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2007 Volume VI: Keeping the Meaning in Mathematics: The Craft of Word Problems

The Art of Solving Word Problems by Using Proportions

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Objective

The unit that I have written is based on developing and using word problems in the classroom to satisfy an important objective in the North Carolina curriculum. I teach seventh grade mathematics in an urban district, Charlotte Mecklenburg Schools. The district itself is large and within the district there are 32 middle schools. The school where I teach, Carmel Middle School, has a culturally diverse population that is around 60 percent white, 40 percent minority: African-American, Asian, and Hispanic. There are a few obstacles that I would like to overcome with the students to make them successful.

There are three levels of math classes in my school district. Standard math is for students that are at or below grade level. Standard plus is for students that are on grade level. Honors is the third level. Students in this class are above grade level. Within the seventh grade, I teach a couple of different levels of students varying from ones that are below grade level to others that are well above grade level. Also, within each class, there is an academically assorted group of students. This is the first challenge or obstacle. The second challenge deals with reaching individuals in a culturally diverse group of students. Using several different types of word problems varying in difficulty and subject matter to successfully teach my students an important topic is my main goal for this unit.

In mathematics, it seems that the most difficult skill for students to grasp is solving word problems. This is noticeable in any age group. The students may be able to perform basic math tasks such as multiplying or dividing, but if that same skill is surrounded by excess words, it really confuses most students. To solve my own math problem I will begin by introducing the students to word problems that are fairly simple to make the students feel successful so they will be comfortable dealing with the more difficult ones. In doing this, I hope it will build confidence in each of the students so they are not intimidated when looking at word problems. They will be more confident when given the challenge of a difficult word problem.

One of the largest objectives in the seventh grade math curriculum in the state of North Carolina is one that deals with ratios, rates and proportions. Within the state standards, there are several indicators that involve using proportions to solve a problem. Along with solving proportions, students also need to be able to evaluate problems that deal with scaling, similar figures, unit rates and percent proportions. Students tend to be at ease solving a proportion that is already set up just by using the method of cross-multiplying. It is more difficult to set it up on their own when reading a word problem because of the units. They tend to set them up incorrectly because they choose the numbers in the order that they appear in the word problem and do not focus on the units that are attached to the numbers themselves. This occurs with the majority of the students that I teach, regardless of their academic level. Setting up proportions is a difficult and sometimes confusing process that my unit will be able to address and help students to become more successful.

I have put together a large selection of problems based on the objective. I have taken the problems and split them into groups based on different topics within the goal. From there, the problems are broken down into different categories. The different groups or categories are word problems that include unit rates, similar figures and scale drawings/models, along with percent proportions. All of the word problems that I have put together can be solved by setting up proportions. Students need an understanding of preparing a proportion because it is a skill that will help them in school and throughout their lives. As adults, there are many different problems solved on a daily basis using proportions such as reading maps, figuring out tips to leave at a restaurant and also determining a sale price on an item. Students who are successful in setting up proportions will be able to use that skill in many ways and situations.

I hope this unit will be beneficial to teachers at different levels. It is based on the standards for students in seventh grade math, but it is not limited to just that grade or subject. Proportions are used throughout middle school and high school. For example, in science, proportions are used in converting measurements, and in social studies, scales are used to read maps. The difficulty of the sample problems themselves, (see Appendix A), can be modified to meet the needs of other subject areas or grade levels.

Strategies

Within the different groups of word problems based on using proportions to solve, there are several different types of situations or categories of problems. There are problems with different difficulty levels and varying subjects. Because the students that I teach have a wide variety of needs, it is important to focus on the main weakness that all of the students tend to have: difficulty setting up proportions to solve word problems. This unit focuses on helping the student to work through several types of problems and correctly put them into proportions. The problems will be used to help the students develop an understanding of the goal of setting up proportions. The different subjects or situations in the word problems to make it possible to better relate to a diverse group of students. There are word problems that represent all different types of proportion problems.

