

WAMC Lab Template

Math Concept(s): Square Roots; Ratios; Solving Literal Equations

Source / Text: FA Text 4-9

Developed by: Rick Chance E-Mail: Rick.Chance@kent.k12.wa.us

Date: Summer Conference 2019

Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

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

Lab Plan

Lab Title: Accident Investigation

Prerequisite skills: Use of a tape measure; find mean, ability to take sq. roots, calculator, reason and justify an estimate

Lab objective: Find an approximate speed of Officer Wilson when she applied brakes to create skid marks

Standards: (Note SPECIFIC relationship to Science, Technology, and/or Engineering)

Mathematics K–12 Learning Standards: A-REL, A-REI2, G-C5, F-LF, F-FIF4

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Standards for Mathematical Practice: Make sense of problems and persevere in solving them; Construct viable arguments and critique the reasoning of others; Model with mathematics; Attend to Precision

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Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 11-12):

- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Educational Technology:

- 3.d Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions
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Leadership/21st Century Skills:

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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

Creativity and Innovation

- Think Creatively
 Work Creatively with Others
 Implement Innovations

Critical Thinking and Problem Solving

- Reason Effectively
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 Solve Problems

Communication and Collaboration

- Communicate Clearly
 Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy

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Media Literacy

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Information, Communications and Technology (ICT Literacy)

- Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability

- Adapt to Change
 Be Flexible

Initiative and Self-Direction

- Manage Goals and Time
 Work Independently
 Be Self-Directed Learners

Social and Cross-Cultural

- Interact Effectively with Others
 Work Effectively in Diverse Teams

Productivity and Accountability

- Manage Projects
 Produce Results

Leadership and Responsibility

- Guide and Lead Others
 Be Responsible to Others

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

Materials

- Student Lab wkst
- Measuring tool up to 150 feet
 - Suggest Measuring Wheel (talk w/ track coach)
- Calculator

Set-Up Required:

- SRO or local police need (DO NOT HAVE STUDENT DO THIS) to place skid marks down in parking lot and be sure to check speed at time of brake application
 - If possible, this activity will work best if 2 or 3 sets of skid marks can be placed

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

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Cooperative Learning:

- Students will work together to determine Officer Wilson's speed, they will work in groups (determined by number of sets of skid marks) to determine speed
- They must reason through how they choose to determine braking efficiency and drag factor

Expectations:

- Students will work together cooperatively to estimate a reasonable drag factor, a reasonable braking efficiency, an accurate skid mark length and then determine using the speed formula the speed at which the vehicle was traveling when brakes first applied

Timeline:

- 1 day

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Dangers of speeding, how far a car actually travels when brakes applied

Career Applications

- Accident Investigator

Optional or Extension Activities

- Scott was driving on I-5 where the speed limit is 60 mph and was in an accident where both parties are blaming the second party. The police were involved and the case went to court. Scott's lawyer claims the other party was speeding because of the estimates he made based on the other party's car. The skid marks were measured by police to be 185'. Scott's lawyer argues the brakes were operating at 100% because the car of the other driver was brand new. Scott's lawyer demonstrated to the court the driver had to be speeding because of this, if you are on the jury, do you believe Scott's lawyer?
- Create an argument using math for or against Scott's lawyer
(I expect students to use Desmos)

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Name: _____

Skid Mark Activity

Situation #1:

Skid Mark Lengths: We found the skid marks to be (circle one):

the same length: _____ different length: The average is: _____

Speed Formula: $S = \sqrt{(30 * D * f * n)}$

We will use a drag factor of: _____ How did your group decide on the drag factor?

We will use a braking efficiency of: _____ How did your group decide on the braking efficiency?

My Work:

How fast I think Officer Wilson was traveling: _____ mph

Wrap Up:

Officer Wilson was traveling _____ mph when she applied the brakes. Was your group correct? Yes / no

Answer one of the following:

If so, why do you think your group was able to determine her speed?

If not, why do you think you weren't correct and what would you do differently next time to be more accurately determine her speed?

