WAMC Lesson Plan

Name(s): Tim Ostrander
Lesson Title: Historical and Exponential Depreciation
Date:
Text: Financial Algebra   5-6   Lesson Length: 3 days

Domain: Creating equations, Interpreting functions, Linear, quadratic and exponential models, Statistics and Probability	
Big Idea (Cluster): **Creating equations that describe numbers or relationships, Analyze functions using different representations, Construct and compare linear and exponential models and solve problems, Summarize, represent, and interpret data on two categorical and quantitative variables**	
Common Core State Standards: A-CED2, A-CED3, F-IF7e, F-IF8b, F-IF9, F-LE1b, F-LE1c, F-LE5, S-ID6	
Mathematical Practice(s): 1, 2, 4, 5, 6	
Content Objectives: Write, interpret, and graph an exponential depreciation equation, Manipulate the exponential depreciation equations in order to determine time, original price, and depreciated value	Language Objectives: Students will understand key vocabulary
Vocabulary: dollar value, historical data, historical depreciation, exponential decay exponential depreciation	Connections Prior to Learning: Write, interpret, and graph a straight line depreciation equation, simplifying powers, evaluating exponents
Questions to Develop Mathematical Thinking: • CCSS Warm-up pg. 252	Common Misconceptions: • If a value decreases by a constant percent, the function will still be linear

Assessment (Formative and Summative):
• Ch. Application questions, teacher questioning during work time, quiz

Materials:
• Textbook, graph paper, graphing calculators

Instruction Plan:

Launch: Hold a discussion from the examine the question section on pg.252 of the TE
Explore: work out example problems together as a class. Students take notes and work out check your understanding questions.
When I observe students: probing questions, check for understanding
Questions to Develop Mathematical Thinking as you observe: What happens to the dollar amount depreciated as time goes by? What happens to the percent as time goes by? Would it be beneficial to graph both the depreciation and expense functions on the same graph? What does it mean when the expense line goes above the depreciation curve?
Answers: The dollar amount depreciated each year is less and less. The percentage remains the same over time. It would be a good comparison as long as both functions used the same time frame. You have paid more than the vehicle is worth.
Summarize: A vehicle loses value over time, but not necessarily by the same dollar amount each year. Historical data shows more of an exponential curve. There are many factors that

affect the depreciation and value of a vehicle. An exponential decay model is a more realistic fit for how value depreciates because a vehicles value will decrease slower and slower over time, and never reach $0. (Caution: students frequently forget to convert percent to a decimal, or subtract it from one before using it in the equation).

Career Application(s):

- Accounting, used car sales

21st Century Skills and Interdisciplinary Themes:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)
☐ Global Awareness ☒ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION	**INFORMATION, MEDIA & TECHNOLOGY SKILLS**	**LIFE & CAREER SKILLS**	**Productivity and Accountability**
Creativity and Innovation	Information Literacy	Flexibility and Adaptability	☐ Manage Projects
☐ Think Creatively	☒ Access and Evaluate Information	☐ Adapt to Change	☐ Produce Results
☐ Work Creatively with Others	☒ Use and manage Information	☐ Be Flexible	Leadership and Responsibility
☐ Implement Innovations	Media Literacy	Initiative and Self-Direction	☐ Guide and Lead Others
Critical Thinking and Problem Solving	☐ Analyze Media	☐ Manage Goals and Time	☐ Be Responsible to Others
☒ Reason Effectively	☐ Create Media Products	☒ Work Independently	
☐ Use Systems Thinking	Information, Communications and Technology (ICT Literacy)	☒ Be Self-Directed Learners	
☐ Make Judgments and Decisions	☒ Apply Technology Effectively	Social and Cross-Cultural	
☒ Solve Problems		☒ Interact Effectively with Others	
Communication and Collaboration		☐ Work Effectively in Diverse Teams	
☐ Communicate Clearly			
☐ Collaborate with Others			

Math Concept(s): linear and exponential depreciation equations
Source / Text: Financial Algebra
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Date: Summer In-service 2014

Attach the following documents:
Lab Instructions
Student Handout(s)
Rubric and/or Assessment Tool

Short Description: Lab Plan – Lab occurs after lessons 5-5 and 5-6
Lab Title: Is it a good deal?

Prerequisite skills: basic internet research skills, writing linear and exponential equations

Lab objective:
1. Research one (make/model/year) used vehicle from at least two different sources. ie: craigslist, dealership, Edmunds.com, Kelly blue book, etc.
2. Research the historical price data/depreciation rates for that make/model/year.
3. Determine a reasonable price point for the fair value of that vehicle.
4. Write and compare linear, exponential decay and expense equations for the value.
5. Determine other factors to consider when purchasing besides price.
6. Make a decision on what you would pay for that particular vehicle.

