Announcements

- Please change problem 221 to problem 21 on your bookmark.

Sec 1.5 Use Problem Solving Strategies and Models

Before	You wrote and solved equations.
Now	You will solve problems using verbal models.
Why?	So you can solve constant rate problems, as in Ex. 26.

Goals

- **Goal 1: To use a general problem solving plan to solve real-life problems.**
- **Goal 2: To use other problem solving strategies**

Problem Solving

- One of the major goals of this course is to learn how to use algebra to solve real-life problems. We have done some of this in previous lessons and will gain more experience in this section.

Vocabulary

- Use a **verbal model** to write an equation in words before using mathematical symbols.
- Examples of problem-solving strategies, you might use to come up with a verbal model are: using a formula, looking for a pattern, or drawing a diagram.

Vocabulary

- Next assign **labels** to the **verbal model** you just created.
- Combine the two steps above to create a(n) **algebraic model**.
- Finally, solve the problem and answer the question(s) asked.

Example 1

- The Bullet Train runs between the Japanese cities of Osaka and Fukuoka, a distance of 550 kilometers. When it makes no stops, it takes 2 hours and 15 minutes to make the trip. What is the average speed of the train?
- First, create a verbal model then label:

Distance = Rate • Time

Example 1

- The Bullet Train runs between the Japanese cities of Osaka and Fukuoka, a distance of 550 kilometers. When it makes no stops, it takes 2 hours and 15 minutes to make the trip. What is the average speed of the train?
- Combine the two for an algebraic model.
  - 550 = r (2.25)

Example 1

- The Bullet Train runs between the Japanese cities of Osaka and Fukuoka, a distance of 550 kilometers. When it makes no stops, it takes 2 hours and 15 minutes to make the trip. What is the average speed of the train?
- Finally, solve for the rate.
  - $\frac{550}{2.25} = \frac{r(2.25)}{2.25}$

$244 \frac{km}{hr} \approx r$

Example 1

- The Bullet Train runs between the Japanese cities of Osaka and Fukuoka, a distance of 550 kilometers. When it makes no stops, it takes 2 hours and 15 minutes to make the trip. What is the average speed of the train?
- Unit analysis:

$$kilometers = \frac{kilometers}{hour} \cdot hours$$

km = km ✓ units work!

GUIDED PRACTICE for Example 1

1. **AVIATION** A jet flies at an average speed of 540 miles per hour. How long will it take to fly from New York to Tokyo, a distance of 6760 miles?

$d = r \cdot t$

$hr \rightarrow \frac{mi}{\frac{mi}{hr}} \cdot hr \rightarrow mi \cdot \frac{hr}{mi} = hr$

Example 2

- **Paramotoring** A paramotor is a parachute propelled by a fanlike motor. The table shows the height h of a paramotorist t minutes after beginning a descent. Find the height of the paramotorist after seven minutes.

Time (min), t	0	1	2	3	4
Height (ft), h	2000	1750	1500	1250	1000

Example 2

Time (min), t	0	1	2	3	4
Height (ft), h	2000	1750	1500	1250	1000

- **In this example, we want to look for a pattern. We can then use the pattern to write a verbal model for the height**

decreasing $\frac{250 \text{ ft}}{\text{min}}$

Height = Starting ht − decrease per min · # min

Example 2

Time (min), t	0	1	2	3	4
Height (ft), h	2000	1750	1500	1250	1000

- **What values do we know and what do we want to know?**

Example 2

- The relationship between these items will give us our verbal model which we can then label.

Height (feet)	=	Initial height (feet)	−	Rate of descent (feet/minute)	·	Time (minutes)
h	=	2000	−	250	·	t

Example 2

- Use the equation to find the height of the paramotorist after seven minutes.

$$h = 2000 - 250t$$

$h = 2000 - 250(7)$

$h = 2000 - 1750$

$h = 250$ ft

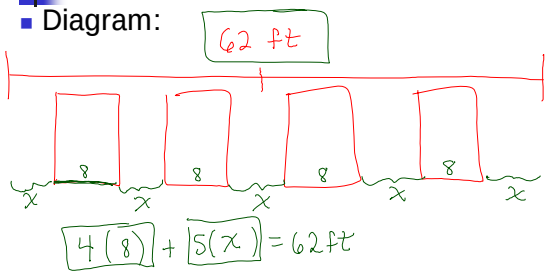
Example 3

- You are hanging four championship banners on a wall at your school's gym. The banners are 8 feet wide. The wall is 62 feet long. There should be an equal amount of space between the ends of the wall and the banners, and between each pair of banners. How far apart should the banners be placed?
- It is helpful to draw a diagram for this problem:

