

## Modeling 9-12 Day 1 Session 1

<http://robertkaplinsky.com/what-isnt-mathematical-modeling/>

1. It is not modeling in the sense of, “I do; now you do.”
2. It is not modeling in the sense of using manipulatives to represent mathematical concepts (these might be called “using concrete representations” instead.)
3. It is not modeling in the sense of a “model” being just a graph, equation, or function. Modeling is a process.
4. It is not just starting with a real world situation and solving a math problem; it is returning to the real world situation and using the mathematics to inform our understanding of the world. (I.e. contextualizing and de-contextualizing, see MP.2.)
5. It is not beginning with the mathematics and then moving to the real world; it is starting with the real world (concrete) and representing it with mathematics.
6. It is not beginning with a contrived real world situation; it is starting with a situation that is as close to how students would actually encounter it as possible.

### Modeling Tasks and Suggested Answers [(T) = from a textbook]

1. John found the data in the table below about his favorite redwood tree. He wondered if he could use it to predict the height of the tree at other points of time.

<b>Number of Years after Planting</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Height of Tree (in feet)</b>	<b>17</b>	<b>21</b>	<b>25</b>

John decided to find out more about his favorite redwood tree by graphing the data. What does the graph look like? Does the graph represent a proportional relationship? Justify your answer. (T)

Not Modeling (#3). CPM Course 3 – Beta Version. Section 3.1.2. Problems 3-10 and 3-11.

2. When a car skids to a stop, the length of the skid  $d$  (in feet) for a car traveling at speed  $s$  (in miles per hour) is given by  $d = \frac{1}{30f} s^2$ . If you have only 120 feet to stop safely, what is the maximum speed you should be driving under dry conditions, when  $f = 0.8$ ? How does your answer change under wet conditions, when  $f = 0.4$ ? (T)

Not modeling (#5). From Mathematics, Concepts and Skills, CA Middle School Course 2, McDougal Littell © 2001, page 63 #83 and #84.

3. A dime is 0.135 cm. thick. How tall would a stack of 100 dimes be? (T)

Not modeling (#4). From Jump Math 6.1 Common Core Edition page E-61.  
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4. How much paint will I need to paint my bedroom?

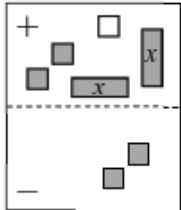
Modeling. I need to make measurements and assumptions, calculate, and after painting, compare with my calculation and revise as needed.

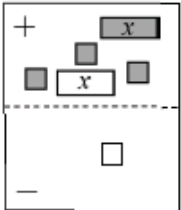
5. John and Dave are building a rectangular pen next to the barn for their goat, Ginny. They plan to use one 60-foot wall of the barn as part of the pen, so they only need to build the remaining three sides. They want the width of the pen to be half of the length. How much fencing will they need to complete Ginny's pen? Can you find more than one answer? (T)

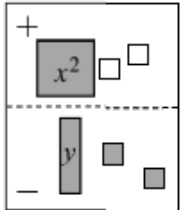
Not modeling (#6). CPM Course 1 – Beta Version. Section 7.2.4. Problem 7-76.

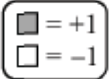
6.

Find a simplified algebraic expression for each Expression Mat below.

a. 

b. 

c. 



[T]

Not Modeling (#2). CPM Course 3 – Beta Version. Section 2.1.3. Problem 2-30.

7.

**EXAMPLE Write and Use a Linear System**

**VOLUME AND MASS** A gold crown, suspected of containing some silver, was found to have a mass of 714 grams and a volume of 46 cubic centimeters. The density of gold is about 19 grams per cubic centimeter. The density of silver is about 10.5 grams per cubic centimeter. What percent of the crown is silver?

**Solution**

**VERBAL MODEL**

$$\begin{array}{c} \text{Gold volume} + \text{Silver volume} = \text{Total volume} \\ \text{Gold density} \cdot \text{Gold volume} + \text{Silver density} \cdot \text{Silver volume} = \text{Total mass} \end{array}$$

**LABELS**

Volume of gold =  $G$  (cubic centimeters)  
 Volume of silver =  $S$  (cubic centimeters)  
 Total volume = 46 (cubic centimeters)  
 Density of gold = 19 (grams per cubic centimeter)  
 Density of silver = 10.5 (grams per cubic centimeter)  
 Total mass = 714 (grams)

**ALGEBRAIC MODEL**

$$\begin{array}{l} G + S = 46 \quad \text{Equation 1} \\ 19G + 10.5S = 714 \quad \text{Equation 2} \end{array}$$

Use linear combinations to solve for  $S$ .

$$\begin{array}{r} -19G - 19S = -874 \quad \text{Multiply Equation 1 by } -19. \\ 19G + 10.5S = 714 \quad \text{Write Equation 2.} \\ \hline -8.5S = -160 \quad \text{Add equations.} \\ S \approx 18.8 \quad \text{Solve for } S. \end{array}$$

**ANSWER** ▶ The volume of silver is about 19 cm<sup>3</sup>. The crown has a volume of 46 cm<sup>3</sup>, so the crown is  $\frac{19}{46} \approx 41\%$  silver by volume.

[T]

Not modeling (#1). Algebra 1 Concepts and Skills. McDougal Littell, © 2001 Chapter 7 page 406.

8. Darn, I just discovered a leak under my kitchen sink. Before the floor got too wet, I quickly placed a glass jar with diameter 8 cm. and height 12 cm. under it because I had to go out. When I returned 90 minutes later, the jar was nearly full. I had to go out again, so I replaced the jar with a dishpan with dimensions 38 cm × 31 cm × 20 cm. How long will it take the dishpan to fill? (The formula for the volume of a cylinder is  $V = \pi r^2 h$ , where  $r$  = radius of the base and  $h$  = height.)

Not modeling (#4)

9. You are making a garden and have a budget of \$100. What dimensions can the garden be?

Modeling. You need to gather information, make decisions, do calculations, and check your prediction against the actual result.

10. A car is traveling on a desert highway at an average speed of 67 mph. Find the time  $t$  needed to go a distance  $d$ .

Not modeling (#3)

11. If there are 11 coins, nickels and dimes, valuing 70 cents, how much of each are there?

Not modeling (Math 422 Lia Vas Mathematical Modeling – Introduction and early examples)

#### Other potential resources

MP4 from MAP: <http://map.mathshell.org/materials/stds.php#standard1164>

CMP Task Force Resources: <http://caccsm.cmpso.org/>

Math Modeling: Getting Started and Getting Solutions - SIAM  
<http://m3challenge.siam.org/about/mm/>