WAMC Lab Template

Math Concept(s):

- Interpreting functions that arise in applications in terms of the content.
- Build a function that models a relationship between two quantities.
- Construct and compare linear, quadratic, and exponential models and solve problems.
- Interpret expressions for functions in terms of the situation they model.

Source / Text: CORD

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Attach the following documents:

Lab Instructions/Student Handout(s)

Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

Lab Plan

Lab Title: Cars: Life is a Highway

Prerequisite skills:
Construct and create a graph
Calculate Slope
Convert minutes to hours
Build a function based on given data
Collect and record data
Solve for an unknown x value when given the value of y

Lab objective:

- Through this activity, students will;
  - Be able to calculate slope at various intervals.
  - Find missing information to solve problems.
  - Construct the function of both their data and the given data.
  - Use a data table to plot points on a graph and determine the trend line.

  Student understanding will be assessed with a rubric upon completion of the student handout. Summative assessment will follow with use of State COE Task, Connor's Touchdown.

Standards:

CCSS-M:

- F-IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
- Estimate the rate of change from a graph.★

- F-BF.1.C: Write a function that describes a relationship between two quantities.★

- (+) Compose functions. *For example, if T(y) is the temperature in*
- *the atmosphere as a function of height, and h(t) is the height of a*
- *weather balloon as a function of time, then T(h(t)) is the temperature*
- *at the location of the weather balloon as a function of time.*

- F-LE. 1.B: Distinguish between situations that can be modeled with linear functions and with exponential functions.
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

- F-LE. 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).

- F-LE.5: Interpret the parameters in a linear or exponential function in terms of
- a context.

Standards for Mathematical Practice:

- MP.1: Makes sense of problems and persevere in solving them.
- MP.2: Reason abstractly and quantitatively.
- MP.3: Construct viable arguments and critique the reasoning of others.
- MP.4: Model with mathematics.
- MP.5: Use appropriate tools strategically.
- MP.6: Attend to precision.
- MP.8: Look for and express regularity in repeated reasoning.

State Standards addressed (2008 Washington State Mathematics Standards):

- A.1.6.D: Find the equation of a linear function that best fits bivariate data that are linearly related, interpret the slope and *y*-intercept of the line, and use the equation to make predictions.
- A.1.8.G: Synthesize information to draw conclusions, and evaluate the arguments and conclusions of others.

Reading:

- 1.3.2: Understand and apply content/academic vocabulary critical to the meaning of the text, including vocabularies relevant to different contexts, cultures, and communities.

Writing:

- 3.2.1: Analyzes audience and purpose and uses appropriate voice.
- 3.2.2: Analyzes and selects language appropriate for specific audiences and purposes.
- 3.3.1: Uses legible handwriting.

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	☒ 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	
☒ Reason Effectively	☐ Create Media Products	☒ Work Independently	
☐ Use Systems Thinking		☒ Be Self-Directed Learners	

☐ Make Judgments and Decisions ☒ Solve Problems Communication and Collaboration ☒ Communicate Clearly ☒ Collaborate with Others	Information, Communications and Technology (ICT Literacy) ☒ Apply Technology Effectively	Social and Cross-Cultural ☒ Interact Effectively with Others ☐ Work Effectively in Diverse Teams	☒ Be Responsible to Others

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

Materials

- Automobile or Pedometer (if modified)
- Watch/ Clock
- Handout
- Pencil
- Calculator
- Straight edge
- Driver/Recorder

Set-Up Required:

- Copies of handouts and rubrics.

Lab Organization Strategies:

Grouping/Leadership/Presentation Opportunities:

- Students will be grouped in groups of 3-4 to collaborate and share the data they have collected.
- Students will work individually to complete the student handout.

Cooperative Learning:

- Students will collaborate in small groups at the beginning and end of the activity to discuss their data and reflect on their understanding.
- Students will work with a family member or friend to collect their data while taking a 20 minute or longer drive.

Expectations:

- Students will be expected to complete the graphs using the collected and given data.
- Calculate rate at each interval of collected data.
- Construct a function for the given data by plotting points, creating a trend line, and calculating slope, and using either point slope or another method to find b.
- Solve for an unknown variable using technology appropriately.

Timeline:

- Two class periods or approximately 90 minutes.

Post Lab Follow-Up/conclusions:

Discuss real world application of learning from lab

- Police Officers determining your speed
- Calculating gas mileage
- Stats for sports and athletes

Career Applications

- Police Officer
- Sporting Scouts
- Sales Projections
- Travel Agents
- Stock Market

Alternative Strategies

- Peer tutor/ Driving partner (ELL)
- Modified for health by walking and calculating steps per second and convert to miles per hour.
- Advanced students will find the area below the curve on the graph they created and compare it to their mileage.
- Struggling students will be given additional instruction and time to make modifications on the formative assessment (Student Handout).

