Algebra 1B Live Lesson

U2L7 – Exponential Growth and Decay (Chapter 7-7 in textbook)

CONNECTIONS ACADEMY®

Agenda

1. Review selected problems and topics from U2L7.

2. Use the 2-column note system to take better notes in math class. Bring your math notebook and pen or pencil to each math LiveLesson class.

2-Column Notes Template

1. Announcements/To Do's	1. Write down important details.
2. School-Wide Learner Outcomes	2. What are you going to work on this week?
3. LL Objectives	
4. Vocabulary words	4. Definitions (fill in as we go)
5. Problems	5. Steps to solving problems
6. Summary (End of class)	6. 1 or 2 sentences about the LL class.

Reminders and To – Do's

Information	What to do
1. Complete 1 math lesson per day.	1. Go to your Planner in Connexus to find the math lesson for the day
2. Check your WebMail every day	2. Go to Connexus to find WebMail
3. Be prepared to spend 4 - 6 hours per day on schoolwork.	3. Complete lessons for the day from your Planner. Do not get behind on lessons.
4. Remind your Learning Coach to take daily attendance	4. Have your Learning Coach log into Connexus daily.

Reminders and To – Do's

Information	What to do
5. Go to the Message Board first for information about our math class.	5. Link to Message Board:
6. Contact Mr. Elizondo for math questions. Remember: You need at least 2 phone calls with Mr. Elizondo per semester.	6. Call (559) 549 - 3244 and leave a voicemail if call is not answered. Make an appointment at: https://elizondo.youcanbook.me Send a WebMail

U2L7 – California Common Core State Standards

- HSF-LE.A.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- HSF-LE.A.1: Distinguish between situations that can be modeled with linear functions and with exponential functions

U2L7 - Objectives

At the end of this LiveLesson class students should be able to:

- Model exponential growth and decay

U2L7 - Vocabulary

- exponential growth
- growth factor
- compound interest
- exponential decay
- decay factor

U2L7 – Exponential Function

- An exponential function can model growth or decay of an initial amount.
- Rapid growth or rapid decay.

take note

Key Concept Exponential Growth

Definitions

Exponential growth can be modeled by the function $y = a \cdot b^x$, where $a > 0$ and $b > 1$. The base b is the **growth factor,** which equals 1 plus the percent rate of change expressed as a decimal.

Algebra

initial amount (when $x = 0$)

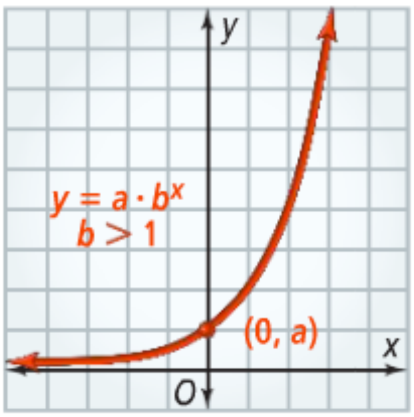
↓

$y = a \cdot b^x$ ← exponent

↑

The base, which is greater than 1, is the growth factor.

Graph



U2L7 – Modeling Exponential Growth

Economics Since 2005, the amount of money spent at restaurants in the United States has increased about 7% each year. In 2005, about $360 billion was spent at restaurants. If the trend continues, about how much will be spent at restaurants in 2015?

Relate $y = a \cdot b^x$ Use an exponential function.

Define Let x = the number of years since 2005.
Let y = the annual amount spent at restaurants (in billions of dollars).
Let a = the initial amount spent (in billions of dollars), 360.
Let b = the growth factor, which is $1 + 0.07 = 1.07$.

Write $y = 360 \cdot 1.07^x$

U2L7 – Modeling Exponential Growth

Use the equation to predict the annual spending in 2015.

$$y = 360 \cdot 1.07^{x}$$

$$= 360 \cdot 1.07^{10}$$ 2015 is 10 yr after 2005, so substitute 10 for *x*.

$$\approx 708$$ Round to the nearest billion dollars.

About $708 billion will be spent at restaurants in the United States in 2015 if the trend continues.

