Homework Helpers

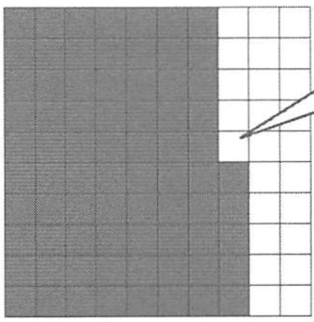
Grade 7
Module 4

G7-M4-Lesson 1: Percent

1. Create a model to represent the following percents.

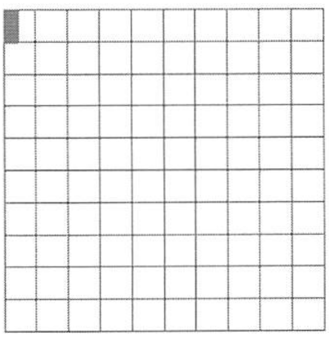
   a. 75%

   Each box represents 1% because there are 100 boxes. Therefore, I can shade in any 75 boxes to represent 75%.



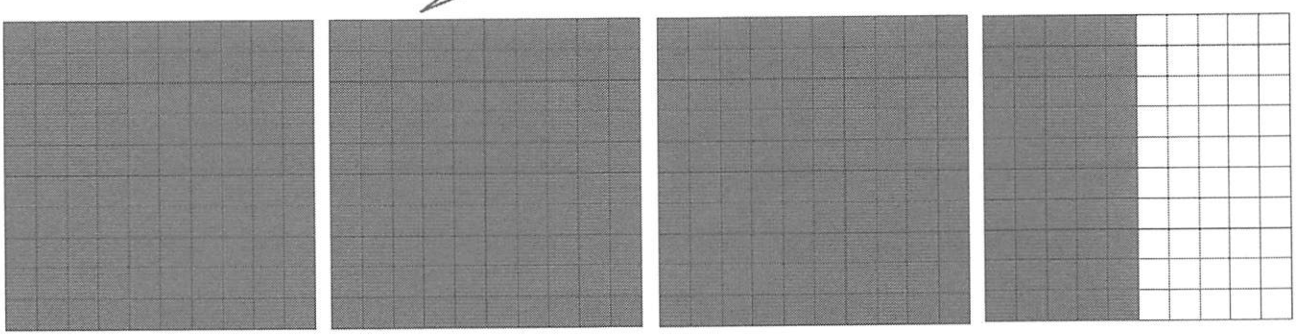
   b. 0.5%

   I will have to shade in less than one box because the percent given is less than 1.



   c. 350%

   350% is greater than 100%, so I will need more than one grid to model the given percent.



2. Complete the table by converting among fractions, decimals, and percents.

To convert a fraction to a decimal, I can either use long division or find an equivalent fraction with a denominator as a multiple of 10.

To convert a fraction to a percent, I find an equivalent fraction with a denominator of 100.

To convert a decimal to a fraction, I use the place value of the digit furthest to the right to determine my denominator.

The 5 is in the thousandths place.

To convert a decimal to a percent, I write the decimal as a fraction with a denominator of 100.

To convert a percent to a fraction, I write the percent as a fraction with a denominator of 100 and change to a mixed number if necessary.

To convert a percent to a decimal, I write the percent as a fraction with a denominator of 100 and then use place value to write the value as a decimal.

Fraction	Decimal	Percent
$\frac{1}{5}$	$\frac{1}{5}=\frac{2}{10}=0.2$	$\frac{1}{5}=\frac{20}{100}=20\%$
$\frac{815}{1000}$	0.815	$\frac{81.5}{100}=81.5\%$
$\frac{225}{100}=2\frac{25}{100}=2\frac{1}{4}$	$\frac{225}{100}=2\frac{25}{100}=2.25$	225%

3. Order the following from least to greatest.

$200\%,\ 2.1,\ \frac{1}{50},\ 0.2,\ \frac{20{,}000}{1{,}000},\ 0.02\%,\ 0.002$

I can rewrite every term as a decimal to make the comparison easier:
2, 2.1, 0.02, 0.2, 20, 0.0002, 0.002

$0.02\%,\ 0.002,\ \frac{1}{50},\ 0.2,\ 200\%,\ 2.1,\ \frac{20{,}000}{1{,}000}$

G7-M4-Lesson 2: Part of a Whole as a Percent

Represent each situation using an equation.

I know that "is" means "equals" and that "of" means "multiply." Using this knowledge, I can translate the words into an equation.

1. What number is 20% of 80?

   Let n represent the unknown number.

   $n = 20\%(80)$

   $n = 0.2(80)$

   $n = 16$

   Before I can solve for n, I need to convert the percent to a decimal or a fraction.

   This means 16 is 20% of 80.

2. 28 is 40% of what number?

   Let n represent the unknown number.

$$28 = 40\%(n)$$
$$28 = \frac{40}{100}n$$
$$\left(\frac{100}{40}\right)(28) = \left(\frac{100}{40}\right)\left(\frac{40}{100}n\right)$$
$$70 = n$$

   Therefore, 28 is 40% of 70.

   In order to solve for n, I multiply both sides of the equation by the multiplicative inverse of $\frac{40}{100}$.

3. 40 is what percent of 50?

   Let p represent the unknown percent.

$$40 = p(50)$$
$$40\left(\frac{1}{50}\right) = p(50)\left(\frac{1}{50}\right)$$
$$0.8 = p$$

   $p = 0.8 = 80\%$

   Therefore, 40 is 80% of 50.

Use percents to solve the following real-world problems.

When solving real-world problems, I can use the formula Part $=$ Percent $\times$ Whole.

4. Michael spent 40% of his money on new shoes. If Michael spent $\$85$ on his new shoes, how much money did Michael have at the beginning?

$\text{Part} = \text{Percent} \times \text{Whole}$

I know the percent and the part; I need to calculate the whole.

Let w represent the amount of money Michael had at the beginning.

$$85 = 40\% \times w$$
$$85 = 0.4 \times w$$
$$85\left(\frac{1}{0.4}\right) = 0.4w\left(\frac{1}{0.4}\right)$$
$$212.5 = w$$

Michael spent 40% of his money, w, on shoes.

This means that Michael had $\$212.50$ before he bought new shoes.

5. McKayla took 30 shots during her last basketball game, but only made 18 baskets. What percent of her shots did McKayla make?

$\text{Part} = \text{Percent} \times \text{Whole}$

I know the whole is the number of shots McKayla took, and the part is the 18 baskets she made.

Let p represent the percent of the shots McKayla made.

$$18 = p \times 30$$
$$18\left(\frac{1}{30}\right) = p(30)\left(\frac{1}{30}\right)$$
$$0.6 = p$$

$p = 0.6 = 60\%$

This means that McKayla made 60% of the baskets she shot.

G7-M4-Lesson 3: Comparing Quantities with Percent

When solving real-world problems with percents, I can use the formula Quantity $=$ Percent $\times$ Whole.

I am being asked to find the percent of the old number of participants. Therefore, the old number of participants is the whole.

1. The number of participants in the city choir decreased from 40 to 25.
   a. Express the new number of participants as a percent of the old number of participants.

      Let p represent the unknown percent.

$$\begin{aligned}\textbf{Quanitity} &= \textbf{Percent} \times \textbf{Whole}\\ 25 &= p \times 40\\ 25\left(\frac{1}{40}\right) &= p(40)\left(\frac{1}{40}\right)\\ 0.625 &= 1p\\ 0.625 &= p\end{aligned}$$

The question is asking for a percent, so I need to convert this decimal to a percent.

In Lesson 2, I solved equations similar to this one.

The new number of participants is 62.5% of the old number of participants.

The question has changed, and now the new number of participants is the whole.

   b. Express the old number of participants as a percent of the new number of participants.

      Let p represent the unknown percent.

$$\begin{aligned}\textbf{Quantity} &= \textbf{Percent} \times \textbf{Whole}\\ 40 &= p \times 25\\ 40\left(\frac{1}{25}\right) &= p(25)\left(\frac{1}{25}\right)\\ 1.6 &= 1p\\ 1.6 &= p\end{aligned}$$

The old number of participants is 160% of the new number of participants.

The number of students who attend Berry is the whole, and the number of students who attend Newton is the quantity.

2. The number of students who attend Newton Elementary School is 75% of the number of students who attend Berry Middle School.

   a. Find the number of students who attend Newton if 500 students attend Berry.

   $\text{Quantity} = \text{Percent} \times \text{Whole}$

   I know the percent and the whole; I have to determine the quantity.

   Let n represent the number of students who attend Newton.

