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Women in the Automobile Industry

Math: Ratios & Percentages

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Content:

Women in the Automobile Industry

Knows:

- The first woman to drive across the US and the impact she had on the automobile industry
- The first woman to create the windshield wiper and its impact
- Well known and powerful women in the automobile industry in recent years, and what contributions they made to the automobile industry. These may include:
    - Mary Barra
    - Grace Lieblein
    - Julie Hamp
    - Danica Patrick
    - Alicia Boler-Davis
    - Barb Samardzich
    - Chris Barman
    - Linda Hasenfratz
    - Trudy Hardy
    - Elena Ford
- The distribution of women within each department of the automobile industry,. These may include:
    - Body and related repairs
    - Service technicians and mechanics
    - Executive/senior level officials & managers
    - First/mid level officials & managers
    - Professionals
    - Craft workers
    - Technicians
    - Sales workers
    - Office workers
    - Service workers

Dos:

- Define ratio, ratio table, equivalent ratios, rate, unit rate, and percent
- Describe the relationship between men and women in the automobile industry, and other quantities, using ratios
- Solve real-life problems using ratios and rates
- Determine whether or not two ratios and/or rates are equivalent
- Find equivalent ratios using ratio tables
- Compare contributions made by women in the automobile industry using unit rates, ratios, and rates
- Convert between percents and fractions in order to describe the representation of women in the automobile industry and contributions made by women
- Calculate percents of numbers, such as the percent of women represented in different areas of the automobile industry (i.e. sales, assembly, etc)
- Find the whole given the part and the percent

Essential Questions:

1. What influence(s) did women have on the automobile industry?
2. What women have made significant contributions to the automobile industry, and what effects did those contributions have on society/the current automobile industry?

Prior Knowledge:

- Multiply and divide decimals and fractions
- Convert measurement units, such as miles to feet and hours to seconds
- Equivalent fractions
- Identify patterns (ex. Inputs of 1 and 2 with outputs of 6 and 12 have the pattern “multiply the input by 6)

Standards:

Standard CC.2.1.6.D.1: Understand ratio concepts and use ratio reasoning to solve problems

Assessment Anchor M06.A-R.1: Understand ratio concepts and use ratio reasoning to solve problems

Anchor Descriptor M06.A-R.1.1: Represent and/or solve real world and mathematical problems using rates, ratios, and/or percents

M06.A-R.1.1.1: Use ratio language and notation (such as 3 to 4, 3:4, 3/4) to describe a ratio relationship between two quantities. Example 1: "The ratio of girls to boys in a math class is 2:3 because for every 2 girls there are 3 boys." Example 2: "For every five votes candidate A received, candidate B received four votes."

M06.A-R.1.1.2: Find the unit rate a/b associated with a ratio a:b (with $b \neq 0$) and use rate language in the context of a ratio relationship. Example 1: "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." Example 2: "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

M06.A-R.1.1.3: Construct tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and/or plot the pairs of values on the coordinate plane. Use tables to compare ratios.

M06.A-R.1.1.4: Solve unit rate problems including those involving unit pricing and constant speed. Example: If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

M06.A-R.1.1.5: Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percentage.

Road Trip Performance Task Rubric

	Outstanding	Good	Fair	Needs Improvement
Explanation of trip (starting and ending point, type of car, mpg of car, total miles of trip, how long trip will take) 6 pt	All 6 pieces of information are provided.	5 pieces of information are provided.	3-4 pieces of information are provided.	Less than 3 pieces of information are provided.
Comparisons (ratios) to Alice Ramsey's trip (driving distance, hours driven) 8 pt	Both ratios are provided and are correct.	Both ratios are provided, but only one is correct.	Both ratios are provided, but neither are correct. Or Only one ratio is provided (may or may not be correct)	No ratios are provided.
Rates (money spent per day, miles driven per day) 8 pt	Both rates are provided and are correct.	Both rates are provided, but only one is correct.	Both rates are provided, but neither are correct. Or Only one rate is provided (may or may not be correct)	No rates are provided.
Relation to women in the automobile industry. 8 pt	At least 2 aspects of trip are related to women in the automobile industry, and information is correct.	At least 2 aspects of trip are related to women in the automobile industry, but most information is correct.	1 aspect of trip is related to women in the automobile industry, and information is correct.	No aspects of trip are related to women in the automobile industry. Or All information is incorrect.
MUGS 5 pt	No grammatical or spelling errors.	Very few grammatical or spelling errors.	Many grammatical or spelling errors.	Numerous grammatical or spelling errors.
Sources for - Both aspects of trip connecting to women - mpg of car - distance of trip 5 pt	Sources confirm all 4 pieces of requested information	Sources confirm 3 pieces of requested information	Sources confirm 1-2 pieces of requested information	No sources are provided Or No sources confirm requested information

