Section 5.1 Guided Notebook

Section 5.1 Exponential Functions

- ☐ Work through Section 5.1 TTK #1
- ☐ Work through Section 5.1 TTK #2
- ☐ Work through Objective 1
- ☐ Work through Objective 2
- ☐ Work through Objective 3
- ☐ Work through Objective 4

Section 5.1 Exponential Functions

5.1 Things To Know

1. Using Combinations of Transformations to Graph Functions

Do you remember how to sketch functions using transformations? You will need to use transformations to sketch exponential functions in this section. Work through the **animation** to refresh your memory. Write down the "Order of Transformations" as seen in this animation.

2. Determining Whether a Function is One-to-One Using the Horizontal Line Test
You must understand the **definition of a one-to-one function**. Go back to Section 3.6 to see this definition or work through the video. You should also work through the animation to recall how to use the horizontal line test.

Section 5.1 Objective 1 Understanding the Characteristics of Exponential Functions

Write down the **definition of an exponential function.**

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Click on the video link found in this objective and take notes here: **WRITE DOWN THE CHARACTERISTICS OF THE EXPONENTIAL FUNCTION AS SEEN NEAR THE END OF THIS VIDEO.**

Watch the video that describes the natural base, *e*, and takes notes here:

What is the number *e* rounded to 6 decimal places?

Sketch the graphs of $y = 2^x$, $y = 3^x$, and $y = e^x$ on the same grid.

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Make sure that you have a scientific calculator that has an $\boxed{e^x}$ key. Then do Example 1: Evaluate each expression correctly to six decimal places.

a. $\left(\frac{3}{7}\right)^{0.6}$

b. $9\left(\frac{5}{8}\right)^{-0.375}$

c. e^2

d. $e^{-0.534}$

e. $1000e^{0.013}$

Work through the interactive video that accompanies Example 2 and take notes here:

Sketch the graph of each exponential function.

a. $f(x)=\left(\dfrac{2}{3}\right)^{x}$

b. $f(x)=-2e^{x}$.

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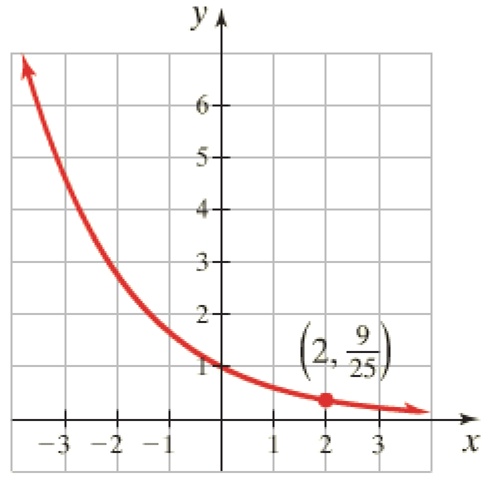
Work through the video that accompanies Example 3 and take notes here:

Find the exponential function $f(x)=b^x$ whose graph is given as follows.



Section 5.1 Objective 2 Sketching the Graphs of Exponential Functions Using Transformations

Sketch the graphs of $y=3^x$ and $y=3^x-1$ here:

Work through the video that accompanies Example 4 and take notes here:

Use transformations to sketch the graph of $f(x) = -2^{x+1} + 3$. (Make sure to label the three points as shown in the video on your final graph.)

Work through the video that accompanies Example 5 and take notes here:

Use transformations to sketch the graph of $f(x) = e^{-x} - 2$. Determine the domain, range, *y*-intercept, and find the equation of any asymptotes. (Make sure to label the three points as shown in the video on your final graph.)

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Take some time to experiment with the **Guided Visualization** titled "Sketching Exponential Functions" seen on page 5.1-21. Sketch two exponential functions below. One function should be base *e* and the other function should be a base other than *e*. Clearly label your functions and give the equations of the vertical asymptotes.

Section 5.1 Objective 3 Solving Exponential Equations by Relating the Bases

Why is every exponential function of the form $f(x) = b^x$ one-to-one?