   $n = 75\%(500)$

   Before solving the equation, I need to convert the percent to a decimal.

   $n = 0.75(500)$

   In order to solve for n, multiply the two factors together.

   $n = 375$

   This means that 375 students attend Newton Elementary School.

   b. Find the number of students who attend Berry if 150 students attend Newton.

   The question has changed. I now know the percent and the quantity. I need to calculate the whole.

   $\text{Quantity} = \text{Percent} \times \text{Whole}$

   Let b represent the number of students who attend Berry.

$$150 = 75\% \times b$$
$$150 = 0.75b$$
$$150\left(\frac{1}{0.75}\right) = 0.75b\left(\frac{1}{0.75}\right)$$
$$200 = b$$

   Therefore, 200 students attend Berry Middle School.

G7-M4-Lesson 4: Percent Increase and Decrease

This is the original price, so it represents the whole.

1. A store is advertising 20% off a new Blu-ray Player that regularly sells for $\$60$.

   a. What is the sale price of the item?

   $100\% - 20\% = 80\%$

   Therefore, I am paying 80% of the original price.

   In order to solve this problem, I determine the percent of the original price I have to pay.

   Let n represent the sale price.

   $n = 80\% \times 60$

   $n = 0.8(60)$

   $n = 48$

   The sale price is $\$48$.

   Percent increase and decrease problems are still percent problems in the real-world, so I use the formula $\text{Quantity} = \text{Percent} \times \text{Whole}$.

   b. If 6% sales tax is charged on the sale price, what is the total with tax?

   $100\% + 6\% = 106\%$

   I pay 106% of the sale price ($\$48$), which will represent the whole since I am finding the sale price with tax.

   Sales tax increases the price, so I have to pay 100% of the sale price, plus the extra 6% for tax.

   Let t represent the sale price with tax.

   $t = 106\% \times 48$

   $t = 1.06 \times 48$

   $t = 50.88$

   The sale price with tax is $\$50.88$.

2. The Parent-Teacher Organization had 30 participants attend the first meeting of the school year and only 24 participants attend the second meeting. Find the percent decrease in the participants from the first meeting to the second meeting.

$$\text{Quantity} = \text{Percent} \times \text{Whole}$$

I only want to determine the percent decrease; therefore, the quantity is the amount of decrease, which is 6 because $30 - 24 = 6$.

The number of participants who attended the first meeting represents the whole.

Let p represent the percent decrease.

$$6 = p \times 30$$
$$6\left(\frac{1}{30}\right) = p \times 30\left(\frac{1}{30}\right)$$
$$0.2 = p$$
$$20\% = p$$

Therefore, the percent decrease is 20%.

3. Chelsey is keeping a diary to keep track of the number of days she goes running. In the first 40 days, she ran 40% of the days. She kept recording for another 20 days and then found that the total number of days she ran increased to 50%. How many of the final 20 days did Chelsey go running?

Let r represent the number of days Chelsey ran during the first 40 days.

$r = 40(40\%)$

I know I can find the number of days Chelsey ran during the first 40 days where 40 represents the whole.

$r = (40)(0.40)$

$r = 16$

Chelsey ran 16 days in the first 40 days.

Let d represent the total number of days Chelsey went running.

$d = 60(50\%)$

$40 + 20 = 60$ This means that Chelsey kept the diary for a total of 60 days.

$d = 60(0.50)$

$d = 30$

Chelsey ran a total of 30 days.

$30 - 16 = 14$

I know the number of days Chelsey ran during the last 20 days is the difference between the total number of days she ran and the number of days she ran during the first 40 days.

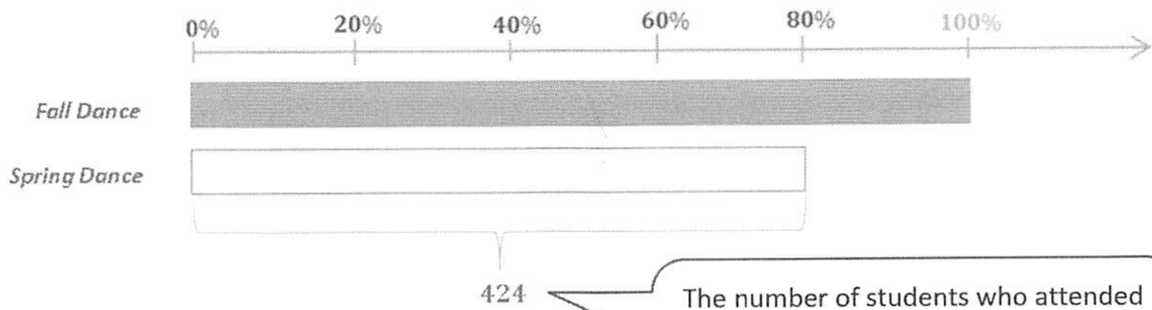
Chelsey ran 14 days during the last 20 days.

G7-M4-Lesson 5: Finding One Hundred Percent Given Another Percent

Use a model to answer the problem.

1. The number of students who attended the spring school dance was a 20% decrease from the number of students who attended the fall dance. If 424 students attended the spring dance, how many students attended the fall dance?

100% represents the number of students who attended the fall dance and 80% represents the number of students who attended the spring dance. The greatest common factor of 100 and 80 is 20. Therefore, I split the number line into five equal sections each representing 20%.



The number of students who attended the spring dance represents 80% of the number of students who attended the fall dance.

There are four equal sections of 20% in 80%.

$424 \div 4 = 106$

Therefore, each of these sections would represent 106.

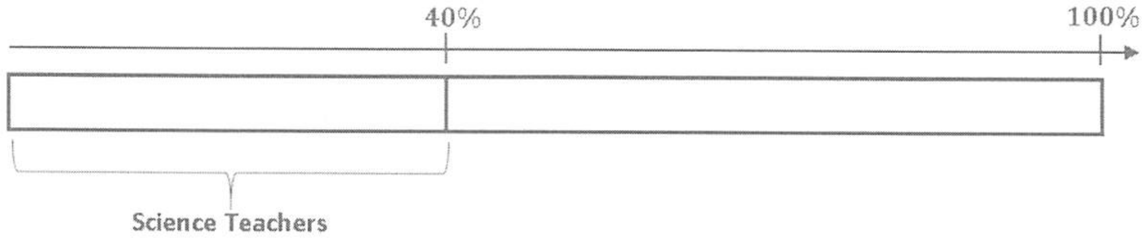
$106 \times 5 = 530$

There are five equal sections of 20% in 100%. I know that each section of 20% represents 106 students. The number of students who attended the fall dance was 530.

Use any method to solve the problem.

2. A middle school ordered new calculators. The science teachers received 40% of the calculators, and the math teachers received 75% of the remaining calculators. There were 60 calculators that were not given to either science or math teachers. How many calculators were given to the science teachers? Math teachers? How many calculators were originally ordered?

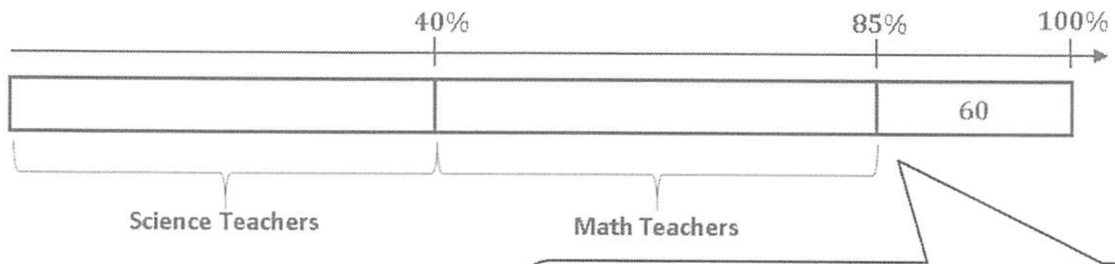
   I know that 40% of the calculators were given to science teachers, which means 60% of the calculators were given to other teachers.



   Of the remaining 60% of calculators, math teachers received 75% of them.

   $60\% \times 75\% = 45\%$

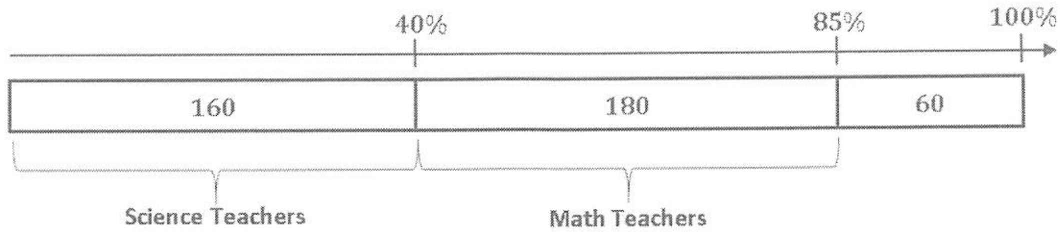
   Therefore, math teachers received 45% of the original amount of calculators.



