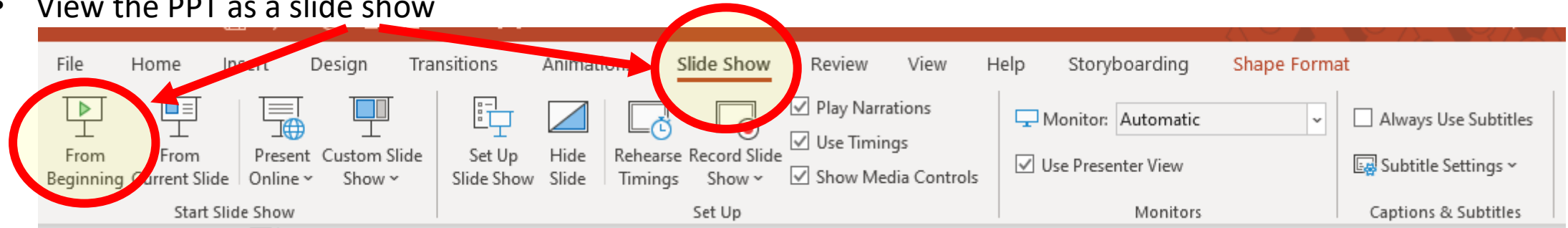


How to best use these slides...

- 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, email me, ask in the Teams Student Center channel!

LESSON 6.5a

Properties of Logarithms

Today you will:

- Use the properties of logarithms to evaluate logarithms.
- Use the properties of logarithms to expand or condense logarithmic expressions.
- Practice using English to describe math processes and equations

Previous Vocabulary:

- Base of exponential function
- Base of logarithmic function
- Properties of exponents

Exponential Function

$$y = ab^x$$

Variable is in the exponent!

Leading coefficient

Base
Not a variable, just a number

The diagram illustrates the components of the exponential function $y = ab^x$. The variable x is highlighted in red, with a red arrow pointing to it from the text "Variable is in the exponent!". The coefficient a is highlighted in green, with a green arrow pointing to it from the text "Leading coefficient". The base b is highlighted in blue, with a blue arrow pointing to it from the text "Base" and "Not a variable, just a number".

Logarithm

Another way of writing $y = b^x$

$$\log_b y = x$$

Read it as “Log base b of y is x ”

...as an exponential function it is b to the x is y

Three Basic Properties of Exponents

$$a^m a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

Three Basic Properties of Logarithms

$$\log_b mn = \log_b m + \log_b n$$

$$\log_b \frac{m}{n} = \log_b m - \log_b n$$

$$\log_b m^n = n \log_b m$$

Use $\log_2 3 \approx 1.585$ and $\log_2 7 \approx 2.807$ to evaluate each logarithm.

a. $\log_2 \frac{3}{7}$

b. $\log_2 21$

c. $\log_2 49$

SOLUTION

a. $\log_2 \frac{3}{7} = \log_2 3 - \log_2 7$
 $\approx 1.585 - 2.807$
 $= -1.222$

Quotient Property

Use the given values of $\log_2 3$ and $\log_2 7$.
Subtract.

b. $\log_2 21 = \log_2(3 \cdot 7)$
 $= \log_2 3 + \log_2 7$
 $\approx 1.585 + 2.807$
 $= 4.392$

Write 21 as $3 \cdot 7$.

Product Property

Use the given values of $\log_2 3$ and $\log_2 7$.
Add.

c. $\log_2 49 = \log_2 7^2$
 $= 2 \log_2 7$
 $\approx 2(2.807)$
 $= 5.614$

Write 49 as 7^2 .

Product Property

Use the given value $\log_2 7$.
Multiply.

COMMON ERROR

Note that in general
 $\log_b \frac{m}{n} \neq \frac{\log_b m}{\log_b n}$ and
 $\log_b mn \neq (\log_b m)(\log_b n)$.

STUDY TIP

When you are expanding or condensing an expression involving logarithms, you can assume that any variables are positive.

Expand $\ln \frac{5x^7}{y}$.

SOLUTION

$$\begin{aligned}\ln \frac{5x^7}{y} &= \ln 5x^7 - \ln y && \text{Quotient Property} \\ &= \ln 5 + \ln x^7 - \ln y && \text{Product Property} \\ &= \ln 5 + 7 \ln x - \ln y && \text{Power Property}\end{aligned}$$

Condense $\log 9 + 3 \log 2 - \log 3$.

SOLUTION

$$\begin{aligned}\log 9 + 3 \log 2 - \log 3 &= \log 9 + \log 2^3 - \log 3 \\ &= \log(9 \cdot 2^3) - \log 3 \\ &= \log \frac{9 \cdot 2^3}{3} \\ &= \log 24\end{aligned}$$

Power Property

Product Property

Quotient Property

Simplify.

Homework

Pg 331, #3-32