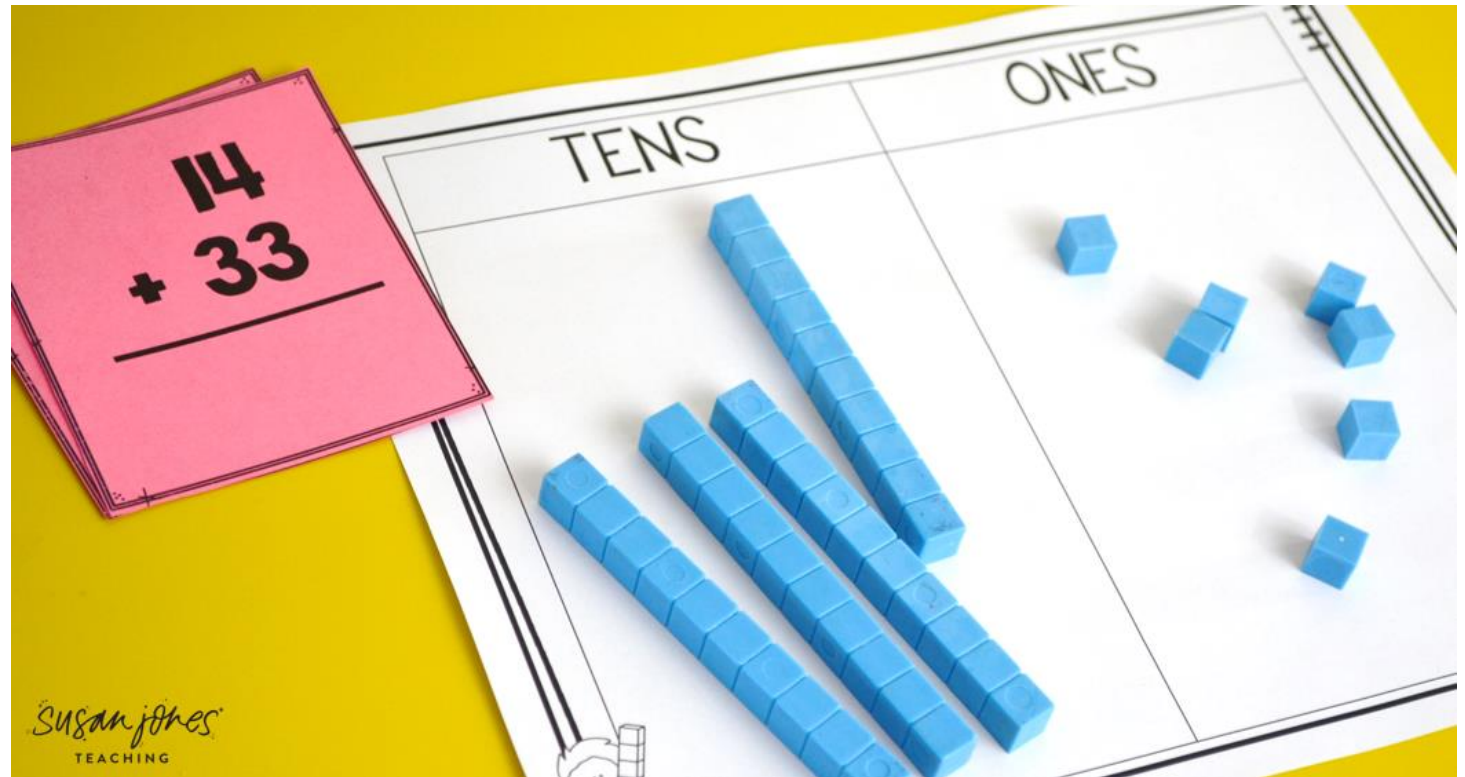
# Grade 3:

## Standard Area: Numbers and Operations

- Standard - CC.2.1.3.B.1 - Apply place value understanding and properties of operations to perform multi-digit arithmetic.

### Activity Recommendation:

- The students are given an addition or subtraction problem to make into a story problem and solve by using the base ten blocks as a manipulative to find the answer.



# Grade 4:

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## Standard Area: Numbers and Operations

- Standard - CC.2.1.4.B.1 - Apply place value concepts to show an understanding of multi-digit whole numbers.

### Activity Recommendation:

- **Number Hunt**
  - Take students out for a walk through the neighborhood or even just the school building.
  - Ask them to find numbers in their environment and write them down
    - Numbers found can be physical written numbers in environment or counting objects (ie-speed limit or number of stop signs passed)
    - Discuss with students during walk the place value of the numbers
  - Once back in classroom, ask students to represent numbers using base 10 blocks





# In-Class Activity

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HappyNumbers.com

Module 3, Topic C, A

Module 3, Topic E, A

Module 3, Topic E, B

Module 3, Topic E, D

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