   I know 45% of the calculators were given to math teachers, which means 85% of the calculators were given to math and science teachers, and 15% of the calculators were given to other teachers.

   According to my model, 60 represents 15% of the calculators. Therefore, 20 represents 5% of the calculators ordered.

   If I know 20 represents 5%, I can multiply both values by eight in order to determine how many calculators represents 40% of the calculators ordered. For the same reason, I need to multiply both values by nine to determine the number of calculators the math teachers received.



Science teachers received 160 *calculators. Math teachers received* 180 *calculators.*

$160 + 180 + 60 = 400$

The school originally ordered 400 *calculators.*

G7-M4-Lesson 6: Fluency with Percents

1. Monroe Middle School has 564 students, which is 60% of the number of students who attend Wilson Middle School. How many student attend Wilson Middle School?

$$\text{Quantity} = \text{Percent} \times \text{Whole}$$

Let s represent the number of students who attend Wilson Middle School.

$$564 = 60\% \times s$$
$$564 = 0.6 \times s$$
$$\left(\frac{1}{0.6}\right)(564) = \left(\frac{1}{0.6}\right)(0.6)s$$
$$940 = s$$

I know the number of students who attend Wilson Middle School represents the whole because it is the value being compared to the percent.

940 *students attend Wilson Middle School.*

2. In a school-wide survey, students could either choose basketball or soccer as their favorite sport. The number of people who chose basketball as their favorite sport was 20% greater than the number of people who chose soccer. If 450 students chose basketball as their favorite sport, how many people took the survey?

Let s represent the number of people who chose soccer as their favorite sport.

$$450 = 120\% \times s$$
$$450 = 1.2s$$
$$\left(\frac{1}{1.2}\right)(450) = \left(\frac{1}{1.2}\right)(1.2s)$$
$$375 = s$$

The number of people who chose basketball is 120% of those who chose soccer because the number of people who chose basketball is equal to the number of people who chose soccer plus an extra 20% of the people.

The number of people who chose soccer as their favorite sport is 375.

$375 + 450 = 825$

The total number of people who completed the survey was 825.

3. Electricity City increases the price of televisions by 25%. If a television now sells for \$425, what was the original price?

$$\text{Quantity} = \text{Percent} \times \text{Whole}$$

Let p represent the original price, in dollars, of the television.

$$425 = 125\% \times p$$
$$425 = 1.25p$$
$$\left(\frac{1}{1.25}\right)(425) = \left(\frac{1}{1.25}\right)(1.25)p$$
$$340 = p$$

I know the television sold for 125% of the original price because the cost would be 100% of the original price plus the 25% increase.

The original price of the television is $340.

I can do a quick check to make sure my answer makes sense. I know that my answer is the original price, which means it should be a smaller value than the price the television sold for.

4. Christopher spent 20% of his paycheck at the mall, and 35% of that amount was spent on a new video game. Christopher spent a total of \$21.35 on the video game. How much money was in Christopher's paycheck?

Let m represent the amount Christopher spent at the mall.

$$21.35 = \frac{35}{100}m$$
$$\left(\frac{100}{35}\right)(21.35) = \left(\frac{100}{35}\right)\left(\frac{35}{100}m\right)$$
$$61 = m$$

The amount Christopher spent at the mall is the whole, and I can determine the amount he spent on a video game.

Christopher spent $61.00 *at the mall. Let p represent the amount of money in Christopher's paycheck.*

I can use the information I found in the previous equation to determine the amount of money in Christopher's paycheck.

$$61 = \frac{20}{100}p$$
$$\left(\frac{100}{20}\right)(61) = \left(\frac{100}{20}\right)\left(\frac{20}{100}p\right)$$
$$305 = p$$

Christopher's paycheck was $305.00.

G7-M4-Lesson 7: Markup and Markdown Problems

1. A school is conducting a fundraiser by selling sweatshirts. The school marks up the price of the sweatshirts by 40% in order to make a large profit. The school sells each sweatshirt for $\$28$.

   a. What is the original cost of the sweatshirts?

   $\text{Selling Price} = 140\%(\text{Original Cost})$

   There was a markup of 40%; therefore, the selling price is 140% of the original price because I have to pay 100% of the original price and the 40% markup.

   Let c represent the original cost.

   $$28 = 140\%(c)$$
   $$28 = 1.4c$$
   $$\frac{1}{1.4}(28) = \left(\frac{1}{1.4}\right)(1.4)(c)$$
   $$20 = c$$

   Therefore, the original cost of each sweatshirt was $\$20$.

   b. How much did the school earn on each sweatshirt due to the markup?

   $\$28 - \$20 = \$8$

   The school earned $\$8$ due to the markup.

   Due to the discount, I will pay $100\% - 25\%$, or 75%, of the original price. However, the sales tax will force me to pay $100\% + 6\%$, or 106%, of the discounted price.

2. A tool bench costs $\$650$ but is marked 25% off. If sales tax is 6%, what is the final cost of the tool bench?

   Let c represent the final cost of the tool bench.

   $$c = (\text{original cost})(\text{percentage paid})(\text{sales tax})$$
   $$c = (650)(0.75)(1.06)$$
   $$c = 516.75$$

   The commutative and associative properties can help me calculate the product.

   Therefore, the final price of the tool bench is $\$516.75$.

3. A local store sells a small television for $\$185$. However, the local store buys the same television from a wholesaler for $\$100$. What is the markup rate?

Let p represent the percent of the original price.

$$\text{Selling Price} = \text{Percent} \times \text{Original Price}$$
$$185 = p \times 100$$
$$\left(\frac{1}{100}\right)(185) = \left(\frac{1}{100}\right)(p \times 100)$$
$$1.85 = p$$

The selling price is $\$185$, and the original price is $\$100$.

This means that the selling price is 185% of the wholesale price, but this is not the markup rate.

$185\% - 100\% = 85\%$

The markup rate is 85%.

4. The sale price for a computer is $\$450$. The original price was first discounted by 25% and then discounted an additional 20%. Find the original price of the computer.

Let c represent the cost of the computer before the additional 20% discount.

$$450 = 0.80c$$
$$\left(\frac{1}{0.80}\right)(450) = \left(\frac{1}{0.80}\right)(0.80c)$$
$$562.5 = c$$

I need to work backward and first find the cost of the computer before the second discount.

The cost of the computer before the second discount was $\$562.50$.

Now, I can use the price of the computer after the first discount to determine the original cost.

Let p represent the original cost of the computer.

A discount of 25% means I pay 75% of the original price.

$$562.5 = 0.75p$$
$$\left(\frac{1}{0.75}\right)(562.5) = \left(\frac{1}{0.75}\right)(0.75p)$$
$$750 = p$$

The original cost of the computer was $\$750$.

G7-M4-Lesson 8: Percent Error Problems

1. Lincoln High School just installed a new basketball court. The length of the new court is 90 feet, and the width of the court is 49 feet. However, the regulation length and width of a basketball court are 94 ft. and 50 ft.

   a. What is the percent error of the width of the basketball court?

   $$\frac{|49-50|}{|50|} \times 100\%$$

   I know the exact value is 50 ft., and the approximate value is 49 ft.

   $$\frac{|-1|}{|50|} \times 100\%$$

   I complete the operations within the absolute value before calculating the absolute value, or distance from 0.

   $$\frac{1}{50} \times 100\%$$

   $$2\%$$

   The percent error of the width is 2%*.*

   b. The percent error of the area of the basketball court must be less than 5%. If the percent error is larger, the court will have to be re-installed. Does Lincoln High School have to re-install its new basketball court? Why or why not?

   Exact Area: $94 \text{ ft.} \times 50 \text{ ft.} = 4,700 \text{ ft}^2$

   In order to find the percent error of the area, I first calculate the exact area and the approximate area.

   Approximate Area: $90 \text{ ft.} \times 49 \text{ ft.} = 4,410 \text{ ft}^2$

   Percent Error:

   $$\frac{|4,410-4,700|}{|4,700|} \times 100\%$$

   $$\frac{|-290|}{|4,700|} \times 100\%$$

   $$\frac{29}{470} \times 100\%$$

   $$6.17\%$$

   Lincoln High School needs to re-install its basketball court because the area of the new court has more than a 5% *percent error.*

2. Michael volunteered his mom to bring snacks for the seventh grade dance. Michael said that the school is expecting anywhere from 100 to 125 students at the dance. At most, what is the percent error?