The students will be taught exactly how a proportion problem is set up by using the units in the problem. Before that can be done, there will be a discussion about what the problem itself means. For example, let's say Joey went out of town to visit his grandma, which was a 120-mile journey. He traveled at the same speed for the whole trip. If it took him 2 hours to get there, what was his speed in miles per hour? There would need to be a discussion with the class about the problem itself. I would discuss with them what it means. If it took Joey two hours to get there, and he is traveling at the same rate, what kind of conclusions can we draw from that? Well, we could talk about if we figure out how far he goes in one hour, and then all we would have to do is multiply it by two to get what it would be for two hours.

After having the discussion about what the actual problem is asking, I will then lead the students to write a proportion. Writing a proportion allows a person to correctly solve a problem. The students will need to understand that the problem itself is discussing two different units; hours and miles. I would write that as a ratio, miles/hours. The ratio would be set up in front of the actual proportion so that the students could see where to place the *miles* and where to place the *hours.* The following proportion would need to be set up along with the ratio of units in the front:

miles/hours —> 120 miles/ 2 hrs = x miles/ 1 hr

There would then be a discussion about why it should be set up in that fashion. It is like an analogy; 120 miles is to 2 hours in the same way that *x* miles is to 1 hour. For the equation to make sense, both sides have to have the same units. The same units have to be on the top of the ratios, which is miles in this case, and the same units need to be on the bottom of the ratios, which is hours in this case. Having the students focus on where the units go is the main key. They should always label the numbers that they place in a proportion form so that they can check the units to be sure it is set up correctly. In this case it is *miles* on top and *hours* on the bottom. Some students may want to know while miles are on the top and hours are on the bottom. It is crucial for them to understand that it does not matter as long as the units are the same in the numerator and the units are the same in the denominator. That is, for the equation to make sense, both sides have to have the same units. I would show students that the answer would turn out the same if the units in the proportion above were flipped from numerator to denominator. As a class, we would discuss the similarities of the two proportions. The two ratios that make up a proportion are essentially unit rates, which I will go into more clearly below.

Unit rates

Unit rates are the basis of all proportion problems. Beginning with this topic allows the students to not only get an understanding of ratios and proportions, but they begin to see the importance of both units and unit rates. Students must have an understanding of unit rates for several reasons. First, they need to understand what a unit rate actually is. It is, for example how many miles a vehicle travels in *one* hour or how much it costs for *one* ounce of cereal, etc. The following set of problems will be used to introduce this topic. The proportions below each of the problems are the correct way to set them up.

A. Traveling cross-country, the Beeper family rode 510 miles in 8.5 hours. At this rate, how many miles did the Beepers drive per hour?

miles/hours —> 510 miles/ 8.5 hrs = x miles/ 1hr

B. Traveling cross-country, the Beeper family went an average of 60 miles per hour. If they traveled for 8.5 hours, how many total miles did they travel?

miles/hours —> x miles/ 8.5 hrs = 60 miles/1 hr

C. Traveling cross-country, the Beeper family went 510 miles at a speed of 60 miles per hour. How many hours did it take them?

miles/hours —> 510 miles/ x hrs = 60 miles/1 hr

The previous problems are all discussing the same situation. The only difference is in each problem a different variable needs to be solved for. Each of the problems are asking the students to look at the amount of miles driven, the amount of hours driven and the speed in miles per hour. Using these three different problems allows students to see the same type of problem could be set up several ways depending on the missing variable. The students will be able to see that in each of the proportions miles are on the top of the two ratios and hours are on the bottom of the ratios. The right side of the proportion represents the unit rate because the Beeper family drove 60 miles in *one* hour. I specifically chose a word problem that deals with miles per hour for a reason. My students never seem to understand that finding out how many miles per hour a car travels is a unit rate. Unit rates are individual rates of items. For example, if a problem states that a person is driving a certain distance and it takes them a given amount of time to get to a destination, finding the miles per hour would be the unit rate. I always need to stress with them that it is so many miles per *one* hour. The problems above are ones that I would do with my students. I would then give them problems to work on either individually or in pairs to ensure they can do it on their own. I would take these problems from the appendix. (See Appendix A, numbers 1-13 for additional sample problems based on unit rates.)