Total Points _____/40

Benchmark #1: Alice Ramsey's Trip Across America (For Use After Lesson 3)

Research Alice Ramsey's trip across America. Describe her trip and the impact it had on the automobile industry. While researching, determine 3 ratios and 3 rates that are included in the trip.

Differentiation: Students may complete this assignment in any way they choose. The description may be in the form of a one to two page paper, brochure, PowerPoint presentation, interview, etc.

Benchmark #2: Women in the Automobile Industry (For Use After Lesson 5)

Research current significant women in the automobile industry. Choose 3 women. Find one ratio that pertains to each woman, and compare them. Then find 2 percents OR 2 fractions (per woman), and convert them to the opposite.

Women in the Automobile Industry Performance Task

You're going on a road trip! You will drive a distance of your choice. You will compare your trip to Alice Ramsey's trip using ratios and rates. Include sources!

Explain your trip using the guidelines below. Then, mention at least 2 aspects of your trip that you are able to do because of a woman in the automobile industry

Determine/Explain:

- Specific beginning and ending points of your trip
- Type of car being driven and miles per gallon of the car
- Total miles of the trip
- How many hours/days you drove for the entire trip

Compare to Alice Ramsey's trip using ratios:

- Total driving distance
- Total hours driven

Using the information, determine the following rates:

- Money spent per day
- Miles driven per day

WOMEN IN THE AUTOMOBILE INDUSTRY LESSON 1: Ratios

Essential Question: How can we represent a relationship between men and women in the automobile industry?

Objectives: SWBAT:

- Define the term ratio
- Write ratios
- Describe the relationship between men and women in the automobile industry using ratios

Standards:

CC.2.1.6.D.1: Understand ratio concepts and use ratio reasoning to solve problems

Activating Strategy: Using Ratios to Preview Ratios

Distribute worksheets to students that will be used during the lesson. At the top corner of each worksheet, there will be a picture of either a man or a woman (about 21.5% of the worksheets should have women). Students will get into 2 groups, corresponding to the worksheets' pictures. Students will compare how many worksheets had women and how many worksheets had men, and will write it down on their paper.
Students will then get into groups of approximately 5 (4 students with a man on the worksheet and 1 student with a woman on the worksheet). They will then compare how many worksheets had women and how many worksheets had men, and will write it down on their paper.

Teaching Strategies:

The teacher will explain that the comparison of numbers is a ratio representing the number of men and women employees in the automobile industry. The students will write the definition of ratio on their worksheet, which will be projected at the front of the room.
The remainder of the worksheet will be completed within groups and/or individually.

Summarizing Strategy: Review to Preview

Students will answer the questions, "Is there a relationship between the number of men and women in the automobile industry? If so, how would you describe it?" using the information they learned in the lesson. These answers, which will be turned in on index cards, will be used for the next class.

Differentiation:

- Work can be done individually and in groups
- Ratios will be observed using physical representations (using the students)

Assessment/Assignment:

- Informal, formative assessment- Assess students throughout the lesson as they complete the worksheet
- Review what students wrote on their index cards
- Assignment: Create a list of 5 ratios

Materials Needed:

- In-class worksheet
- Index cards

Name_____

WOMEN IN THE AUTOMOBILE INDUSTRY
RATIOS

In your class:

Students with men in the corner: _____ Students with women in the corner: _____

In your group:

Students with men in the corner: _____ Students with women in the corner: _____

What do these numbers represent? _____

_____

Ratio: _____

Examples: _____

_____

Practice Problems

1. In 2010, 1/5 of the automotive industry in Europe was comprised of women. What is the ratio of women to men?

2. What do you think the ratio of men to women drivers is? Explain.

3. The ratio of women to men laborers in the automobile industry is 28:72. If there are 84 women laborers, how many men are there?