The approximate value is 125*, and the exact value is* 100*.*

$$\frac{|100-125|}{|125|} \times 100\%$$

$$\frac{|-25|}{|125|} \times 100\%$$

$$\frac{25}{125} \times 100\%$$

$$20\%$$

I know that the percent error is the largest value when the exact value is the smallest value.

The largest percent error is 20%*.*

3. In the school choir, 76% of the members are female. If there are 350 members in the school choir, how many members are male?

$$100\% - 76\% = 24\%$$

If 76% of the members of female, then the remaining 24% of the members are male.

Let m *represent the number of choir members who are male.*

$$m = 0.24(350)$$

$$m = 84$$

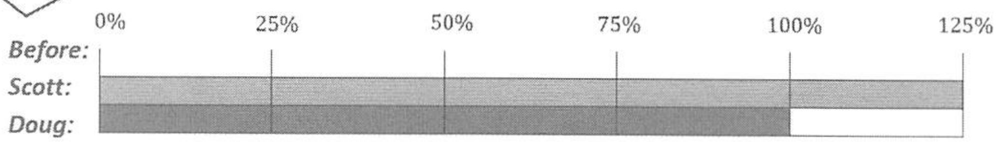
There are 84 *males in the school choir.*

G7-M4-Lesson 9: Problem Solving When the Percent Changes

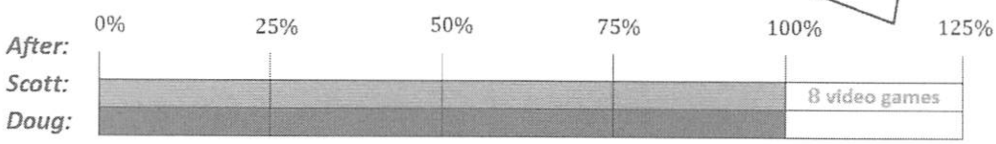
Use models to solve each problem.

1. The number of video games Scott has is 125% of the number of Doug's video games. However, Scott's mother forced him to donate 8 video games. Now, Scott and Doug have the same number of video games. How many video games did each boy start with?

I create a model to show that Scott has 25% more video games than Doug.



The after model shows that Doug and Scott have the same number of video games, but Scott donated 8 video games.



The models show that each bar represents 8 video games.

Scott started with 40 video games because his original tape diagram has 5 bars that each represent 8 video games.

Doug started with 32 video games because his original tape diagram has 4 bars that, again, each represent 8 video games.

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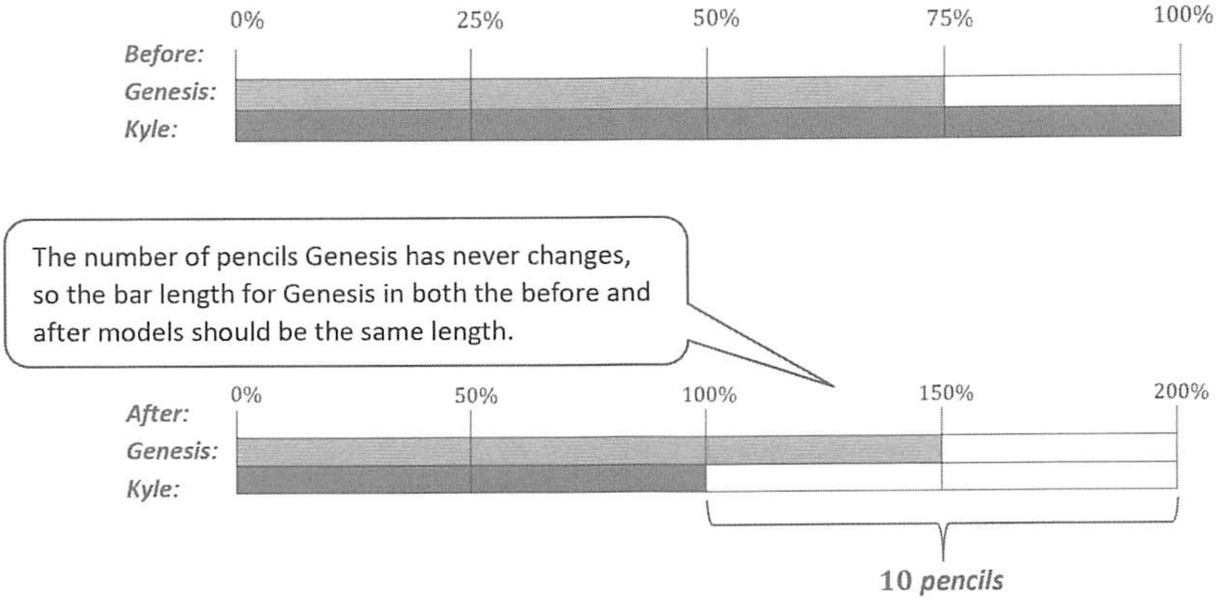
2. Genesis and Kyle went to the store to buy school supplies. Genesis bought 75% as many pencils as Kyle. Kyle ended up giving 10 of his pencils to his friend, and now the number of pencils Genesis has is 50% more than Kyle. How many pencils did each person have at the beginning?

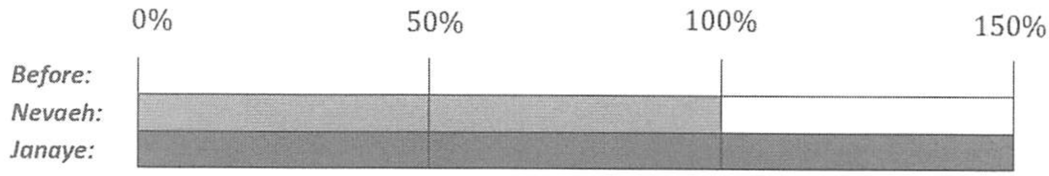


The models show that each bar represents 5 pencils because two bars represent 10 pencils.

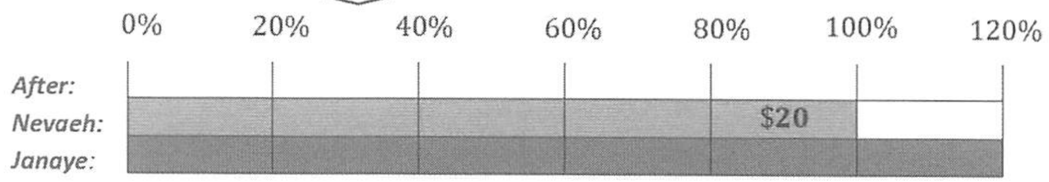
Genesis started with 15 pencils because her tape diagram has 3 bars where each represents 5 pencils.

Kyle started with 20 pencils because his tape diagram has 4 bars where each represents 5 pencils.

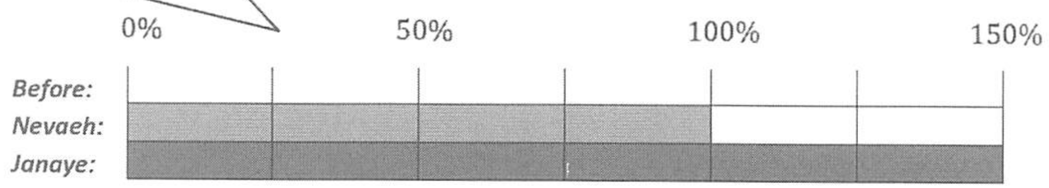
3. Janaye and Nevaeh compared their money and noticed Janaye had 50% more money than Nevaeh. After Nevaeh earned an extra \$20, Janaye had 20% more money. How much more money did Janaye have than Nevaeh at first?



Each model has a different size bars; in order to solve the problem the bars must all be the same size.



The bars in the first model need to be split in half in order to be the same size as the bars in the after model. This is shown below.



Now that the bars on both models are the same size, I know each bar represents $\$20$.

Therefore, Nevaeh had $\$80$ *at the beginning because her tape diagram has* 4 *bars where each represents* $\$20$*, and Janaye had* $\$120$ *at first.*

In order to answer the question, I have to determine how much each girl had at the beginning.

$\$120 - \$80 = \$40$

This means that Janaye had $\$40$ *more than Nevaeh at the start.*

G7-M4-Lesson 10: Simple Interest

1. Joy borrowed \$2,000 from the bank and agreed to pay an annual interest rate of 6% for 24 months. What is the amount of interest she will pay on this loan?

$$I = Prt$$

$$I = (2,000)(6\%)\left(\frac{24}{12}\right)$$

I have annual interest, which means the time must be represented in years.

$$I = (2,000)(0.06)(2)$$

$$I = 240$$

Joy will pay $\$240$ in interest.

