How to best use these slides…
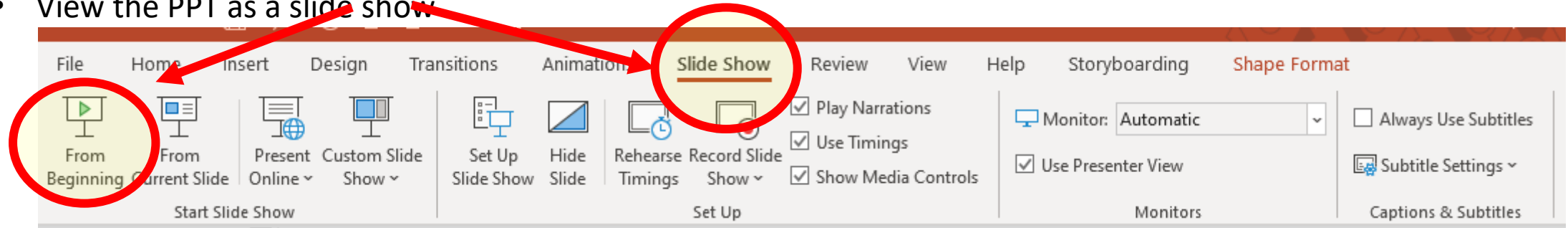
- View the PPT as a slide show

- Then click through every step

  - Mouse clicks will advance the slide show

  - Left/right arrow keys move forward/backward

  - Mouse wheel scrolling moves forward/backward

- When a question is posed, stop and think it through, try to answer it yourself before clicking

- If you have questions, use PS discussion boards, email me, and/or visit us in a Teams class session!

LESSON 7.1b

Writing Inverse Variation Equations & Modeling

Today you will:

- Write inverse variation equations

- Practice using English to describe math processes and equations

Core Vocabulary:

- Inverse variation, p. 360
- Constant of variation, p 360

Previous:
- Direct variation
- Ratios

Suppose we are told:

- The variables x and y vary inversely

- When $x = 4$, then $y = 8$

…and we were asked to come up with the equation for the inverse variation relationship…

How would we do this?

Well, again … let's ask ourselves some questions:

1. What information are we given?
    - That it is an inverse relationship $\rightarrow y = \dfrac{a}{x}$
    - …and we know 1 set of values for x and y

2. What information are we missing?

    - We don't know the constant of variation a

    - If we knew a we could write the equation!

Okay, so let's find a!

- Write the general equation out, and fill in what we know

- Solve for what we don't know!

The variables x and y vary inversely, and $y = 4$ when $x = 3$.
Write an equation that relates x and y. Then find y when $x = -2$.

SOLUTION

$$y = \frac{a}{x}$$ Write general equation for inverse variation.

$$4 = \frac{a}{3}$$ Substitute 4 for y and 3 for x.

$$12 = a$$ Multiply each side by 3.

▶ The inverse variation equation is $y = \dfrac{12}{x}$. When $x = -2$, $y = \dfrac{12}{-2} = -6$.

Now let's put all this to work and use it to solve a real-world problem!

The time t (in hours) that it takes a group of volunteers to build a playground varies inversely with the number n of volunteers. It takes a group of 10 volunteers 8 hours to build the playground.

- Make a table showing the time that it would take to build the playground when the number of volunteers is 15, 20, 25, and 30.

- What happens to the time it takes to build the playground as the number of volunteers increases?

SOLUTION

1. **Understand the Problem** You are given a description of two quantities that vary inversely and one pair of data values. You are asked to create a table that gives additional data pairs.

2. **Make a Plan** Use the time that it takes 10 volunteers to build the playground to find the constant of variation. Then write an inverse variation equation and substitute for the different numbers of volunteers to find the corresponding times.

2. Make a Plan Use the time that it takes 10 volunteers to build the playground to find the constant of variation. Then write an inverse variation equation and substitute for the different numbers of volunteers to find the corresponding times.

3. Solve the Problem

$$t = \frac{a}{n} \qquad \text{Write general equation for inverse variation.}$$

$$8 = \frac{a}{10} \qquad \text{Substitute 8 for } t \text{ and 10 for } n.$$

$$80 = a \qquad \text{Multiply each side by 10.}$$

The inverse variation equation is $t = \frac{80}{n}$. Make a table of values.

n	15	20	25	30
t	$\frac{80}{15} = 5 \text{ h } 20 \text{ min}$	$\frac{80}{20} = 4 \text{ h}$	$\frac{80}{25} = 3 \text{ h } 12 \text{ min}$	$\frac{80}{30} = 2 \text{ h } 40 \text{ min}$

▶ As the number of volunteers increases, the time it takes to build the playground decreases.

4. Look Back Because the time decreases as the number of volunteers increases, the time for 5 volunteers to build the playground should be greater than 8 hours.

$$t = \frac{80}{5} = 16 \text{ hours} \quad ✓$$

Review/recap

You can come up with the equation for an inverse variation if you are given 1 set of x & y values:

1. Write the general inverse variation equation

2. Fill in what you know (x & y)

3. Solve for what you don't know (a)

4. Write the final equation using the value for a from step 3

To solve real-world problems:

•   You will be told if the data varies directly or inversely

•   You will be given some of the data

•   Use that data to find a, and write the resulting equation

•   If asked to describe a trend or "end behavior", build a table of values to see what is going on

Some good Khan Academy videos:
•   Direct variation word problem: filling gas
•   Direct variation word problem: space travel
•   Inverse variation word problem: string vibration

Homework

Pg 363, #15-30