The first category that I dealt with was separating proportion problems into three different groups: unit rates, similar figures/scale drawings, and percents. Above I described how I would introduce unit rates to my students. Within unit rates, I determined another group. I constructed problems pertaining to the same topic, but with a different variable left out each time. This will give the students a variety of different ways to see the problems and also ways to set them up given different information. Again, one of the more difficult topics for students is to set up proportions correctly from word problems. This gives them practice in doing it several different ways.

Percents

Another category that I will introduce focuses on percents. Proportions that are set up with percents slightly differ from unit rates. Percents are used in students' lives every day. They see percents on their tests or report cards in the form of a grade. They go shopping and see discounts in stores that are a certain percentage off of the original price. The students will work with word problems that involve percents to set up proportions. Percent proportions are always set up the same way; with one of the ratios being a percent over 100. This is something that I stress to my students. The other ratio in the proportion needs to be set up in a certain way. The students need to look at it two different ways, depending on the type of problem they are working on as either *is/of* or *part/whole*. For example: There were eight equal pieces of pizza and Bobby ate two. What percent of the pizza did Bobby eat? As a class we would discuss the contents of the problem and figure out its meaning. If he ate 2 pieces out of the total 8 pieces, that would be one-fourth of the pizza. If we thought of one-fourth as a percent the answer would then be 25%. After understanding the problem, we would as a class come up with a way to set up a proportion. First, we need to identify what it is that is known in the problem. I see that Bobby ate 2 pieces out of the total 8 pieces of pizza. In this case it needs to be set up as a ratio in the form, *part/whole*. Focusing on the pizza as a *whole* broken into *parts*, I would set up the following proportion:

3 pieces (part) / 8 pieces (whole) = x % / 100

The proportion above is set up in so that the percent is the unknown. In the problem itself, it specifically asks what *percent* of pizza Bobby ate. Using the previous problem as a standard for solving other percent problems, the following examples would be given to the class.

D. There are 206 bones in the human body. There are 33 bones in the spinal column. To the nearest whole percent, what percent of your bones are in your spine?

33 bones (part) / 206 bones (whole) = x % / 100

E. There are 206 bones in the human body. About 16% of them are in the spinal column. About how many bones are in the spinal column?

x bones (part) / 206 bones (whole) = 16% / 100

F. About 16% of the total number of bones in your body are in you spinal column. If there are about 33 bones in the spinal column, about how many total bones are in the human body?

33 bones (part) / x bones (whole) = 16% / 100

The problems above are proportions that are set up with percents. All of the problems are similar in subject matter; they just differ with the variable that is missing. (To see more examples, see Appendix A, numbers 14 - 18.) Within this dimension of percent proportions, I have further broken the problems down. Above, I began by working with ones that were fairly simple, one-step problems that just had a different variable that was missing in each one. I will also vary the problems by making the problems a little more difficult by using complimentary percents and multi-step problems. Complimentary percents are a different type of percent problem. The question in the word problem is formed in such a way that it takes more than solving the proportion to complete the problem. There may be more steps included. For example, Amy went shopping and found a shirt that was on sale for 50% off. How much would the shirt be after the discount if the original price was $26? In this problem, the student is not just looking for the answer to the proportion; they need to take it to a higher level. If the students have the answer to the proportion, that would only tell me what the discount would be. In order to get the correct answer, the student would have to take the answer from solving the percent and subtract it from the original cost. That would then give the discounted price of the shirt. The following are examples of complimentary percents and/or multi-step percent problems.