2. Xavier opened a new savings account by putting \$300 into the account. At the end of the year, the savings account pays an annual interest of 5.25% on the amount he put into the account.

   a. How much will Xavier earn if he leaves his money in the savings account for 15 years?

Before multiplying, I must convert the percent to a decimal.

I know the principal amount is \$300, the annual interest rate is 5.25%, and the time is 15 years.

$$I = Prt$$

$$I = (300)(5.25\%)(15)$$

$$I = (300)(0.0525)(15)$$

$$I = 236.25$$

Xavier will earn $\$236.25$ in interest.

   b. If Xavier does not add any money to his account, how much money will Xavier have in his account after the 15 years?

   $\$300 + \$236.25 = \$536.25$

   After 15 years, Xavier will have $\$536.25$ in his account.

3. Mr. Brown had to take out a loan to help pay rent. He borrowed $800 and agreed to pay an annual interest rate of 6%. If Mr. Brown was able to pay the loan back in just 6 months, how much interest did Mr. Brown pay?

12 months = 1 year

If we divide both sides by 2, we find that 6 months is equal to $\frac{1}{2}$ year.

$I = Prt$

$I = 800(0.06)\left(\frac{1}{2}\right)$

$I = 24$

Mr. Brown paid $24 in interest.

The rate and time are not compatible. The rate is annual, which means time must be converted to years.

4. Stefani received a loan for $2,000 and now has acquired $720 in interest. If she pays an annual interest of 4.5% on the amount borrowed, how much time has elapsed since Stefani received the loan?

Let t represent the time, in years, that has elapsed since Stefani received the loan.

$$I = Prt$$
$$720 = 2000(0.045)t$$
$$720 = 90t$$
$$\left(\frac{1}{90}\right)(720) = \left(\frac{1}{90}\right)90t$$
$$8 = t$$

This time, I know the interest and need to calculate the time (in years).

Therefore, Stefani received the loan 8 years ago.

G7-M4-Lesson 11: Tax, Commissions, Fees, and Other Real-World Percent Applications

1. In order for Josue to pay all of his bills, he needs to make $1,900 a month. Josue earns $10 an hour, plus 8% commission on his insurance sales. If Josue worked 160 hours each month, what is the least amount in insurance Josue would have to sell in order to have enough money to pay his bills?

   Let s represent the amount, in dollars, sold in insurance.

   The 1900 represents the amount Josue needs to earn each month.

   These factors will tell me how much Josue gets paid each month, without commission.

   These factors will tell me the amount of commission Josue will earn.

$$\begin{aligned} 1900 &= 160(10) + 8\%(s) \\ 1900 &= 1600 + 0.08s \\ 1900 - 1600 &= 1600 + 0.08s - 1600 \\ 300 &= 0.08s \\ \left(\frac{1}{0.08}\right)(300) &= \left(\frac{1}{0.08}\right)(0.08)s \\ 3750 &= s \end{aligned}$$

   Therefore, Josue would have to sell $\$3,750$ worth of insurance in order to pay his monthly bills.

2. A dealership sells a car to an average of 12% of the daily customers.

   a. Write an equation that shows the proportional relationship between the number of customers who go to the dealership, c, and the number of customers who actually buy a car, b.

      $b = 0.12c$

      I will multiply the percent of customers who buy a car by the number of daily customers in order to determine the number of customers who buy a car.

b. Use your equation to complete the table. List 5 possible values for b and c.

I can choose any numbers for c because this is the independent variable.

c	b
50	6
100	12
150	18
200	24
250	30

In order to determine my b values, I have to use my equation. For example, $b = 0.12(50)$. After multiplying, I find $b = 6$.

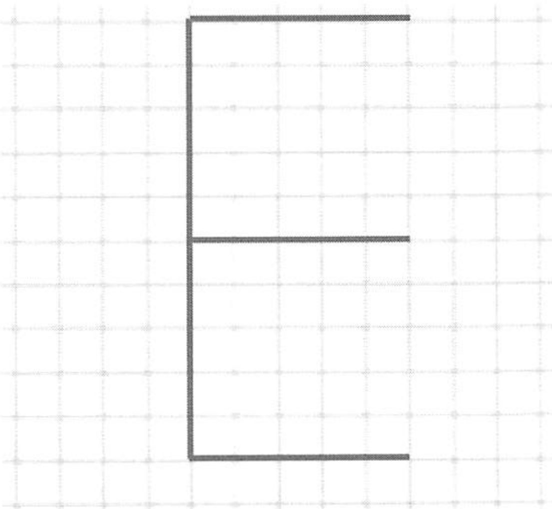
c. Identify the constant of proportionality, and explain what it means in the context of the situation.

The constant of proportionality is 0.12*, or* 12%*. On average, for every* 100 *customers who go to the car dealership,* 12 *will buy a car.*

G7-M4-Lesson 12: The Scale Factor as a Percent for a Scale Drawing

The scale factor is less than 100%, which means the scale drawing will be smaller than the original diagram.

1. Use the diagram below to create a scale drawing using a scale factor of 80%. Write numerical equations to find the horizontal and vertical distances in the scale drawing.



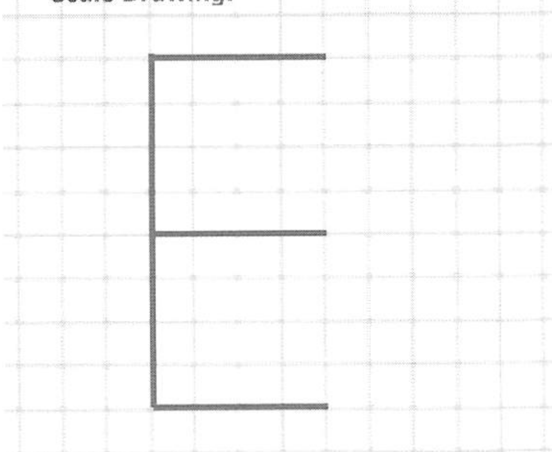
Scale Factor: $80\% = \frac{80}{100} = \frac{4}{5}$

Horizontal Distance: 5 *units*

Vertical Distance: 10 *units (broken into two equal sections of* 5 *units).*

To determine the dimensions of the scale drawing, I multiply each dimension by the scale factor of 80%, or $\frac{4}{5}$.

Scale Drawing:

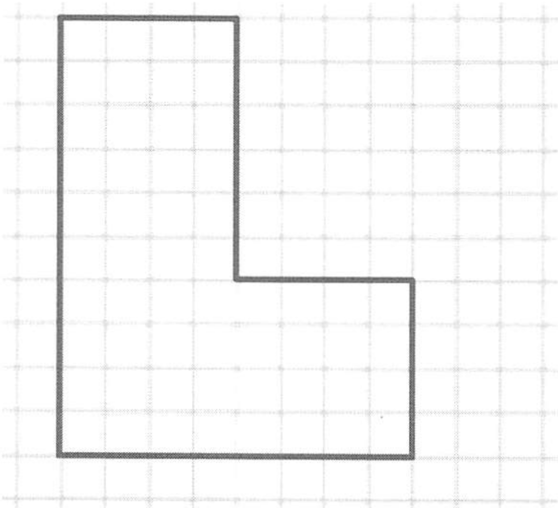


Horizontal Distance of Scale Drawing:
$(5 \text{ units})\left(\frac{4}{5}\right) = 4 \text{ units}$

Vertical Distance of Scale Drawing:
$(10 \text{ units})\left(\frac{4}{5}\right) = 8 \text{ units}$ *(broken into two equal sections of* 4 *units).*

I have two different scale factors this time. The horizontal distance will be enlarged, and the vertical distance will be reduced.

2. Create a scale drawing of the original drawing given below using a horizontal scale factor of 150% and a vertical scale factor of 50%. Write numerical equations to find the horizontal and vertical distances.



Horizontal Scale Factor: $150\% = \frac{150}{100} = \frac{3}{2}$

Vertical Scale Factor: $50\% = \frac{50}{100} = \frac{1}{2}$

Horizontal Distance: 8 *units*

The top is broken into two sections of 4 *units.*

Vertical Distance: 10 *units*

The right side is broken into two sections, where one section is 6 *units and the other is* 4 *units.*

Horizontal Distance of Scale Drawing:

$(8 \text{ units})(150\%) = (8 \text{ units})\left(\frac{3}{2}\right) = 12 \text{ units}$

However, the top will be broken into two sections of 6 *units.*

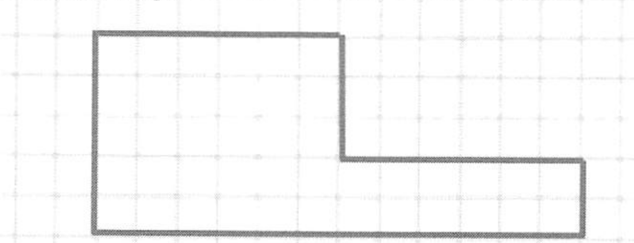
When finding the distances for the scale drawing, I need to make sure I use the correct scale factor for the horizontal distances and the vertical distances.