Standards:
CCSS-M:
- A-CED2, A-CED3, F-IF7e, F-IF8b, F-IF9, F-LE1b, F-LE1c, F-LE5, S-ID6

Standards for Mathematical Practice:
- 1, 2, 4, 5, 6

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)
☐ Global Awareness   ☒ Financial/Economic/Business/Entrepreneurial Literacy   ☐ Civic Literacy
☐ Health/Safety Literacy   ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	Productivity and Accountability
Creativity and Innovation	Information Literacy	Flexibility and Adaptability	☐ Manage Projects
☐ Think Creatively	☒ Access and Evaluate Information	☐ Adapt to Change	☐ Produce Results
☐ Work Creatively with Others		☐ Be Flexible	Leadership and Responsibility
☐ Implement Innovations	☒ Use and manage Information	Initiative and Self-Direction	☐ Guide and Lead Others
Critical Thinking and Problem Solving	Media Literacy	☐ Manage Goals and Time	
☒ Reason Effectively	☐ Analyze Media	☒ Work Independently	☐ Be Responsible to Others
☐ Use Systems Thinking	☐ Create Media Products	☒ Be Self-Directed Learners	
☐ Make Judgments and Decisions	Information, Communications and Technology (ICT Literacy)	Social and Cross-Cultural	
☒ Solve Problems	☒ Apply Technology Effectively	☒ Interact Effectively with Others	
Communication and Collaboration		☐ Work Effectively in Diverse Teams	
☐ Communicate Clearly			
☐ Collaborate with Others			

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials
- Computers, graphing calculators, graph paper, poster paper

Set-Up Required:
- Reserve computer lab, gather supplies

Lab Organization Strategies:
Grouping/Leadership/Presentation Opportunities:
- Random groups of 2

Cooperative Learning:
-

Expectations:
- Equal participation by both partners

Timeline:
- 3 days

Post Lab Follow-Up/conclusions:
Discuss real world application of learning from lab
- Be an informed consumer and consider multiple sources before making a large purchase

Career Applications
- Used car sales

Optional or Extension Activities
-

Is it a Good Deal?

1. Decide on a make, model and year of a used vehicle you are interested in buying. The vehicle must be at least 5 years old.

2. Choose three different sources to compare prices for purchasing your vehicle. Be sure that all vehicles are the same make/model/year and similar features. Decide on what price you will pay.

3. Based on the original and current price of the vehicle, write a linear equation for the depreciation? Hint: Use (0, original price) and (age of vehicle, current price) as points on your line.

4. What is the depreciation rate for your vehicle? Write the exponential decay equation that models your situation. Hint: find depreciation information here: http://www.edmunds.com/tco.html

5. Graph both equations.

6. Which seems more reasonable? Why?

7. You purchase the vehicle with a 20% down payment and will make monthly payments of $300 after that, until it is paid off. Write the expense equation.

8. Graph the expense equation with the other graphs.

9. What are the coordinates of the intersections of the expense and depreciation graphs?
   a. Linear depreciation and expense intersection:

   b. Exponential depreciation and expense intersection:

10. What do the regions of the graphs before, at, and after the intersections tell you about the situation?
11. If you were to sell this vehicle in five more years, what can you expect to sell it for based on the linear model? The exponential model?

12. What conclusions can you draw from your findings?

With your partner, create a poster to organize your findings and present to the class.

Is it a Good Deal?

Scoring Rubric

Item	Points
Appropriate vehicle choice at least 5 years old	1
Three prices from different sources	3
Correct linear equation	2
Correct exponential equation	2
Correctly calculate depreciation rate	2
Correct expense equation	2
Correct graphs with appropriate scales, labels and title	5
Attractive poster	5
Present to the class	5
Total	27

Historical and Exponential Depreciation   Name_____
5-6 Quiz

1. James purchased a used car that originally sold for $35,000. It exponentially depreciates at a rate of 6.8% per year. Write the exponential decay equation for this car.

2. Kristin bought a used car for $9,700. It depreciates at a rate of 8% per year. How much will her car be worth in 5 years? Round your answer to the nearest cent.

3. A graphing calculator determined this exponential regression equation based upon historical car value data: $y=a*b^x$, a=29,870.34, and b=0.883.

   a. What is the rate of depreciation for this car?

   b. How much will the car be worth in 4 years?

   c. How much will it be worth in 72 months?

4. Dave purchased an 8-year-old car for $16,359. This model depreciates exponentially at a rate of 7.3% per year. What was the original price of the car when it was new?

5. What is the exponential depreciation rate, to the nearest tenth of a percent, for a car that originally sold for $38,000 and is worth $14,576 after 9 years?

Answer Key

1. $y = 35000 \cdot (.932)^x$

2. $6,393.09

3. a. 11.7%
   b. $18,158.63
   c. $14,158.08

4. $29,999

5. 10.1%