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Collaborative Work Skills : Accident Investigation

Teacher Name: **Rick Chance**

Student Name: _____

CATEGORY	4	3	2	1
Contributions	Routinely provides useful ideas when participating in	Usually provides useful ideas when participating in	Sometimes provides useful ideas when participating in	Rarely provides useful ideas when participating in
Problem-solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions, but is willing to try out	Does not try to solve problems or help others solve problems.
Focus on the task	Consistently stays focused on the task and what needs to be	Focuses on the task and what needs to be done most of the	Focuses on the task and what needs to be done some of	Rarely focuses on the task and what needs to be done. Lets others
Quality of Work	Provides work of the highest quality.	Provides high quality work.	Provides work that occasionally needs to be checked/redone	Provides work that usually needs to be checked/redone

Date Created: **Jun 26, 2019 01:15 pm (CDT)**

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WAMC Lesson Plan

Name(s): Rick Chance

Email Address: Rick.Chance@kent.k12.wa.us

Lesson Title: Accident Investigation Data

Date: 6/25/19

Text: Financial Algebra STEM Correlation: Math, Technology, Engineering

Lesson Length: 1 Day

Big Idea (Cluster): Square Roots; Ratios; Solving Literal Equations	
Mathematics K–12 Learning Standards: A-REL, A-REI2, G-C5, F-LF, F-FIF4	
Mathematical Practice(s): Make sense of problems and persevere in solving them; Construct viable arguments and critique the reasoning of others; Model with mathematics; Attend to Precision	
Content Objectives: Determine the minimum speed a car is traveling based on its skid marks	Language Objectives (ELL): Ability to understand and convey key terms regarding accident reconstructionist
Vocabulary: Accident Reconstructionist; skid mark; shadow skid mark; ABS; yaw mark, drag factor, braking efficiency	Connections to Prior Learning; 4-8 Driving Data;
Questions to Develop Mathematical Thinking: See below	Common Misconceptions: <ul style="list-style-type: none"> • A connection to speed and length of skid mark

Assessment (Formative and Summative):

<ul style="list-style-type: none"> • Formative : Solve problem #2 pg 280 – Thumbs up/Down – are st. getting answers that are reasonable? • Summative: Quiz 4-9
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Materials:

<ul style="list-style-type: none"> • Quiz 4-9
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Instruction Plan:

<p>Introduction: It takes 8460 bolts to assemble an automobile: And one nut to scatter it all over the road. In your own words, describe what the author trying to say.</p>
<p>Explore: Have a class discussion:</p> <ul style="list-style-type: none"> • Discuss: Skid Marks; Drag Factor; Braking Efficiency; ABS; • How many of you have been in an accident? • Were police called? • What happens when blame has to be assigned and is uncertain? • When you look at a skid mark, what information can you get from it? • Who determines Braking efficiency? Drag Factor? • Discuss the estimates and ranges found on page 275 <p>Give students the formula $S = \sqrt{(30 \cdot D \cdot f \cdot n)}$ Ask students the expected speed of a vehicle if the drag factor is .78, braking efficiency is 100%, and the skid distance is 80' Follow up question: ask for the skid mark length if the car was traveling at 71mph, has a braking efficiency of .9 and a drag factor of .6</p>

WAMC Lesson Plan

When I observe students: Struggling with literal equations I will have a student who was able to get started but stuck come to the doc camera and share. Then have a 2nd and even 3rd student share their progress in completing the formula.

Questions to Develop Mathematical Thinking as you observe: How do accident reconstructionists determine who's at fault?

Answers: 43.3 MPH ; about 311 feet

Summarize: St. should get a basic understanding of speed vs skid marks. They should also be able to solve the Speed equation if given different variables

Career Application(s):

- Accident Reconstructions

Leadership/21st Century Skills:

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

- | | | |
|---|---|---|
| <input type="checkbox"/> Global Awareness | <input type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy | <input type="checkbox"/> Civic Literacy |
| <input type="checkbox"/> Health/Safety Literacy | <input type="checkbox"/> Environmental Literacy | |

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

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1-2 Travel Expenses Show work for full credit. Put a box around your answer.

1. Shannon is traveling from NY to Boston by train. She doesn't know when she will return, therefore she is only purchasing a one-way fare. Below is a list of all available fares, find the percentile rank for a fare of \$119.

49	49	88	88	112	112	112	119	119	119
119	133	133	133	144	144	148	148	154	154
168	168	168	212	212	212	212	218	218	218

2. People travel all over the world. The National Parks tracks how many people visit Mt. Rainier by car each year. The following table shows the collected data.

2015 Month	# of Vehicles
April	127,355
May	140, 226
June	135,000
July	128,850
August	145,000
September	175,000

- Find the average number of vehicles that visit during the 6th month summer frequency.
- Find the median number of vehicles
- What percent of vehicles entered the park during April, May and June combined?