Vertical Distance of Scale Drawing:

$(10 \text{ units})(50\%) = (10 \text{ units})\left(\frac{1}{2}\right) = 5 \text{ units}$

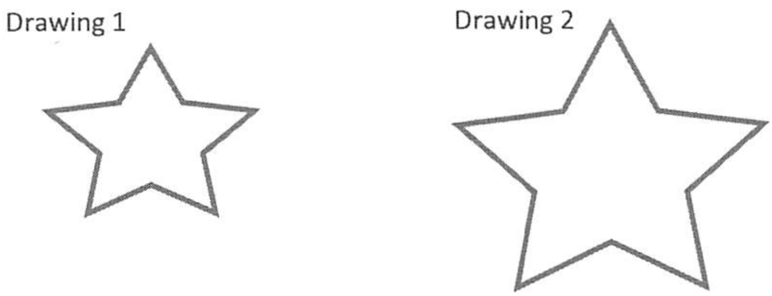
However, the right side will be broken into two sections, where one section is $(6 \text{ units})\left(\frac{1}{2}\right) = 3 \text{ units}$ *and the other section is* $(4 \text{ units})\left(\frac{1}{2}\right) = 2 \text{ units}$.

Scale Drawing:



G7-M4-Lesson 13: Changing Scales

1. The scale factor from Drawing 1 to Drawing 2 is 150%. Justify why Drawing 1 is a scale drawing of Drawing 2 and why it is a reduction of Drawing 2. Include the scale factor in your justification.



$$\text{Length of Drawing 1} = \text{Percent} \times \text{Length of Drawing 2}$$

$$100\% = \text{Percent} \times 150\%$$

$$\left(\frac{1}{150\%}\right)(100\%) = \left(\frac{1}{150\%}\right)(\text{Percent} \times 150\%)$$

$$66\frac{2}{3} = \text{Percent}$$

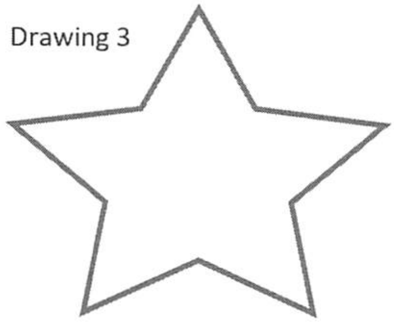
The lengths of the original drawings always represent 100%.

Drawing 1 is a scale drawing of Drawing 2 because the lengths of Drawing 1 would be smaller than the corresponding lengths in Drawing 2.

Since the scale factor from Drawing 2 to Drawing 1 is $66\frac{2}{3}\%$, Drawing 1 is a reduction of Drawing 2.

I know a scale drawing is a reduction when the scale factor is less than 100%. If the scale factor is greater than 100%, then the scale drawing is an enlargement.

2. The scale factor from Drawing 2 (presented in the first problem) to Drawing 3 is 125%. What is the scale factor from Drawing 1 to Drawing 3? Explain your reasoning, and check your answer using an example.



$(150\%)(125\%) = (1.50)(1.25) = 1.875$

Therefore, the scale factor from Drawing 1 to Drawing 3 is 187.5%.

I can choose any length for the length in Drawing 1 when I am checking the scale factors.

Check: Assume that one of the lengths in Drawing 1 is 8 cm.

$(8 \text{ cm})(1.50) = 12 \text{ cm}$

The corresponding length in Drawing 2 would be 12 cm.

$(12 \text{ cm})(1.25) = 15 \text{ cm}$

The corresponding length in Drawing 3 would be 15 cm.

I use the scale factor for Drawing 1 to Drawing 2 and then take the new length and use the scale factor for Drawing 2 to Drawing 3. The result will be the corresponding side length for Drawing 3.

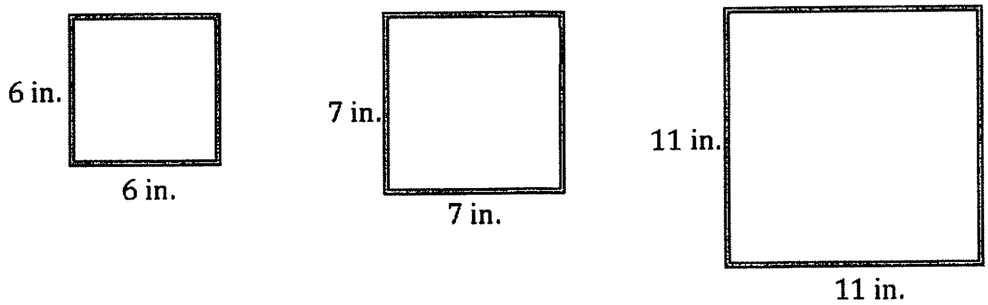
I use the same length that I originally chose for Drawing 1 and use the scale factor for Drawing 1 to Drawing 3 to determine if the side length for Drawing 3 is the same as when I used the two different scale factors.

$(8 \text{ cm})(1.875) = 15 \text{ cm}$

If I use the scale factor from Drawing 1 to Drawing 3, I find that the corresponding length in Drawing 3 will still be 15 cm.

3. Cooper drew a picture in the size of a 6-inch by 6-inch square. He wanted to enlarge the original drawing to a size of 7 inches by 7 inches and 11 inches by 11 inches.

   a. Sketch the different sizes of the drawing.



   b. What was the scale factor from the original drawing to the drawing that is 7 inches by 7 inches?

   $\frac{7}{6} = 1.1\overline{6} = 116\frac{2}{3}\%$

   The scale factor from the original drawing to the drawing that is 7 inches by 7 inches was $116\frac{2}{3}\%$.

   I can check to make sure my answer makes sense because I know the 7×7 is an enlargement of the original drawing. Therefore, the scale factor must be greater than 100%.

   c. What was the scale factor from the original drawing to the drawing that is 11 inches by 11 inches?

   $\frac{11}{6} = 1.8\overline{3} = 183\frac{1}{3}\%$

   The scale factor from the original drawing to the drawing that is 11 inches by 11 inches was $183\frac{1}{3}\%$.

   d. What was the scale factor from the 7×7 drawing to the 11×11 drawing?

   $\frac{11}{7} = 1.\overline{571428} = 157\frac{1}{7}\%$

   The scale factor from the 7×7 drawing to the 11×11 drawing is $157\frac{1}{7}\%$.

e. Write an equation to verify how the scale factor from the original drawing to the enlarged 11×11 drawing can be calculated using the scale factors from the original drawing to the 7×7 drawing.

Scale factor from original to 7×7: $116\frac{2}{3}\%$

Scale factor from the 7×7 *to* 11×11: $157\frac{1}{7}\%$

$6\left(116\frac{2}{3}\%\right) = 6(1.1\overline{6}) = 7$

$7\left(157\frac{1}{7}\%\right) = 7(1.\overline{571428}) = 11$

Similar to Problem 2, I apply two scale factors and see if the final result is the same as only applying the scale factor from the original drawing to the 11×11 drawing.

Scale Factor from 6×6 *to* 11×11: $183\frac{1}{3}\%$

$6\left(183\frac{1}{3}\%\right) = 6(1.8\overline{3}) = 11$

This verifies that the scale factor of $183\frac{1}{3}\%$ *is equivalent to a scale factor of* $116\frac{2}{3}\%$ *followed by a scale factor of* $157\frac{1}{7}\%$.

G7-M4-Lesson 14: Computing Actual Lengths from a Scale Drawing

1. A drawing of a toy car is a two-dimensional scale drawing of an actual toy car. The length of the drawing is 1.8 inches, and the width is 0.55 inches. If the length of an actual toy car is 6.12 inches, use an equation to find the width of the actual toy car.

The length of the drawing of the toy car is 1.8 inches.

The length of the actual toy car is 6.12 inches.

I can use the corresponding lengths to create an equation that will tell me the scale factor that relates the drawing to the actual toy car.