G. Bob has a coupon for 15% off the price of any item in a sporting goods store. He wants to buy a pair of sneakers that are priced at $36.99. About how much will the sneakers cost after the discount?

x / $ 36.99 = 15% / 100 —> *x* = $5.55 —> $36.99 - $5.55 = $31.44

H. Lisa went to an electronics store that was going out of business. The sign on the door read "All items on sale for 60% off of the ticketed price." A computer has a price of $649, and a printer has a price of $199 and she needed both items. What was the total cost of the items after the discount?

$199 + $649 = $848 —> x / $ 848 = 60% / 100 —> $848 - $508.80 = $339.20

I. Between 1924 and 1998, the United States won a total of 161 medals in the Winter Olympic Games. If the United States won 59 silver and 42 bronze medals, about what percent of its medals were gold medals?

59 + 42 = 101 —> 161 - 101 = 60 —> 60 gold / 161 total = x% / 100 —> *x* â‰ˆ 37%

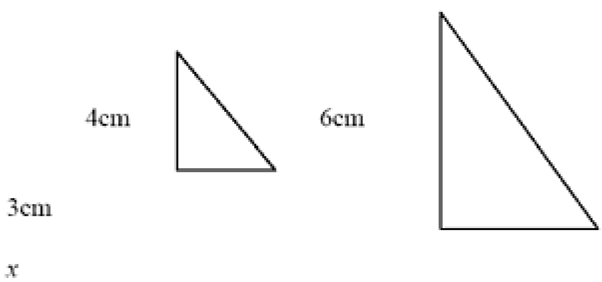
Similar Figures and Scale Models/Drawings

The third main category that my problems are broken into is based around similar figures and scale drawings/models. This group works with setting up proportions in the way that the students learned with unit rates. It is important for students to understand the reasoning for keeping the same variables in the numerators, for example miles, as well as the same variables in the denominators, for example hours. The students will need to be sure to set up a ratio in the beginning labeling what goes on top and what goes on the bottom. They will also need to label all units on every number that they write into the proportions.

Similar figures and scale drawings/models are used in math and other subjects very regularly. In social studies, for example, students are given maps of different countries and cities around the world. The students need to be able to read the maps in order to understand them. Proportions give students an understanding of what a *scale* actually is. Scales are based on a scale factor. A shape may be stretched in every direction by a certain number or scale factor, which then makes the shape similar to the original. If I am trying to figure out how long it will take me to get somewhere, I use the scale to estimate the amount of time.

Similar figures are used regularly also. Whether it is enlarging or shrinking a picture or drawing blue prints for a new house, proportions are essential to figuring out the ratios. Similar figures are related by a scale change. If you know a length in one figure and the corresponding length in the other, their ratio is the scale figure. This factor then tells you the ratio of any pair of corresponding lengths in the two figures. The equality of the ratios of pairs of corresponding lengths gives a proportion.

The first step in solving the problems is to first draw a sketch. When dealing with similar figures or scale drawings/models, the problem for students is usually introducing two different figures. In order for students to see the correct way to set up a proportion, they need to be able to identify the corresponding sides. Corresponding sides of two shapes are ones that directly relate to each other. For example, if there are two similar triangles given, such as the ones below, identifying the sides that correspond to each other is key. The students would have to identify that the side that is marked 4cm on the first triangle corresponds to the side that is marked 6cm on the larger triangle.