4. In 2010, there were 105.7 million women drivers, out of the 210 million drivers. Write a ratio of women to men drivers.

WOMEN IN THE AUTOMOBILE INDUSTRY
RATIOS

In your class:

Students with men in the corner: _____ Students with women in the corner: _____

In your group:

Students with men in the corner: _____ Students with women in the corner: _____

What do these numbers represent? _____

_____

Ratio: _____

Examples: _____

_____

Practice Problems

5. In 2010, 1/5 of the automotive industry in Europe was comprised of women. What is the ratio of women to men?

6. What do you think the ratio of men to women drivers is? Explain.

7. The ratio of women to men laborers in the automobile industry is 28:72. If there are 84 women laborers, how many men are there?

8. In 2010, there were 105.7 million women drivers, out of the 210 million drivers. Write a ratio of women to men drivers.

WOMEN IN THE AUTOMOBILE INDUSTRY LESSON 2: Equivalent Ratios and Ratio Tables

Essential Question: How can we find equivalent ratios using ratio tables?

Objectives: SWBAT:

- Define ratio table and equivalent ratios
- Determine whether or not two ratios are equivalent
- Find equivalent ratios using ratio tables

Standards:

M06.A-R.1.1: Represent and/or solve real world and mathematical problems using rates, ratios, and/or percents

M06.A-R.1.1.3: Construct tables of equivalent ratios relating quantities with whole-number measurements, and find missing values in the tables. Use tables to compare ratios.

Activating Strategy: Index Card Review

Repeat the question asked during the summarizing strategy from the previous lesson ("Is there a relationship between the number of men and women in the automobile industry? If so, how would you describe it?"). Read some of the answers from the index cards submitted by students, and write them on the board. Have a 5-minute discussion with students about the answers and ratios.

Teaching Strategies: "I Do, We Do, You Do" with Worksheet/Notes

"I Do": Give students the definition of ratio table and one example for their notes.
"We Do": Work on one ratio table to determine equivalent ratios as an entire class (on same note sheet)
"You Do": Students will determine on their own if two ratios are equivalent or not, and they will complete ratio tables. The questions will be posted around the room for students to travel to. On the note sheet, they must write the question and the answer.

Summarizing Strategy:

Students will use the two ratios determined from the previous class (ratio of men to women in the automobile industry) and fill them in a ratio table. They will then determine whether the ratios are equivalent. There will be space on the notes for this.

Differentiation:

- Students will be able to learn and practice the information while guided by the teacher as well as individually and with small groups.
- Stations around the room allow for movement.
- The activating and summarizing strategies involve original students' work and questions.

Assessment/Assignment:

- Informal, formative: Give feedback to any students about the index cards from the previous lesson's summarizing strategy. Assess students as they complete practice problems during class.
- Assignment: Finish problems from class (may have to give students these questions)

Materials Needed:

- Student-submitted index cards from the previous lesson
- Note sheet
- Four problems for students to complete, stationed around the room

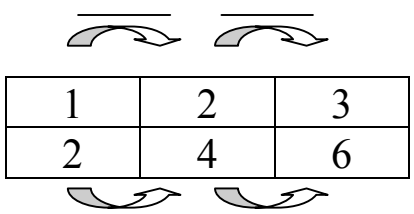
Name _____

RATIO TABLES

Equivalent Ratios: _____

Ratio Table: _____

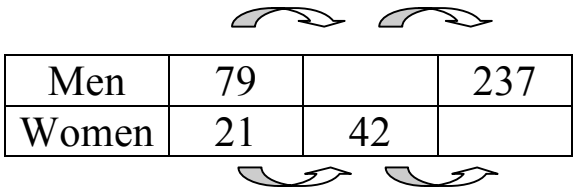
Example:



1	2	3
2	4	6

Equivalent ratios are ___:___, ___:___, and ___:___

Ratio of men to women in the automobile industry:



Men	79		237
Women	21	42	

Equivalent ratios are 79:21, ___:42, and 237:___

Are the ratios 1:2 and 2:3 equivalent?