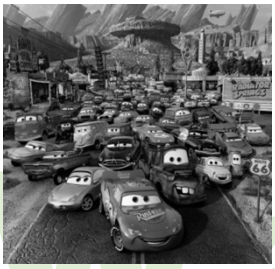
Optional or Extension Activities

- Calculating cost of a road trip based on miles per hour.
- Calculate area below the curve.

Cars: Life is a Highway Rubric

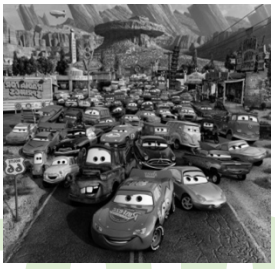
Score:

	0 points	5 point	10 points	15 points
Collect the Data	Incomplete	The data collected is inaccurate or incomplete, but shows some understanding	The data collected is largely complete and accurate.	The data collected is complete and accurate.
Create a function from data	Incomplete	The function is inaccurate or incomplete, but shows some understanding	The function is largely complete and accurate.	The funcrtion is complete and accurate.
Create a table from the data	Incomplete	The table is inaccurate or incomplete, but shows some understanding	The table is largely complete and accurate.	The table is complete and accurate.
Create a graph from the data	Incomplete	The graph is inaccurate or incomplete, but shows some understanding	The graph is largely complete and accurate.	The Graph is complete and accurate.
Created an equation from the data	Incomplete	The equation is inaccurate or incomplete, but shows some understanding	The equation is largely complete and accurate.	The equation is complete and accurate.
Solve for the unknown	Incomplete	The solution is inaccurate or incomplete, but shows some understanding	The solution is largely complete and accurate.	The solution is complete and accurate.
Group Work	Student did not work effectively with others.	Student usually cooperated with others, but frequently needed prompting to stay on-task. Student sometimes had trouble listening to others or participating positively to the discussion.	Student was an engaged member, participating positively to the discussion but sometimes had trouble listening to others or working cooperatively.	Student was an engaged member, listening to suggestions of others, participating positively to the discussion and working cooperatively throughout activity.
Reflections	Incomplete	The reflection was filled with errors.	The reflections was on topic and fairly well written with only a few errors.	The reflection was well written.



Cars

Life is a Highway!

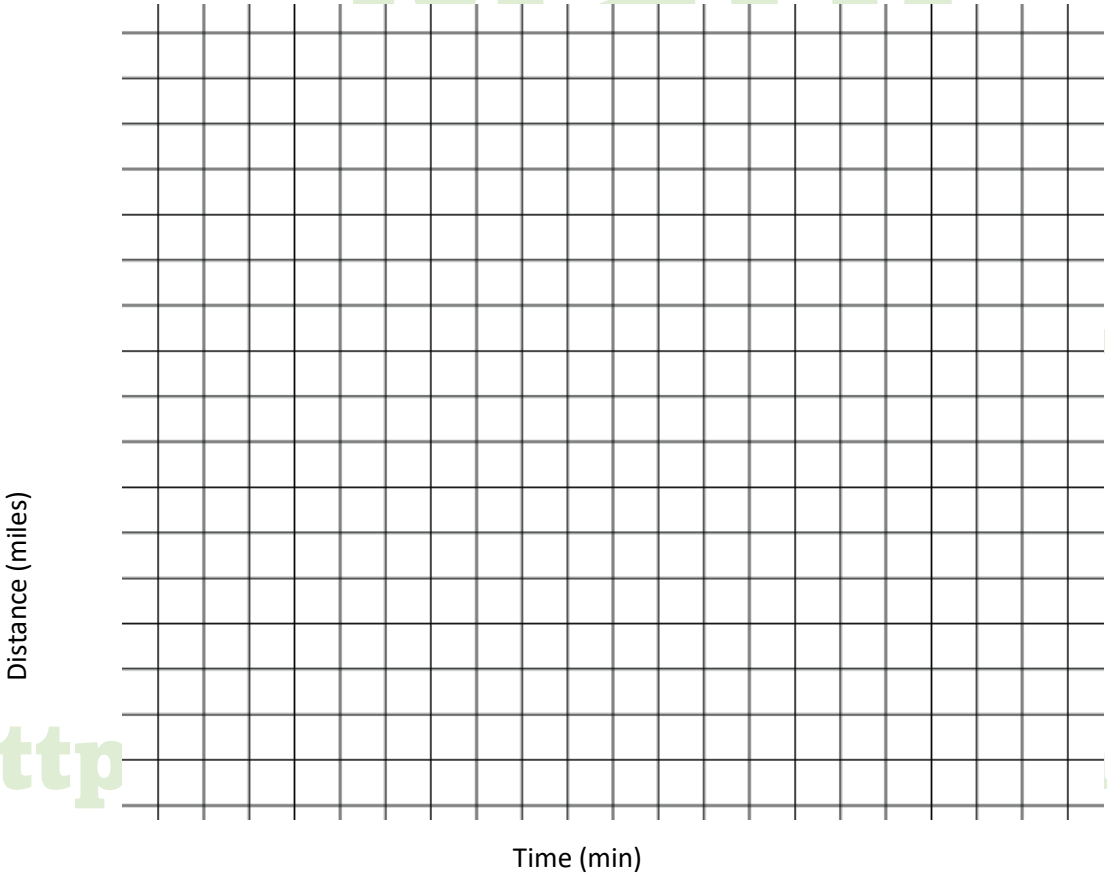


Homework:

1. Take a ride with a friend or relative. (10 to 20 min trip is great)
2. Record the Odometer Reading before you start.
3. Record the Odometer Reading and the time elapsed at the least 9 times during the trip. If you take a 16 min trip, recording every 2 min is perfect. (0 min, 59360), (2 min, 59369)…
4. Write down the odometer reading and the time elapsed at the end of your trip.