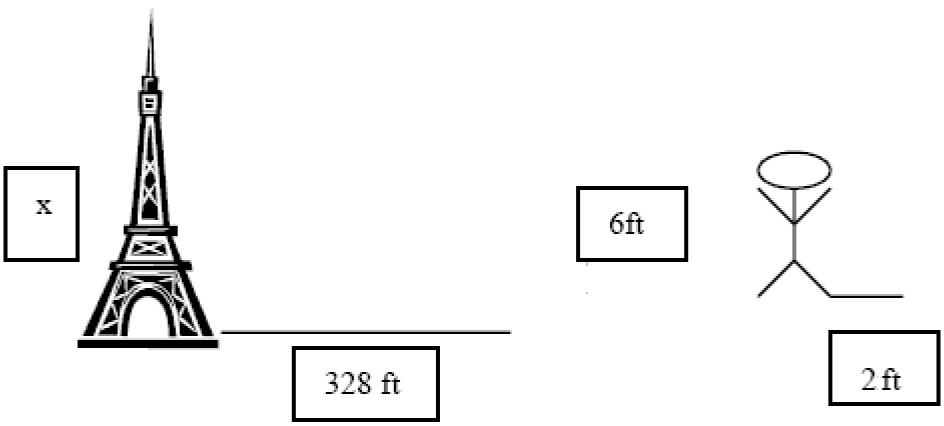


Looking at the two similar triangles there are a few observations that the students need to make and understand. First of all, the two triangles are the same shape but different sizes. That is what actually defines similar figures. Secondly, each side in the small triangle has a corresponding side in the larger triangle. With that information, a proportion can be set up. The ratio of any corresponding sides gives the scale factor. Therefore, the ratios between two pairs of corresponding sides are equal- they form a proportion. The base of the small triangle corresponds to the base of the large triangle and the height of the small triangle corresponds to the height of the large triangle. Therefore, the following proportion could be set up:

4 cm / 6 cm = 3 cm / x

Once the proportion itself is set up, the students should have no problem solving it. Within this category, I have broken the problems into several groups. There will be problems that deal with switching around the same variable in a given situation. For example if problem J below, you could be given the height of the Eiffel tower and not the height of the person. Once a student has an understanding of setting up proportions, it will be easier for them to switch variables around depending on what is given in the problem. Also, there will be problems that will be made more difficult through the use of fractions and decimals. In each of the problems the students will be expected to draw a picture in order to visually see the sides that correspond with each other. The proportion will then be set up based on the similar figures. The following are examples of either similar figure or scale drawing/model problems.

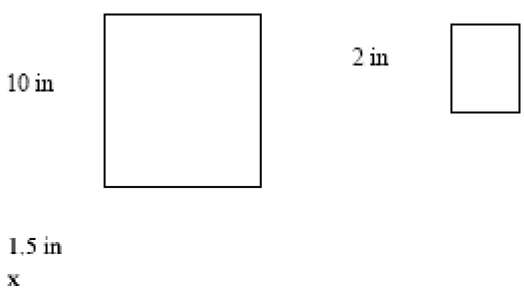
J. On a sunny day, the Eiffel Tower casts a shadow that is 328 feet long. A 6-foot-tall person standing next to the tower casts a 2-foot-long shadow. How tall is the Eiffel Tower?



The following proportion would be set up to solve the missing height of the Eiffel Tower:

328 ft / 2 feet = x ft / 6 ft —> x = 984

K. Rachelle's school photo package includes one large photo and several smaller photos. The large photo is similar to the small photo. The small photo is 2 inches long and 1.5 inches wide. If the height of the large photo is 10 inches, what is the width?



The following proportion would be set up to solve the problem:

10 in / 2 in = x in / 1.5 in —> x = 7.5

The two problems above show the exact process of how students would solve this type of problem. They would first have to sketch a drawing of the problem itself and label the lengths that they know. From there, the proportion could be set up. (See Appendix A, numbers 19 - 25 for additional problems.)

Solving proportions is a broad topic. With this unit, I have been able to analyze the types of problems and separate them into different groups in order to categorize them. The unit itself will allow students to have a much clearer picture of how to set up proportions from word problems. Having the students focus on all of the different dimensions will enable them to successfully solve proportion word problems.

Classroom Activities

Before I begin the lessons with the students, there are a few prerequisites that I would be sure to cover to be confident that my students understand the topics. Defining a proportion as two ratios set equal to each other would be the first idea that I go over with them. Also, I would be sure that my students know how to cross multiply to solve a proportion. Some of this would have been covered earlier in the year or the previous year for most of my students. I would spend some time reviewing and making sure that they felt comfortable with the topics.