3. Complete a "Cumulative Frequency Column.

2015 Month	# of Vehicles	Cumulative Frequency
April	127,355	
May	140, 226	
June	135,000	
July	128,850	
August	145,000	
September	175,000	

Answers:

- 1) 37%
- 2a) 141,905
- 2b) 137,613
- 2c) 47.3%
- 3)

2015 Month	# of Vehicles	Cumulative Frequency
April	127,355	127,355
May	140, 226	267,581
June	135,000	402,581
July	128,850	547,581
August	145,000	722,581
September	175,000	851,431

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Name _____ Period _____ Date _____

4-9 Accident Investigation Data
your answer.

Show work for full credit. Put a box around

For this quiz, you will need to use this formula: $S = \sqrt{30Dfn}$

1. Tyler's car was traveling at an unknown speed. He was driving on gravel which has a drag factor of 0.55. His brakes are 65% efficient. He left a skid mark 70 feet long. Determine how fast Tyler was traveling.
2. Angelica's car was traveling at 60 MPH. She was driving on cement which had a drag factor of 0.9. Angelica's brakes are 55% efficient. She saw a deer in the road and slammed on her brakes. How long was the skid mark left by Angelica's car?
3. Scott was driving on I-5 where the speed limit is 60mph and was in an accident where both parties are blaming the second party. The police were involved and the case went to court. Scott's lawyer claims the other party was speeding because of the estimates he made based on the other party's car. The skid marks were 185'. He estimates the brakes were operating at 100% because the car was brand new. If he estimated the drag factor, was the 2nd driver speeding?

Answers:

- 1) 27.4 mi/hour
- 2) 242.2 feet
- 3) The lawyer cannot make the assumption he was speeding. If the drag factor is .5, the driver was traveling 52 mph and not speeding but if it is .9 he was speeding at 71 mph.

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WAMC Lesson Plan

Name(s): Rick Chance

Email Address: Rick.Chance@kent.k12.wa.us

Lesson Title: Travel Expenses – CH 1-2

Date: 6/26/19

Text: Financial Alg.

STEM Correlation: Math, Technology

Lesson Length: 1 day

Big Idea (Cluster): Summation, frequency, mean, median, mode	
Mathematics K–12 Learning Standards: 6.5S, S-ID2, 7.SP6	
Mathematical Practice(s): Make sense of problems and persevere in solving them; Construct viable arguments and critique the reasoning of others; Model with mathematics; Attend to Precision	
Content Objectives: Determine and interpret frequency; relative frequency, cumulative frequency, model a situation, determine percentiles	Language Objectives (ELL): Ability to understand and convey key terms regarding accident reconstructionist
Vocabulary: Cumulative Frequency. Spreadsheet, relative frequency, percentile, percentile rank	Connections to Prior Learning: st. should be familiar with measures of central tendency
Questions to Develop Mathematical Thinking: <ul style="list-style-type: none"> • See below 	Common Misconceptions: <ul style="list-style-type: none"> • Mix-up of central tendencies •

Assessment (Formative and Summative):

- Formative: As groups work through and share examples, we will stop after each one, ask and answer questions – turn and talks – restate and rethink

Materials:

- Textbook; sticky notes

Instruction Plan:

Introduction: Travel is the only thing you buy that makes you richer. What does the author mean? If you could travel anywhere, where would you go and why? What if you could travel for work, would you? What are the pros and cons? What costs go into travel? (make a list)

Explore: Students will be assigned 1 of 5 groups. Each group will complete an example from the book on large white paper to present to the class. Each of the 5 groups will post their work, each student will get 8 sticky notes and move around from poster to poster. St. must ask one question for explanation and give one “ah ha” or good thought to each of the other groups. After the walk around each group will return to their poster, read over the sticky notes, and then present their problem being sure to answer any questions that were asked

When I observe students: struggling I will encourage them to ask their clarifying questions on the sticky notes

Questions to Develop Mathematical Thinking as you observe: What connection does this have to real life? Have you ever heard of kids who are in the “98th percentile” for height or weight? Connect this to my 4yr old, who is 98th percentile in height and 58th in weight.

Answers: Found in text

Summarize: students will have a solid understanding of measures of central tendency, as well as frequency’s and percentile ranks.

WAMC Lesson Plan

Career Application(s):

- DOT, any travel field, finance, tourism, chamber of commerce, payroll

Leadership/21st Century Skills:

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