U2L7 - Compound Interest

When a bank pays interest on both the principal *and* the interest an account has already earned, the bank is paying **compound interest.** Compound interest is an example of exponential growth.

You can use the following formula to find the balance of an account that earns compound interest.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = the balance
P = the principal (the initial deposit)
r = the annual interest rate (expressed as a decimal)
n = the number of times interest is compounded per year
t = the time in years

U2L7 - Compound Interest

Finance Suppose that when your friend was born, your friend's parents deposited \$2000 in an account paying 4.5% interest compounded quarterly. What will the account balance be after 18 yr?

Know	Need	Plan
• \$2000 principal • 4.5% interest • interest compounded quarterly, 4 times per year	Account balance in 18 yr	Use the compound interest formula.

U2L7 - Compound Interest

Finance Suppose that when your friend was born, your friend's parents deposited \$2000 in an account paying 4.5% interest compounded quarterly. What will the account balance be after 18 yr?

$A = P\left(1 + \frac{r}{n}\right)^{nt}$ Use the compound interest formula.

$= 2000\left(1 + \frac{0.045}{4}\right)^{4 \cdot 18}$ Substitute the values for *P*, *r*, *n*, and *t*.

≈ 4475.53 Use a calculator. Round to the nearest cent.

The balance will be \$4475.53 after 18 yr.

U2L7 - Exponential Decay

The function $y = a \cdot b^x$ can model *exponential decay* as well as exponential growth. In both cases, b represents the rate of change. The value of b tells if the equation models exponential growth or decay.

take note

Key Concept Exponential Decay

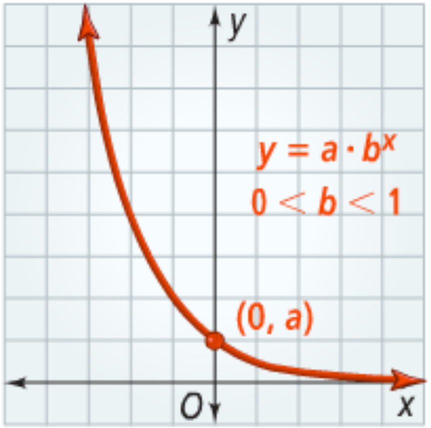
Definitions

Exponential decay can be modeled by the function $y = a \cdot b^x$, where $a > 0$ and $0 < b < 1$. The base b is the **decay factor,** which equals 1 minus the percent rate of change expressed as a decimal.

Algebra

initial amount (when $x = 0$)
↓
$y = a \cdot b^x$ ← exponent
↑
The base, which is between 0 and 1, is the decay factor.

Graph



U2L7 - Modeling Exponential Decay

Physics The kilopascal is a unit of measure for atmospheric pressure. The atmospheric pressure at sea level is about 101 kilopascals. For every 1000-m increase in altitude, the pressure decreases about 11.5%. What is the approximate pressure at an altitude of 3000 m?

Relate $y = a \cdot b^x$ Use an exponential function.

Define Let x = the altitude (in thousands of meters).

Let y = the atmospheric pressure (in kilopascals).

Let a = the initial pressure (in kilopascals), 101.

Let b = the decay factor, which is $1 - 0.115 = 0.885$.

Write $y = 101 \cdot 0.885^x$

U2L7 - Modeling Exponential Decay

Physics The kilopascal is a unit of measure for atmospheric pressure. The atmospheric pressure at sea level is about 101 kilopascals. For every 1000-m increase in altitude, the pressure decreases about 11.5%. What is the approximate pressure at an altitude of 3000 m?

Use the equation to estimate the pressure at an altitude of 3000 m.

$$y = 101 \cdot 0.885^{x}$$

$$= 101 \cdot 0.885^{3}$$ Substitute 3 for x.

$$\approx 70$$ Round to the nearest kilopascal.

The pressure at an altitude of 3000 m is about 70 kilopascals.

Questions?

- Check the Message Board first
- Send a WebMail
- You can also make an appointment at https://elizondo.youcanbook.me
- You can also call me at (559) 549-3244. If I'm not available to answer your call, please leave a voicemail with your full name and phone number.