In Class:

5. Create graph using this data, connecting the point(s), identify your location (in town, Highway, Freeway) for each interval.



6. The local police are concerned that you might be speeding. You are given different intervals in which to calculate your speed in mph. Complete the table below using the data you collected.

Interval	Minutes	Mile per Min	Miles per hour
1	To		
2	To		
3	To		
4	To		
5	To		
6	To		
7	To		
8	To		
9	To		
10	To		

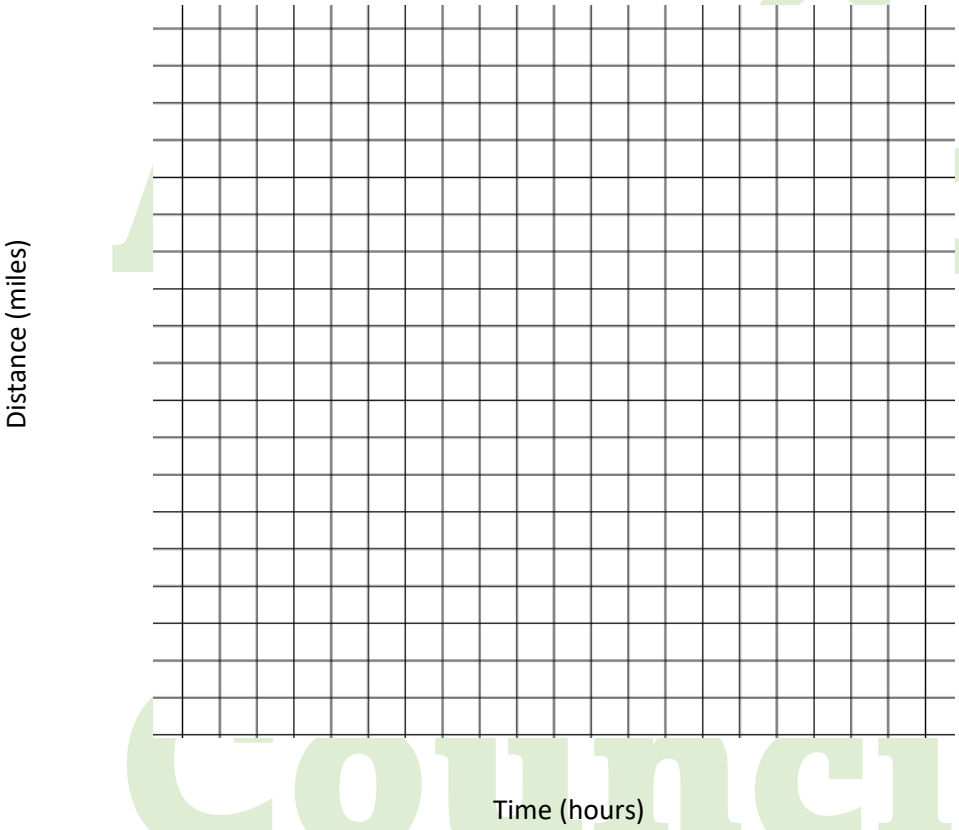
7. At this point, get into groups of three or four, to collaborate and share the data you have collected.

8. What did you notice about this data? What kinds of conclusions can you make about your speed over this entire trip and what would you explain to the police officer about his belief regarding your speed?

- Use diagrams, words, numbers and calculations to explain your answer.

9. Create a graph using the data below.

Time (hours)	Distance (miles)
0.5	15
1.0	30
1.5	45
2.0	60
2.5	75



10. Now creating a trend line which extends through an 80 mile trip and determine the equation of the line you drew.

Equation of the line (show all the steps used):

11. What is your Y- intercept and what does it represent for this scenario?

y-intercept:
y-intercept represents:

12. Calculate your velocity for each interval listed.
(show all the steps used):

Interval 1: 0 to 0.5 hours
Interval 2: 0.5 to 1.0 hours
Interval 3: 1.0 to 1.5 hours
Interval 4: 1.5 to 2.0 hours
Interval 5: 2.0 to 2.5 hours
Interval 6: 2.5 hours to your 80 mile destination

13. What was the most difficult part of calculation interval #6? What steps did you take to find the ending time for this second trip? What do you notice about the velocity of this trip?