Scale factor:

$$6.12 = \text{Percent} \times 1.8$$

$$\left(\frac{1}{1.8}\right)(6.12) = \text{Percent} \times 1.8 \times \frac{1}{1.8}$$

$$3.4 = \text{Percent}$$

$$3.4 = 340\%$$

The length of the actual toy car is larger than the length of the drawing. Therefore, the scale factor is greater than 1, and the percent is over 100%.

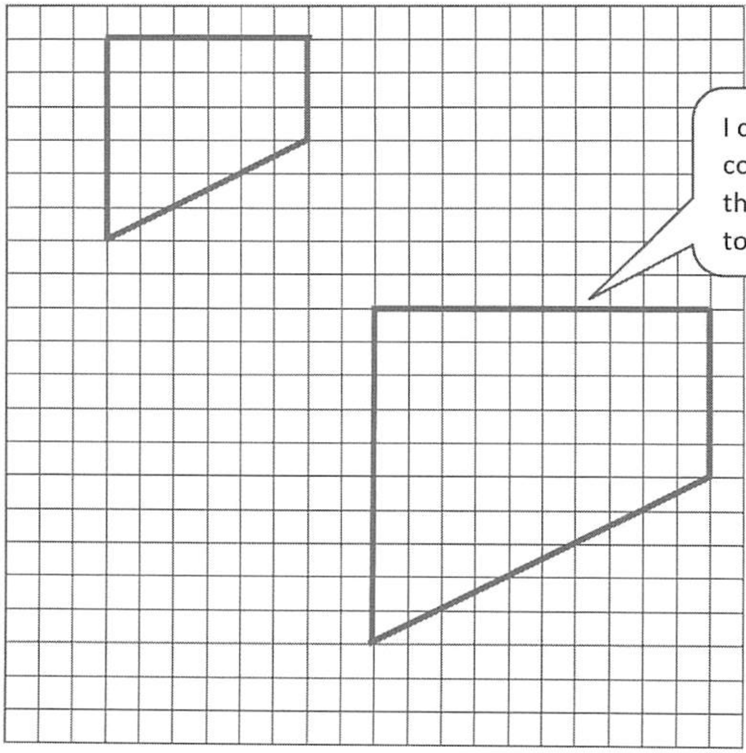
Width of the actual toy car:

$$(0.55)(3.4) = 1.87$$

I can use the scale factor to determine the width of the actual toy car.

The width of the actual toy car is 1.87 inches.

2. The larger quadrilateral is a scale drawing of the smaller quadrilateral. If the distance around the larger quadrilateral is 36.18 units, what is the distance around the smaller quadrilateral? Use an equation to find the distance, and interpret your solution in the context of the problem.



I can use the drawings and count the boxes to determine the horizontal length across the top of each quadrilateral.

The horizontal distance of the smaller quadrilateral is 6 *units.*

The horizontal distance of the larger quadrilateral is 10 *units.*

Scale factor:

$$6 = \text{Percent} \times 10$$

$$\left(\frac{1}{10}\right)(6) = \text{Percent} \times 10 \times \frac{1}{10}$$

$$0.6 = \text{Percent}$$

$$0.6 = 60\%$$

I can write an equation to determine the scale factor. Once I know the scale factor of the horizontal distances, I am able to determine the distance around the smaller quadrilateral.

The distance around the smaller quadrilateral:

$$(36.18)(0.6) = 21.708$$

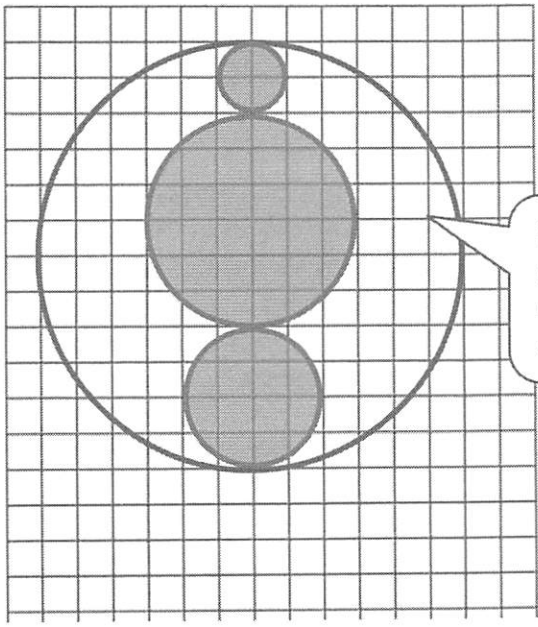
The distance around the smaller quadrilateral is 21.708 *units.*

The lengths of the smaller object are 60% of the lengths of the larger object. So I will multiply the distance around the larger object by 60% to determine the distance around the smaller object.

EUREKA MATH

G7-M4-Lesson 15: Solving Area Problems Using Scale Drawings

1. Use the diagram of the circles to answer the following questions.
   a. What percent of the area of the larger circle is shaded?



I can use the diagram to determine the radius of each of the circles. There are four circles in this diagram, three on the inside and one outside circle.

Shaded small circle: radius $= 1$ *unit*

Shaded medium circle: radius $= 2$ *units*

Shaded large circle: radius $= 3$ *units*

Outside circle: radius $= 6$ *units*

Let A represent the area of the outside circle.

Area of small circle: $\left(\frac{1}{6}\right)^2 A = \frac{1}{36}A$

I can compare the area of each shaded circle to the area of the outside circle. Because we are working with area, I need to square the scale factor that compares the side lengths.

Area of medium circle: $\left(\frac{2}{6}\right)^2 A = \frac{4}{36}A$

Area of large circle: $\left(\frac{3}{6}\right)^2 A = \frac{9}{36}A$

Area of shaded region: $\frac{1}{36}A + \frac{4}{36}A + \frac{9}{36}A = \frac{14}{36}A = \frac{14}{36}A \times 100\% = \left(38\frac{8}{9}\%\right)A$

The area of the shaded region is $38\frac{8}{9}\%$ *of the area of the entire circle.*

b. Using 3.14 as an estimate for π, the area of the outside circle is approximately 113.04 in^2. Determine the area of the shaded region.

If A represents the area of the outside circle, then the total shaded area:

$$\frac{14}{36}A = \frac{14}{36}(113.04) = 43.96$$

I can use the expression that I came up with in part (a) to determine the area. I just need to replace the A with the actual area of the outside circle.

The area of the shaded region is approximately 43.96 in^2.

c. What percent of the outside circle is unshaded?

$113.04 - 43.96 = 69.08$

I know the total area and the area of the shaded region. I can use this to determine the area of the unshaded region. Then, I can use that area to determine the percent.

Therefore, the area of the unshaded region is approximately 69.08 in^2.

The percent of the outside circular region that is unshaded is

$$\frac{69.08}{113.04} = 0.6\overline{1} = 61\frac{1}{9}\%.$$

I could have subtracted the percent the shaded region represents ($38\frac{8}{9}\%$) from 100% because I know the entire area represents 100%.

d. What percent of the area of the medium circle is the area of the large circle?

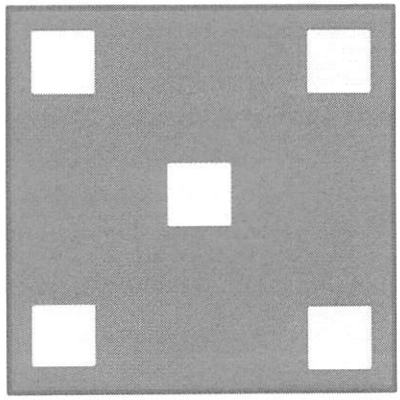
Scale factor: $\frac{3}{2}$

Area: $\left(\frac{3}{2}\right)^2 = \frac{9}{4} = \frac{9}{4} \times 100\% = 225\%$

To determine the percent, I will first write out the scale factor, comparing the radius of the large circle to the radius of the medium circle.

The area of the large circle is 225% *of the area of the medium circle.*

2. On the square page of a menu shown below, five 3-in. by 3-in. squares are cut out for pictures. If these cut-out regions make up $\frac{5}{36}$ of the area of the entire page, what are the dimensions of the page?



Since the cut-out regions make up $\frac{5}{36}$ of the entire page, each cut-out region makes up $\frac{\frac{5}{36}}{5} = \frac{1}{36}$ of the entire page.

To figure out what part of the area is covered by just one square, I can divide by the number of squares.

$$\left(\frac{1}{6}\right)^2 = \frac{1}{36}$$

The scale factor is $\frac{1}{6}$.

In this question, I was given information about the areas, but I need to work backward to determine the side lengths. Because the scale factor was squared to determine the areas, I need to determine what number was squared to determine the scale factor and work toward the side lengths.