Name _____

STATION WORK

1. Question:
Answer:
2. Question:
Answer:
3. Question:
Answer:
4. Question:
Answer:

STATION 1

In 2010, the ratio of men to women workers in the automotive industry in Europe was 4:1. If in 2020 the ratio is 9:3, are the ratios equivalent? Prove/support your response.

STATION 2

The ratio of women on the BMW and GM car design teams is

30:20.

Write 2 equivalent ratios.

STATION 3

In 2010, 105.7 million women and 104.3 million men had licenses.

If we say1 million women have licenses, how many men would have to have a license in order to make an equivalent ratio?

STATION 4

The ratio of men to women technicians in the automotive industry

is 87:13.

The ratio of men to women office/clerical workers in the industry

is 43:57.

Are these two ratios equivalent?

WOMEN IN THE AUTOMOBILE INDUSTRY LESSON 3: Rates

Essential Question: How can we write rates and unit rates to describe aspects of the automobile industry?

Objectives: SWBAT:

- Define the terms rate, unit rate, and equivalent rates
- Write rates as unit rates
- Solve real-life problems using rates
- Name the first woman to drive across America and her impact on the automobile industry.

Standards:

M06.A-R.1.1.2: Find the unit rate a/b associated with a ratio a:b (with $b \neq 0$) and use rate language in the context of a ratio relationship. Example 1: "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." Example 2: "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

M06.A-R.1.1.4: Solve unit rate problems including those involving unit pricing and constant speed.

Activating Strategy: Think-Pair-Share

Project a picture of a speed limit sign on the board and have students write a sentence or two describing what it means. Students will share their ideas with a partner, and then with the class.

Teaching Strategies: Rates Mini-Lesson and Benchmark Work

On notesheet, students will be given the definitions needed for class (rate, unit rate, equivalent rates) and will complete practice problems as a class, in small groups, and individually.

Following this, students will be given a benchmark to be started during class and completed for homework. They will research Alice Ramsey's trip across America and describe her trip and the impact it had on the automobile industry. While researching, they must determine 3 ratios and 3 rates that are included in her trip.

Summarizing Strategy: Exit Ticket

Students will be given an exit ticket where they will be presented with a rate from Alice Ramsey's trip across America and asked to write it as a unit rate. They must explain how they found their answer.

Differentiation:

- Students will relate math to their everyday lives using speed limit signs.
- Students may work individually as well as with groups for the activating strategy and mini lesson.
- The description of Alice Ramsey's trip for the benchmark assignment may be completed in numerous ways: one to two page paper, brochure, Power Point presentation, interview, etc.

Assessment/Assignment:

- Informal, formative: Give feedback to any students about the index cards from the previous lesson's summarizing strategy. Assess students as they complete practice problems during class.
- Assignment: Finish benchmark (formal, summative assessment)

Materials Needed:

- Speed limit sign picture to project on board
- Mini Lesson notesheet
- Benchmark instructions
- Laptops, ipads, or other technology to research
- Exit ticket

Name _____

RATES in the Automobile Industry Notes

Rate:
Examples:
Unit Rate:
Examples:
Equivalent Rates:
Examples:

*How are rates like ratios?*_____

_____

Name _____

Practice Problems

1. In 1922 Henry Ford opened a factory with an all-women workforce to do assembly and welding work. They were paid the same as men: $8 a day. Is this a unit rate?

2. Write two equivalent rates of the rate given in problem 1.

3. In 1995, 87.4 million women had licenses. In 2010, 105.7 million women has licenses. Write a rate describing the increase in licenses over these years.

4. The speed limit on a road is 55 miles per hour. How far does Hannah drive in 2 ½ hours if she follows this speed limit?

EXIT TICKET

During part of her trip across America, Alice Ramsey drove 360 miles in 13 days. Write this as a unit rate in the form mi/day.

EXIT TICKET

During part of her trip across America, Alice Ramsey drove 360 miles in 13 days. Write this as a unit rate in the form mi/day.

WOMEN IN THE AUTOMOBILE INDUSTRY LESSON 4: Comparing Ratios

Essential Question: How can we compare two ratios representing women in the automobile industry?

