WAMC Lab Template

Math Concept(s): Exponential Equations
Modeling, Reasoning with Equations and Inequalities A-REI, Interpreting Functions F-IF, Linear, Quadratic and Exponential Models F-LE
Source / Text: Financial Algebra and Glencoe Algebra I – Chapter 10
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Attach the following documents:

Lab Instructions

- Lab Sheets
- Lesson Plan

Lab Plan

Lab Title:
"Get your Motor Running"

Prerequisite skills:

- Exponents
- Exponential depreciation equation
- Functions
- Breakeven
- Interest

Lab objective:

- Students will be able to see the relationships between compound interest rate equations and exponential deprecation equations in a graph
- Students will create practical applications for complex equations

Standards:

CCSS-M:
· F-IF) 1., 2., 7.e., 8.b., F-LE) 5.

Standards for Mathematical Practice:
· 2. Reason abstractly and quantitatively 4. Model with mathematics

State Standards addressed (2008 Washington State Mathematics Standards):
· A1.1.E Solve problems that can be represented by exponential functions and equations. A1.2.C Interpret and use integer exponents and square and cube roots, and apply the laws and properties of exponents to simplify and evaluate exponential expressions.

A1.3.B Represent a function with a symbolic expression, as a graph, in a table, and using words, and make connections among these representations.

A1.6.B Make valid inferences and draw conclusions based on data.

A1.7.A Sketch the graph for an exponential functionof the form y = abn where n is an integer, describe the effects that changes in the parameters a and b have on the graph, and answer questions that arise in situations modeled by exponential functions.

A1.7.B Find and approximate solutions to exponential equations.

A1.7.D Solve an equation involving several variables by expressing one variable in terms of the others.

Reading:

· A1.8.A Analyze a problem situation and represent it mathematically.

A1.8.B Select and apply strategies to solve problems.

A1.8.C Evaluate a solution for reasonableness, verify its accuracy, and interpret the solution in the context of the original problem.

A1.8.D Generalize a solution strategy for a single problem to a class of related problems, and apply a strategy for a class of related problems to solve specific problems.

A1.8.E Read and interpret diagrams, graphs, and text containing the symbols, language, and conventions of mathematics.

Writing:

· A1.8.F Summarize mathematical ideas with precision and efficiency for a given audience and purpose.

A1.8.G Synthesize information to draw conclusions, and evaluate the arguments and conclusions of others.

A1.8.H Use inductive reasoning about algebra and the properties of numbers to make conjectures, and use deductive reasoning to prove or disprove conjectures.

21st Century Skills

2.C.1 Effectively analyze and evaluate evidence, arguments, claims and beliefs

3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)

4.A.1 Access information efficiently (time) and effectively (sources)
4.A.2 Evaluate information critically and competently

6.A.1 Use technology as a tool to research, organize, evaluate and communicate information

8.C.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
8.C.2 Demonstrate initiative to advance skill levels towards a professional level
8.C.3 Demonstrate commitment to learning as a lifelong process
8.C.4 Reflect critically on past experiences in order to inform future progress

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

Materials

- Internet: kbb.com, carpaymentcalculator.net, Google
- Lab Sheet
- Wrap up worksheet
- Graphing paper
- Calculator

Set-Up Required:

- Standard lab classroom would be helpful for research
- Brochures and YouTube song of "Born to be Wild" (for the get your motor running chorus)

Lab Organization Strategies:

Grouping/Leadership/Presentation Opportunities:

· During the pair share of the lab, students will be given an opportunity to peer tutor and help their peers that are struggling. Once a student has completed the checkpoints, they are also given an opportunity to check off their other peers. A pair share will also allow students to present their findings. At the end of the lab, a class discussion will also give students a time to present their car and graph.

Cooperative Learning:

· Students will be sharing their results with a peer. This will help students differentiate learning, if the warm up was not enough of a schema developer for the lab. Developing learning will happen when the student is the teacher.

Expectations:

· Students will be selecting varying types of cars, of all different costs. This will make it so that almost every student will have different results. The lab shows how real application of depreciation values it something they should want to research when purchasing a car.

Timeline:

· This lab will take two standard 50 minute classes. The research portion will be longer than needed, as to allow students to find their dream car and research prices and types. By allowing students to research their own cars, they will have greater buy in to the lab.

Post Lab Follow-Up/conclusions:

Discuss real world application of learning from lab

· Anytime students make a purchase of a tangible object that has the potential of losing value, they can calculate at what rate their object depreciates. Also, if the student holds a job that utilizes finances or analyzes companies' finances, this lab will be helpful in learning depreciation.

Career Applications

- Sales, Purchase agent, CFO, CPA
- Car owner

Optional or Extension Activities

1) What if you had a down payment?
    a) What would that do to your graph?
    b) Where would your new breakeven point be?
2) How much more than sticker price did you pay at the end of five years of payments?