Prior to the first lesson, the students will be introduced to what a unit rate is. They will be able to correctly set them up and solve them focusing on the units that are attached with the numbers as I have explained in my strategies above.

Lesson 1

Objective

Students will be able to set up and solve proportions. They will also be able to solve word problems based on unit rates.

Warm-up

"Your mom needs to go to the grocery store and she asks you to go shopping with her. When you get to the store, you really want cereal but you are having trouble figuring out what kind to get, you cannot decide between the Fruity O's and the Circles of Fruit. Your mom told you that you need to get the cheapest cereal per ounce. The problem is the boxes are 12 and 16 ounces. Describe, without using numbers, how you would figure out what cereal was cheaper per ounce."

Procedure

To be sure students had a strong understanding of unit rates; I would do an activity with them based on the warm-up. There would be eight to ten stations set up with different products found in a grocery store such as paper towels, cereal, canned soups, toilet paper, etc.

Each station would have two similar products such as a 12 ounce box of name brand cereal and a 20 ounce box of generic brand cereal. I would give the students the price of each of the boxes of cereal. The students would then work in groups to see which one was the better buy. They would essentially have to find the unit rate of each of the different products and then compare the two. The students would rotate around to each of the stations comparing all of the items and identifying unit rates. Once completed, we would have a class discussion about the importance of the activity. The following questions could be asked:

How can this be used in somebody's every day life?

Can you explain in your own words the importance of finding unit rates?

Does this activity change the way that you think about grocery shopping? If so, in what ways has it changed the way you think? (There would be a discussion on different methods of finding unit rates by not setting up proportions.)

When the class discussion is completed the students would work with a partner on an in-class project. The students would need to take the information they have from the previous activity and begin constructing word problems. The students will have to prepare them in different ways using the data that they collected and a scenario to go along with it. Each pair of students would create five word problems on their own.

Assessment

For homework that night, the students would have to take their word problems home and teach their parents how to solve them. They will need to take them through the steps of how to set up and solve each proportion. The parent would then need to write a note stating that their child taught them how to solve problems involving unit rates. This will start up a good discussion with students and their parents because more than likely, their parents figure out the "better buy" or unit rate regularly.

Lesson 2

Prior to Lesson 2, the students would go through the strategies with me for setting up and solving percent proportions as listed in the strategies portion of my unit. We would use the problems in the text itself and also use sample problems from the Appendix. By the time the lesson is taught, the students would understand how to correctly set up a percent proportion to solve.

Objective

Students will be able to solve word problems by setting up and solving percent proportions.

Warm-up

"Describe where and how percents are used in our lives everyday. Be sure to include at least three examples, and then explain the importance of them."

Procedure

There would be a discussion of the warm-up focusing on where percents are used in our daily lives. I would be sure to focus on topics such as discounts when shopping, leaving a tip at a restaurant and tax on purchases.

The students would be given menus from an area restaurant. I find it easier to laminate them so that they will last longer than just paper menus. The students then are put into groups at different 'tables' as if they are coming to the restaurant for dinner. There will be one server for each table of guests. The students will order meals, including a drink and dessert. They will then have to figure out the price of their own meal with a given tax and tip percent. I will change the tax rate and tip amount each time. The server will then be the one that figures out the price for everyone at the table. The guests and server will share and discuss their answers.

The students will then have to take the menus and make three word problems based on the menu. Each individual student will write these based on the prices but using percents such as; how much is a certain entrée with a coupon for 15% off? There would be a discussion about as a customer, the tip is based on the original price, not the discounted price.

Assessment

The students would then trade with each other and answer the problems. They would then give the answered problems back to the person who constructed the problem. At this point, the students would check their peers work and discuss with them issues in ways that they were solved.

Lesson 3

Objective

Students will be able to construct and solve word problems containing proportions. They will also be able to solve problems that are made by their peers into the form of board games.