Objectives: SWBAT:

- Compare ratios and use tables to compare ratios
- State the approximate distribution of women within each department of the automobile industry.

Standards:

M06.A-R.1.1.3: Construct tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and/or plot the pairs of values on the coordinate plane. Use tables to compare ratios.

Activating Strategy: Think Pair Share

The following will be projected at the front of the room:

"In 2013, the ratio of women to men employees in *automotive body and related repairs* was 1.5:98.5. The ratio of men to women in the *automotive service technicians and mechanics* department was 1.8:98.2. Which department do you think had more women workers? Why?"

Students will have time individually and with partners to discuss. Ideas will be shared with the class.

Teaching Strategies: Mini-Lesson and Group Work

Worksheets will be distributed to students, which will be used throughout the lesson. As a class, notes and a practice comparison will be completed. It will also be shown to solve for the answer from the Think Pair Share activity. The teacher will work on the same worksheet as the students for this.

After the practice problems, students get into small groups (chosen by the teacher) and work on more practice problems. These problems will be on the same notesheet.

Summarizing Strategy: Post-It Note

On post-it notes, students will respond to the question, "What are your thoughts about comparing ratios?" They will stick their responses on the board before leaving class.

Differentiation:

- Think Pair Share includes individual and group interactions
- Group work allows for interaction with others
- Teacher ma y group students homogenously or heterogeneously by skill level (possibly determined from activating strategy)
- Post-its allow students to express what they do/do not understand

Assessment/Assignment:

- Informal, formative assessment- Assess students throughout the lesson as they complete the problems
- Activating strategy can be used as an informal pre-test
- Use students' post-it notes to determine if further instruction is necessary
- Assignment: Finish practice problems from in-class worksheet

Materials Needed:

- In-class/homework worksheet
- Post-it notes

Name _____

COMPARING WOMEN DISTRIBUTION IN THE AUTOMOBILE INDUSTRY

How Do we Compare Ratios?

Ratio 1		
Women	3	1
Men	6	

Ratio 2		
Women	2	1
Men	8	

Which is larger? _____

In 2013, the ratio of women to men employees in *automotive body and related repairs* was **1.5 : 98.5**. The ratio of men to women in the *automotive service technicians and mechanics* department was **1.8 : 98.2**. Which department had more women workers?

Body and Related Repairs		
Women	1.5	
Men	98.5	

Service Technicians and Mechanics		
Women	1.8	
Men	98.2	

Which department had more women workers? _____

Name _____

Practice Problems

Directions: The following (approximate) ratios of women to men in different departments of the automobile industry are listed below. Determine which department contains more women, using ratio tables.

1. Executive/Senior Level Officials & Managers ..... **11 : 55**
   First/Mid Level Officials & Managers ..... **9 : 42**

Women		
Men		

Women		
Men		

2. Professionals ..... **12 : 38**
   Craft Workers ..... **4.6 : 95.4**

Women		
Men		

Women		
Men		

3. Technicians ..... **13.4 : 86.6**
   Sales Workers ..... **40.2 : 259.8**

Women		
Men		

Women		
Men		

Name _____

4. Office Workers ..... **28 : 22**
   Service Workers ..... **10 : 90**

Women		
Men		

Women		
Men		

5. The ratio of men to women on the global design staff for BMW is **30 : 70**. The ratio of men to women on the global design staff for GM is **15 : 45.** Which brand has more women on the design staff?

Women		
Men		

Women		
Men		

WOMEN IN THE AUTOMOBILE INDUSTRY LESSON 5: Percents

Essential Question: How can we convert between percents and fractions?

Objectives: SWBAT:

- Define percent
- Write percents as fractions
- Write fractions as percents

Standards:

M06.A-R.1.1.5: Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percentage.

Activating Strategy: Where Have You Seen It?

Write the word "percent" on the board. Students will write where they have seen percents before (ex. Test scores, sales and sales tax, etc)

Teaching Strategies: Graphic Organizer/ Paper Foldable (Part 1) and Benchmark Work

A foldable will be made from copy paper, with different sides explaining different conversions. Students will fold paper in half, hamburger style. On one side, one half will be designated for converting fractions to percents, and the other half will be designated for converting percents to fractions.
Each half will include steps and examples. The other side will be used for the next lesson.