Lesson Title: Exponential Equations - "Get your Motor Running"
Date:
Text: Financial Algebra Lesson Length: Two 50 minute class periods

Domain: Modeling, Reasoning with Equations and Inequalities A-REI, Interpreting Functions F-IF, Linear, Quadratic and Exponential Models F-LE
Big Idea (Cluster): • Understanding the concept the concept of a function and use function notation. • Analyze functions using different representations • Construct and compare linear, quadratic and exponential models and solve problems** • Interpret expressions for functions in terms of the situations they model

Common Core State Standards: F-IF) 1., 2., 7.e., 8.b., F-LE) 5.,	
Mathematical Practice(s): 2. Reason abstractly and quantitatively 4. Model with mathematics	
Content Objectives: • Students will be able to see the relationships between compound interest rate equations and exponential deprecation equations in a graph • Students will create practical applications for complex equations •	Language Objectives: • Students will be able to analyze a graph and explain how making payments affect a loan •
Vocabulary: • Depreciation • Retail Pricing • Function • Purchase Price • Breakeven • Exponents • Interest	Connections Prior to Learning • Exponents • Exponential depreciation equation • Functions • Breakeven • Interest
Questions to Develop Mathematical Thinking: • What does depreciation mean to the value of your car? • Why doesn't your loan go down by the amount you make a payment for? • What happens at the end of your 60-month loan? • How much total interest do you pay for the life of your loan? • What does your graph show? • Does the information from your functions make you want to investigate other cars for purchase? • Do all cars depreciate at the same rate? Why or why not? How do you know?	Common Misconceptions: • Your loan value decreases by the amount you make a payment for • Your car is worth what you owe on it • Your car is worth what you paid for it • Cars depreciate at the same rate • Depreciate of a car is constant over the life of the loan •

Assessment (Formative and Summative):

- Completion of the lab sheet – Formative and Summative
- Complete graphs with work displayed – Formative and Summative
- Write up of explanation of purchasing choices (Wrap up Worksheet)– Summative
- Observation of student work – Formative
- Probing questions - Formative

Materials:

- Internet: kbb.com, carpaymentcalculator.net, Google
- Lab Sheet
- Wrap up worksheet
- Graphing paper
- Calculator

Instruction Plan:

Launch: Play the song of “get your motor running” New car brochures, Car commercials/videos, Talk about how long until your license

Explore:

- Class discussion of cars students may be interested in (to help generate ideas)
- Warm up worksheet (in applicable)

When I observe students:
Students will be researching cars that show their personalities.
Students may change the type of car they want to purchase, based on finding the rate of depreciation.
Students will be graphing two exponential functions on one graph to find an interception.
Students will interpret interception (or lack there of) to find real meaning.

Questions to Develop Mathematical Thinking as you observe:

- What does depreciation mean to the value of your car?
- Why doesn’t your loan go down by the amount you make a payment for?
- What happens at the end of your 60-month loan?
- How much total interest do you pay for the life of your loan?
- What does your graph show?
- Does the information from your functions make you want to investigate other cars for purchase?
- Do all cars depreciate at the same rate? Why or why not? How do you know?

Answers: Interest rates, payoff amounts, high end and low end cars, payoff dates, value of car, sticker price, total price

Summarize: Wrap up worksheet

Career Application(s):

- Sales, Purchase agent, CFO, CPA,
- Car owner

21st Century Skills and Interdisciplinary Themes:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness X 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	X Access and Evaluate	X Adapt to Change	X Produce Results
☐ Work Creatively with Others	Information	X Be Flexible	Leadership and
☐ Implement Innovations		Initiative and Self-Direction	

Critical Thinking and Problem Solving X Reason Effectively ☐ Use Systems Thinking X Make Judgments and Decisions XSolve Problems Communication and Collaboration x Communicate Clearly x Collaborate with Others	X Use and manage Information Media Literacy X Analyze Media ☐ Create Media Products Information, Communications and Technology (ICT Literacy) ☐ Apply Technology Effectively	☐ Manage Goals and Time X Work Independently X Be Self-Directed Learners Social and Cross-Cultural x Interact Effectively with Others ☐ Work Effectively in Diverse Teams	Responsibility ☐ Guide and Lead Others x Be Responsible to Others

Alternative strategies:

Warm up worksheets – writing exponential decay function and how to find the rate of deprecation

"Check points" in the lab

Pair-share warm up worksheets

Team pair with the lab

Share out aspect of partner's lab

Extension activities

Wrap Up Worksheet

What does depreciation mean to the value of your car?

_____

_____

Why doesn't your loan go down by the amount you make a payment for?

_____

_____

What happens at the end of your 60-month loan?

_____

_____

How much total interest do you pay for the life of your loan?

What does your graph show?

At what point do the lines of your graph cross? Or do they not cross?

Does the information from your functions make you want to investigate other cars for purchase?

Do all cars depreciate at the same rate? Why or why not? How do you know?

Compare your depreciation graph with a peer

After conducting your lab, do you still want to purchase the car you researched? Why or why not? What evidence can you use to justify your response?

Select a car you want to realistically want to buy when you can drive. Your car should not be more than 20 years old, for this lab. Use graph paper to show your work for your functions.

1) Research your dream car at kbb.com :
Car:_____ Year:_____

2) Find the retail price of the car you would like to purchase: _____

3) Google MSRP for your car the year it was brand new:_____

Example: google: “MSRP 2008 Mini Cooper”

4) How much value has your car lost? _____

5) Find the rate of depreciation, round to the nearest tenth: _____

a) Write your function: _____

6) Graph the function of the depreciation of your vehicle for the next five years (number 5)

7) Go to carpaymentcalculator.net

a) Enter the cost of your car, (from #2)

b) Enter 0 for down payment, 0 for trade in, 6.5% for Tax Rate, and 5% for Interest Rate, and 60 for number of monthly payments (5 years)

c) Your monthly payment will be: _____

8) Take the purchase price of your car:_____

9) Go to myamoritzationchart.com and input your data. Loan term 60 months, show schedule by year. Scroll to the bottom, and find the yearly amortization schedule.

10) Graph the data from the amortization chart on your graph with the first function. (One graph with two functions) (Amount owing on the y-axis and number of years on the x-axis, only plot years and balance per year) Estimate and draw a line of fit for your data points.

Extension:

1) What if you had a down payment?

    a) What would that do to your graph?

    b) Where would your new breakeven point be?

2) How much more than sticker price did you pay at the end of five years of payments?