Example 3

$4(8) + 2x + 3\left(\frac{x}{2}\right) = 62$

- Diagram:



$4(8) + 5(x) = 62\text{ ft}$

Example 3

- From the diagram, we can easily write our algebraic model and solve our problem:

$4(8) + 5(x) = 62$

$32 + 5x = 62$

$5x = 30$

$x = 6\text{ ft}$

Additional Strategies

- When you are writing a verbal model to represent a real-life problem, remember that you can use other problem solving strategies, such as drawing a diagram, looking for patterns, and guessing, checking, and revising to help create the verbal model.

Example 4

- A car used 16 gallons of gasoline and traveled a total distance of 460 miles. The car's fuel efficiency is 30 miles per gallon on the highway and 25 miles per gallon in the city. How many gallons of gasoline were used on the highway?

(A) 8 gallons (B) 12 gallons (C) $15\frac{1}{4}$ gallons (D) 16 gallons

Example 4

- A car used 16 gallons of gasoline and traveled a total distance of 460 miles. The car's fuel efficiency is 30 miles per gallon on the highway and 25 miles per gallon in the city. How many gallons of gasoline were used on the highway?
- We will create our verbal model by beginning with the total distance
- If you drive some miles on the highway, and some more miles in the city. How do you find your total miles?

Example 4

d mileage gallons

$mi = \frac{mi}{gal} \cdot gal$

- A car used 16 gallons of gasoline and traveled a total distance of 460 miles. The car's fuel efficiency is 30 miles per gallon on the highway and 25 miles per gallon in the city. How many gallons of gasoline were used on the highway?
- What is the relationship between miles, miles per gallon, and gallons. In other words, distance, gas mileage, and number of gallons of gas?

$\text{miles} = \frac{\text{miles}}{\text{gal}} \cdot \text{gal}$

Example 4

- A car used 16 gallons of gasoline and traveled a total distance of 460 miles. The car's fuel efficiency is 30 miles per gallon on the highway and 25 miles per gallon in the city. How many gallons of gasoline were used on the highway?
- We can use these relationships to create a verbal model:

		highway miles				city miles		
Total distance (miles)	=	Fuel efficiency (miles/gallon)	·	Gas used (gallons)	+	Fuel efficiency (miles/gallon)	·	Gas used (gallons)
460	=	30	·	g	+	25	·	$(16 - g)$

Example 4

- A car used 16 gallons of gasoline and traveled a total distance of 460 miles. The car's fuel efficiency is 30 miles per gallon on the highway and 25 miles per gallon in the city. How many gallons of gasoline were used on the highway?

$460 = 30g + 25(16 - g)$

$460 = 30g + 400 - 25g$

$460 = 5g + 400$

$-400 \quad -400$

$\frac{60}{5} = \frac{5g}{5}$

$12 = g$

HW: $\frac{30\text{ mi}}{\text{gal}} \cdot 12\text{ gal} = 360\text{ mi}$

City: $\frac{25\text{ mi}}{\text{gal}} \cdot 4\text{ gal} = 100\text{ mi}$

12 gallons on HW

GUIDED PRACTICE for Examples 2, 3, and 4

2. **PARAMOTORING** The table shows the height h of a paramotorist after t minutes. Find the height of the paramotorist after 8 minutes.

Time (min), t	0	1	2	3	4
Height (ft), h	2400	2190	1980	1770	1560

3. **WHAT IF?** In Example 3, how would your answer change if there were only three championship banners?

4. **FUEL EFFICIENCY** A truck used 28 gallons of gasoline and traveled a total distance of 428 miles. The truck's fuel efficiency is 16 miles per gallon on the highway and 12 miles per gallon in the city. How many gallons of gasoline were used in the city?

Assignment

- Sec 1.5
  - 1, 4, 6-8, 11, 12, 15, 16, 18, 21, 24, 25, 27, 28, 32
  - Note: bookmark should read “21” not “221”