A function *f* is one-to-one if for any two range values $f(u)$ and $f(v)$,

$f(u) = f(v)$ implies that _______________.

(Fill in the Blank)

Method of Relating the Bases

If an exponential function can be written in the form $b^u = b^v$, then

_________________________.

(Fill in the Blank)

Carefully work through the **animation** that accompanies Example 6 and take notes here:

Solve the following equations:

a. $8 = \dfrac{1}{16^x}$

b. $\dfrac{1}{27^x} = \left(\sqrt[4]{3}\right)^{x-2}$

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Work through the interactive video that accompanies Example 7.

Use the method of relating the bases to solve each exponential equation.

a. $e^{3x-1} = \dfrac{1}{\sqrt{e}}$

b. $\dfrac{e^{x^2}}{e^{10}} = \left(e^{x}\right)^{3}$

Section 5.1 Objective 4 Solving Applications of Exponential Functions

Work through Example 8:

Most golfers find that their golf skills improve dramatically at first and then level off rather quickly. For example, suppose that the distance (in yards) that a typical beginning golfer can hit a 3-wood after *t* weeks of practice on the driving range is given by the exponential function $d(t) = 225 - 100e^{-0.7t}$. This function has been developed after many years of gathering data on beginning golfers.

How far can a typical beginning golfer initially hit a 3-wood? Round to the nearest hundredth yard.

How far can a typical beginning golfer hit a 3-wood after 1 week of practice on the driving range? Round to the nearest hundredth yard.

After 5 weeks? Round to the nearest hundredth yard.

After 9 weeks? Round to the nearest hundredth yard.

Section 5.1

Compound Interest

What is simple interest?

Read through the portion of your eText that describes compound interest to see how the formula for periodic compound interest is derived.

Write the **Periodic Compound Interest Formula** here:

For interest compounded…

- annually, use $n = 1$
- semi-annually, use $n = 2$
- quarterly, use $n = 4$
- monthly, use $n = 12$
- daily, use $n = 365$

Work through the video that accompanies Example 9:

Which investment will yield the most money after 25 years?

Investment A: \$12,000 invested at 3% compounded monthly.
Investment B: \$10,000 invested at 3.9% compounded quarterly.

Continuous Compound Interest
Watch the animation seen in the portion of your eText that describes continuous compound interest to see how to derive the formula for continuous compound interest.

Write the **Continuous Compound Interest Formula** here:

Work through the video that accompanies Example 10:
How much money would be in an account after 5 years if an original investment of $6,000 was compounded continuously at 4.5%? Compare this amount to the same investment that was compounded daily.

Present Value for Periodic Compound Interest

Present value is the amount of money needed now (in the present) to reach an investment goal in the future.

Show how to derive the formula for present value for periodic compound interest by starting with the formula for periodic compound interest here:

Write down the **Present Value Formula for Periodic Compound Interest** here:

Write down the **Present Value Formula for Continuous Compound Interest** here:

Work through the video that accompanies Example 11:

a. Find the present value of $8000 if interest is paid at a rate of 5.6% compounded quarterly for 7 years. Round to the nearest cent.

b. Find the present value of $18,000 if interest is paid at a rate of 8% compounded continuously for 20 years. Round to the nearest cent.

Exponential Growth Model
Write down the exponential growth model.

Work through the video that accompanies Example 12:

The population of a small town follows the exponential growth model $P(t) = 900e^{.015t}$, where t is the number of years after 1900. Answer the following questions, rounding each answer to the nearest whole number.

a. What was the population of this town in 1900?

b. What was the population of this town in 1950?

c. Use this model to predict the population of this town in 2012.

Work through the video that accompanies Example 13:

Twenty years ago, the State of Idaho Fish and Game Department introduced a new breed of wolf into a certain Idaho forest. The current wolf population in this forest is now estimated at 825, with a relative growth rate of 12%. Answer the following questions, rounding each answer to the nearest whole number.

a. How many wolves did the Idaho Fish and Game Department introduce into this forest?

b. How many wolves can be expected after another 20 years?