Warm-up

"Describe the correct process of how to set up a proportion and solve it using the following problem: Joey needed to go to the store. He looked on the map and saw that it was 5 inches from his hotel. The scale was 2 inches: 0.75 miles. How many miles did he walk to get to the store?"

Procedure

There would be a discussion about the warm-up. Students would share their responses and give an explanation as to how it works.

A project would be introduced to the students as a cumulative project based on proportions. The students would be put in groups of two to three students. In their groups they would have to make a board game. The game has to satisfy certain criteria. Each game has to have at least twenty word problems (either taken from books or made up on their own), with at least six of the types: percents, similar figures and scaling and unit rates. There also needs to be an answer key so that when other students play the game, they can check their work and answers. The students are expected to be creative on the type of game they produce. It can contain any type of subject or topic, just as long as there are the given amounts of word problems that can be solved by setting up a proportion.

Assessment

After completing the game board, the students would be graded on their project both individually and on the final product as a group grade. We would then spend some time allowing the students to play each other's games. Every game that the students play, they will fill out an evaluation sheet on the game they played. Those evaluations will also get averaged into the final grade.

Appendix A

1a. For a read-a-thon, a seventh grade class read 243 books in 4.5 weeks. If they read the same number of books every week, how many books were read per week?

243 books / 4.5 weeks = x books / 1 week

1b. For a read-a-thon, a seventh grade class read 243 books total. If they averaged 54 books per week, how many weeks did it take them to read all of them?

243 books / x weeks = 54 books / 1 week

1c. For a read-a-thon, a seventh grade class read books. They read 54 books per week and they did it for 4.5 weeks. How many books did they read total?

243 books / 4.5 weeks = x books / 1 week

2a. David read 45 pages of a book in 50 minutes. How many pages should he be able to read in 80 minutes?

45 pages / 50 min = x pages / 80 min

2b. David reads 45 pages of a book. If he can read 72 pages in 80 minutes, how long did it take him to read the 45 pages of the book?

45 pages / x min = 72 pages / 80 min

2c. David reads a book for 50 minutes. If he can read 72 pages in 80 minutes, how many pages will he read in the 50 minutes?

x pages / 50 min = 72 pages / 80 min

3. Jim found out that after working for 9 months he had earned 6 days of vacation time. How many days will he have earned after working for two years?

9 months / 6 days = 24 months / x days —> x = 16

4. Mary baked a batch of 3 dozen cookies for 40 women at the women's club. Next month the women's club is expecting 60 women to attend the monthly meeting, how many cookies should Mary bake?

3 dozen / 40 women = x dozen / 60 women —> x = 45

5. Last week, Amy worked seven hours each day Monday through Thursday, and eight hours on Saturday. She earned a total of $333. If her hourly rate was constant find the amount of money that Amy earned for each hour of work?

36 hrs / $333 = 1hr / x dollars —> x= $9.25

6. Shop-A-Lot Market is advertising 3 pounds of bananas for $2.37. Food Farm is advertising 2 pounds of bananas for $1.70. Which supermarket is advertising the lower price per pound for bananas?

3 lbs / $ 2.37 = 1 lb / x dollars and *2 lbs / $ 1.70 = 1 lb / x dollars* —> Food Farm is cheaper.

7. Mr. Scrub offers three ways to pay for carwashes: a book of six car wash coupons for $33.00, a special offer of two washes for $11.50, or one was for $5.95. Which option offers the least expensive unit price for one car wash?

6 coupons / $ 33.00 = 1 coupon / x dollars and *2 coupons / $ 11.50 = 1 coupon / x dollars* and *1 coupon / $ 5.95 = 1 coupon / x dollars* —>6 coupons

8. For a read-a-thon, a fifth grade class read 243 books in 4.5 weeks. At this rate, how many books were read per week?

243 books / 4.5 weeks = x books / 1 week —> x = 54

9. It is 600 miles from San Diego to Napa Valley. Duane drove up to Napa on Tuesday. He averaged 50 mph. What was his travel time?