Following this, students will begin working on their second benchmark. They will research significant women in the automobile industry. They will choose 3 women, find one ratio that pertains to each woman, and compare them., finally find 2 percents OR 2 fractions (per woman), and convert them to the opposite.

Summarizing Strategy: In Your Opinion

Students will be asked "Which do you think is easier: converting fractions to percents, or converting percents to fractions? Explain your answer." Students may answer by raising their hands, anonymously by submitting answers, or another way chosen by the teacher.

Differentiation:

- Activating strategy connects the upcoming lesson to what students have seen in their own lives.
- Graphic organizer is beneficial for visual and kinesthetic learners.
- Technology is used for benchmark work.
- The benchmark assignment may be completed in numerous ways: one to two page paper, brochure, Power Point presentation, interview, etc.

Assessment/Assignment:

- Informal, formative assessment- Assess students throughout the lesson as they complete the worksheet.
- Summarizing strategy allows the teacher to decide if further instruction is needed on either conversion.
- Formal, summative assessment: Student benchmark
- Assignment: Finish benchmark

Materials Needed:

- Copy paper for students to make graphic organizers
- Laptops, iPads, or other technology to research
- Benchmark Instructions

WOMEN IN THE AUTOMOBILE INDUSTRY LESSON 6: Percent Problems

Essential Question: How can we find the percent of a number and use percents to describe women's contributions to the automobile industry?

Objectives: SWBAT:

- Find percents of numbers
- Find the whole given the part and percent
- List important women who contributed to the automobile industry, as well as their contributions.

Standards:

M06.A-R.1.1.5: Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percentage.

Activating Strategy: Discussion

Present students with the statement, "40% of the 75 million NASCAR fans are women."
Have a discussion on this percentage and how to find out how many NASCAR fans are actually women (.4*75M).

Teaching Strategies: Graphic Organizer/ Paper Foldable (Part 2)

Using the foldable from the last class, students will use the side of the paper that was not written on. On the unused side, one half will be designated for finding percents of numbers (i.e. What is 25% of 200?), and the other half will be designated for finding the whole given the part and percent (i.e. 15 is 30% of what number?). Each half will include steps and examples.

Practice

A practice worksheet will be distributed. The problems will include finding percents of numbers, finding the whole given the part and percent, and word problems.

Summarizing Strategy: Summary Sentence

Students will write one sentence that best summarizes what they consider to be the most important information from the lesson (or unit).

Differentiation:

- Discussion allows for student interaction
- Graphic organizer is beneficial for visual and kinesthetic learners.
- There is much room and flexibility for student choice in the performance task.

Assessment/Assignment:

- Informal, formative assessment- Assess students throughout the lesson as they complete the worksheet.
- Summary sentence allows last minute data to be taken on what the students have learned during the unit.
- Assignment: Performance Task (due date determined by teacher)

Materials Needed:

- Foldable from previous class
- Practice Worksheet
- Performance Task

Name _____

PERCENT PROBLEMS

What Contributions Have Women Made in the Automobile Industry?

1. Mary Anderson invented the windshield wipers in the early 1900s. If 15 out of 20 cars have windshield wipers, what percentage of cars have windshield wipers?

2. Grace Lieblein, the VP of global purchasing and supply chain of General Motors, oversees 6,700 employees. What is 70% of the 6,700 employees she oversees?

3. Danica Patrick is the first woman to win the pole position at the Daytona 500. If she wins 4 of the 10 races she competes in, what is her win percentage?

4. Julie Hamp helps Toyota maintain its title as the world's largest automaker. If you want to buy a Toyota car for $20,000 that is 15% off, how much do you pay?

Answers

13	**17,000**
1,900	**45**
75	**40**
450	**4,690**

5. What is 50% of Alice Ramsey's 3,800 mile trip across America?

6. At Chrysler, Chris Barman was in charge of the team that designed the Dodge Dart. How big is your gas tank if you have used 75% of your gas and have 3.25 gallons left?

Name _____

7. What is 15% of 300?

8. 126 is 28% of what number?