To find the dimensions of the square page:

$$\textbf{Quantity} = \textbf{Percent} \times \textbf{Whole}$$

$$\textbf{Small square side length} = \textbf{Percent} \times \textbf{Page length}$$

$$3 \text{ in.} = \frac{1}{6} \times \text{Page length}$$

I can write a percent as a fraction to use in the formula.

$$6(3) \text{ in.} = 6\left(\frac{1}{6}\right) \times \text{Page length}$$

$$18 \text{ in.} = \text{Page length}$$

The dimensions of the square menu page are 18 in. by 18 in.

G7-M4-Lesson 16: Population Problems

1. During a school fundraiser, 70% of customers ordered vanilla ice cream, and 30% of customers ordered chocolate ice cream. Of the customers who ordered vanilla, 80% asked for sprinkles as well. Of the customers who ordered chocolate, 50% asked for sprinkles. What is the percent of customers who ordered sprinkles with their ice cream?

Let c represent the number of customer orders.

I don't know how many customers bought ice cream, so I need to use a variable to represent this value.

Vanilla Orders: $70\% \times c = 0.7c$

Chocolate Orders: $30\% \times c = 0.3c$

I need to multiply the number of orders by the percent of orders that included sprinkles.

Vanilla Orders with Sprinkles: $0.7c \times 0.8 = 0.56c$

Chocolate Orders with Sprinkles: $0.3c \times 0.5 = 0.15c$

Orders with Sprinkles: $0.56c + 0.15c = 0.71c$

I know the percent of vanilla orders with sprinkles and chocolate orders with sprinkles; now I need to determine the total percent of orders with sprinkles.

Therefore, the percent of customers who ordered sprinkles is 71%.

2. The city zoo keeps records on the number of guests they have throughout the year. Last year, 40% of the guests were adults, and 60% of the guests were children. This year, there was an 8% decrease in adult guests and a 3% increase in children guests. What is the percent increase or decrease in guests this year?

Let g represent the number of guests last year.

Adults Decrease: $(0.4g)(0.92) = 0.368g$

I know 40% of the guests were adults.

An 8% decrease means 92% of the number of adult guests from last year went to the zoo this year.

Children Increase: $(0.6g)(1.03) = 0.618g$

60% of the last year's guests were children.

A 3% increase means 103% of last year's children guests went to the zoo this year.

$0.368g + 0.618g = 0.986g$

$100\% - 98.6\% = 1.4\%$

Therefore, the number of guests decreased by 1.4%.

3. A seventh grade math class is made up of 40% girls and 60% boys, and 35% of the entire class is earning an A in the class. If 50% of the girls are earning an A, what is the percent of boys who are earning an A?

Let b represent the percent of boys who are earning an A.

$$0.4(0.5) + 0.6b = 1(0.35)$$

I know the total percentage of A's is 35%. Therefore, the sum of percentages of the girls A's and the boys A's is 35%.

$$0.2 + 0.6b = 0.35$$

$$0.2 + 0.6b - 0.2 = 0.35 - 0.2$$

I use the additive inverse of 0.2 in order to isolate the variable.

$$0.6b = 0.15$$

$$\left(\frac{1}{0.6}\right)(0.6b) = \left(\frac{1}{0.6}\right)0.15$$

I use the multiplicative inverse of 0.6 in order to isolate the variable.

$$b = 0.25$$

Therefore, 25% of the boys are earning an A.

G7-M4-Lesson 17: Mixture Problems

1. A 3-liter container is filled with a liquid that is 40% juice. A 5-liter container is filled with a liquid that is 60% juice. What percent of juice is obtained by putting the two mixtures together?

   Let x represent the percent of juice in the resulting mixture.

   $$3(0.4) + 5(0.6) = 8x$$

   I know there will be a total of 8 liters in the resulting mixture because there is a 3-liter container and a 5-liter container.

   $$1.2 + 3 = 8x$$
   $$4.2 = 8x$$

   In order to solve for x, I must collect the like terms.

   $$\left(\frac{1}{8}\right)(4.2) = \left(\frac{1}{8}\right)8x$$
   $$0.525 = x$$

   I multiply by the multiplicative inverse of 8 in order to isolate the variable.

   Therefore, the resulting mixture will have 52.5% juice.

2. Solution A contains 50 liters of a solution that is 75% hydrochloric acid. How many liters of Solution B containing 50% hydrochloric acid must be added to get a solution that is 60% hydrochloric acid?

   Let b represent the amount of Solution B, in liters, to be added.

   $$50(0.75) + (0.50)b = (0.60)(50 + b)$$

   The final solution will have 50 liters of Solution A and b liters of Solution B.

   $$37.5 + 0.5b = 30 + 0.6b$$
   $$37.5 + 0.5b - 30 = 30 + 0.6b - 30$$
   $$7.5 + 0.5b = 0.6b$$
   $$7.5 + 0.5b - 0.5b = 0.6b - 0.5b$$

   I know that I need to collect like terms, even when they are on opposite sides of the equal sign.

   $$7.5 = 0.1b$$
   $$\left(\frac{1}{0.1}\right)(7.5) = \left(\frac{1}{0.1}\right)(0.1b)$$
   $$75 = b$$

   In order to get the desired solution, 75 liters of Solution B needs to be added.

3. Miguel is consolidating two containers of trail mix. The first container has 2.5 cups and is 70% nuts. The second container is 3 cups. If the resulting trail mix is 50% nuts, what percent of the second container is nuts?

I am trying to determine the percent of nuts in the second container of trail mix.

Let n represent the percent of nuts in the second container of trail mix.

$$2.5(0.7) + 3n = 5.5(0.5)$$

After consolidating, Miguel will have 5.5 cups of trail mix.

$$1.75 + 3n = 2.75$$
$$1.75 + 3n - 1.75 = 2.75 - 1.75$$
$$3n = 1$$

I use my algebraic knowledge to isolate the variable.

$$\left(\frac{1}{3}\right)3n = \left(\frac{1}{3}\right)(1)$$
$$n = \frac{1}{3}$$

The second container of trail mix had $33\frac{1}{3}\%$ nuts.

4. Veronica wants to create a 20-cup mixture of candy with 80% of the candy being chocolate by mixing two bags of candy. The first bag of candy contains 50% chocolate candy, and the second bag contains 100% chocolate candy. How much of each bag should she use?

Let x represent the amount, in cups, in the first bag of candy.

If the first bag of candy has x cups and the total is 20 cups, then I know the second bag will have $20 - x$ cups.

$$0.5x + 1(20 - x) = 0.8(20)$$

Use the distributive property.

$$0.5x + 20 - 1x = 16$$

Collect like terms.

$$-0.5x + 20 = 16$$
$$-0.5x + 20 - 20 = 16 - 20$$
$$-0.5x = -4$$
$$\left(-\frac{1}{0.5}\right)(-0.5x) = \left(-\frac{1}{0.5}\right)(-4)$$
$$x = 8$$

Therefore, Veronica needs to use 8 cups of candy from the first bag and 12 cups of candy from the second bag to get her desired mixture.

G7-M4-Lesson 18: Counting Problems

1. A carnival game requires you to roll a six-sided number cube two times. To determine if you win a prize, you must calculate the product of the two rolls. The possible products are

1	2	3	4	5	6
2	4	6	8	10	12
3	6	9	12	15	18
4	8	12	16	20	24
5	10	15	20	25	30
6	12	18	24	30	36

a. What is the percent that the product will be greater than 20?

Greater than 20 does not include 20.

$\frac{6}{36} = \frac{1}{6} = 16\frac{2}{3}\%$

I know the numerator represents the number of outcomes with a product greater than 20, and the denominator represents the total number of outcomes.

b. In order to win the carnival game, the product can be no more than 10. What percent chance do you have of winning the game?

No more than 10 means the product must be 10 or less.

$\frac{19}{36} = 52\frac{7}{9}\%$

I have about a 53% chance of winning the carnival game.

2. Calleigh loves to accessorize. She always wears three pieces of jewelry using combinations of rings, necklaces, and bracelets. The table shows the different combinations of accessories Calleigh wore with her last eight outfits.

R	B	N	R	B	N	N	B
R	N	B	B	N	R	R	B
R	R	N	B	R	B	B	B

a. What percent of Calleigh's outfits included at least one ring?

At least 1 ring means that Calleigh wears 1 or more rings.

$$\frac{6}{8} = \frac{3}{4} = 75\%$$

There are 6 outfits where Calleigh wore at least one ring and 8 total outfits.

b. What percent of Calleigh's outfits only included one type of accessory?

$$\frac{2}{8} = \frac{1}{4} = 25\%$$

The first and last outfit Calleigh wore only included one type of accessory.