60 miles / x hours = 50 miles / 1 hour —> x = 12

10. Jim found out that after working for 9 months he had earned 6 days of vacation time. How many days will he have earned after working for two years?

9 months / 6 days = 24 months / x days —> x = 16

11. If 4 grapefruits sell for 79 cents, how much will 6 grapefruits cost?

4 grapefruits / $ 0.79 = 6 grapefruits / x dollars —> x = 1.19

12. Kelly takes inventory of her closet and discovers that she has 8 shirts for every 5 pairs of jeans. If she has 40 shirts, how many pairs of jeans does she have?

8 shirts / 5 jeans = 40 shirts / x jeans —> x = 25

13. David read 40 pages of a book in 50 minutes. How many pages should he be able to read in 80 minutes?

40 pages / 50 min = x pages / 80 min —> x = 64

14. Mr. Green has a garden. Of the 40 seeds he planted, 35% were vegetable seeds. How many vegetable seeds were planted?

x / 40 = 35% / 100 —> x = 14

15. Shelley ordered a painting. She paid 30% of the total cost when she ordered it, and she will pay the remaining amount when it is delivered. If she has paid $15, how much more does she owe?

15 / x = 30% / 100 —> x = 50 —> 50 - 15 = 35

16. Glucose is a type of sugar. A glucose molecule is composed of 24 atoms. Hydrogen atoms make up 50% of the atoms in the molecule, carbon atoms make up 25% of the molecule, and oxygen atoms make up the other 25 %. How many atoms of hydrogen are in a molecule of glucose?

x / 24 = 50% / 100 —> x = 12

17. Kylie usually makes 85% of her shots in basketball. If she shoots 20 shots, how many will she likely make?

x / 20 = 85% / 100 —> x = 17

18. In a high school survey, it was found that 240 of 600 students walk to school. What percent of the students walk to school?

240 / 600 = x % / 100 —> *x* = 40

19. A statue casts a shadow that is 360m long. At the same time, a person who is 2 m tall casts a shadow that is 6 m long. How tall is the statue?

x / 360 m = 2 m / 6 m —> *x* = 120

20. Paul swims in a pool that is similar to an Olympic-sized pool. Paul's pool is 30m long by 8 m wide. The length of an Olympic-sized pool is 50 m. To the nearest meter, what is the width of an Olympic-sized pool?

8 m (width) / 30 m (length) = x m (width) / 50 m (length) —> *x* = 13.3

21. A blueprint for a house states that 2.5 inches equals 10 feet. If the length of a wall is 12 feet, how long is the wall in the blueprint?

2.5 in / 10 ft = x in / 12 ft —> *x* = 3

22. A collector's model truck is scaled so that 1 inch on the model equals 6 Â¼ feet on the actual truck. If the model is 2.3 inch high, how high is the actual truck?

1 in / 6.25 ft = 2.3 in / x ft —> *x* = 14.38 ft

23. Truss bridges use triangles in their support beams. Mark plans to make a model of a truss bridge in the scale 1 inch=12 feet. If the height of the triangles on the actual bridge is 40 feet, what will the height be on the model?

1 in / 12 ft = x in / 40 ft —> *x* = 3.33

24. On a map, every 2 inches represents an actual distance of 100 miles. Find the actual distance between two towns if the map distance is 5 inches.

2 in / 100 mi = 5 in / x mi —> *x* = 250

25. Murphy and Abby are trying to determine the distance between two particular cities by using a map. The map key indicates that 4.5 cm is equivalent to 75 km. If the cities are 12.7 cm apart on the map, what is the actual distance between the cities?

4.5 cm / 75 km = 12.7 cm / x km —> *x* = 212

Annotated Bibliography

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This is a book just like the other in the series to break down ways to successfully learn Algebra.