Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2004 Volume V: The Craft of Word Problems

The Art of Interpreting Percent

Curriculum Unit 04.05.04
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Introduction

I have found that 5th grade students have difficulty understanding and solving word problems, particularly problems involving percent concepts. I believe that students often avoid word problems, as they have not yet developed the strategies to successfully master them. Therefore, my goal is to develop a comprehensive and sequential curriculum to teach word problems. I will accomplish this via introducing, supporting, and expounding on the “meaning of percent”. In addition, students increase their retention rates when they can attach real world meaning to the information learned. Consequently, I have utilized everyday situations, which 5th grade students can relate to, in order to increase the likelihood that students will attach meaning and increase retention rates of the lessons.

I have developed an assortment of word problems beginning quite simplistically to address percent in an elementary fashion. These easier problems will become the foundation of the introduction of the unit. I will build on prior knowledge and develop the percent concepts slowly, utilizing many examples and corresponding illustrations. Students should be successful in solving these easier problems, which should lead to excitement and desire to continue to solve progressively more difficult word problems. The problems will increase in difficulty and will culminate with quite challenging word problems for the gifted and talented students. I plan to share my unit with my colleagues, at Jackie Robinson Middle School, as we are developing our vertical teaming approach to mathematics education.

I will utilize many problem solving strategies to teach students that the “meaning of percent” is per 100. Percent means per hundredths. Therefore, one whole is equivalent to 100 hundredths. Any percent less that 100 hundredths or 100% is equivalent to a fraction with a value less than 100%. When a percent is greater than 100% it represents an equivalent improper fraction.

Lesson 1

Goal: Students will visualize the use of a number line of fractions and their corresponding percentages. The meter system will provide an easy point of reference for measurement, fractions, and percentage. Students will become comfortable with recognizing common fractions and their corresponding percentages. Students will complete a KWL, which will enable the class to build on prior knowledge as it relates to percentages. Students will write in their math journals and begin making individual time lines that will correspond to the class clothes line, time line.

Before the students arrive, set up a clothes line suspended ten meters across the back of the room. (Any even number of meters will work easily, if utilizing a length of ten meters then the 50% and 1/2 location will be five meters from the end point.) Provide index cards to write the fractions on the bottom of the index card and the corresponding percentages above the fractions, as they are discovered. Equivalent fractions will be written on separate index cards and attached via a paperclip to existing fractions already located on the clothes line. There will be numerous equivalent fractions suspended from the original fractions via paperclips. For example, index cards with the following fractions will be attached to the 50% index card 1/2 , 2/4, 3/6, 4/8, 5/10, and 6/12. The cards will be attached via paperclips and left in place during the entire unit. (See Table VIII, IX, and X) This will be a wonderful visual aide of fractions and their corresponding percentages, which should assist the students in their understanding of each concept and how they relate to each other.

I recommend utilizing the strategy of “KWL”, (what the students “Know”, what they “Want” to learn, and what they have “Learned”); about percent. This strategy is an effective means to determine prior knowledge, which should be posted on a permanent board to review as needed, during the unit. As the students learn about percent they can verify whether or not their “knowledge” was accurate and erase anything that is determined to be inaccurate, as it is proven. In addition, keep a record of the things students “Want” to learn about percent. This list should be developed and posted during the class “KWL” brainstorming discussion, which should be added to by the students anytime during the discovery of percent unit.

My students will be expected to utilize their math journals to identify information that the students have discovered and proven to be accurate. This daily journal will include mathematical calculations, illustrations, written documentation and reflections. The students should be well versed in journal writing as studies have shown that writing about mathematics enhances understanding.

I will introduce percent as, a number that expresses a relationship between two numbers. Percentages are like fractions: just as a fraction is of an associated whole, a percentage is of some number. In fact, the numerator of a fraction with denominator of 100 is also the percentage. Because every fraction can be expressed as a decimal, therefore every percentage can also be expressed as a decimal.

In addition, each student will make a number line which will correspond to the class clothes line. Utilizing large paper held length wise the students should draw a line in the center of the paper. The percentages will be put above the number line and the corresponding fractions will be listed below the line. This will be an individual work in progress which will be added to daily. (See Table VIII, IX, and X)

Lesson 2

Goal: Students will reinforce their understanding of the metric system as it easily relates to percentage. One meter equals 100 centimeters; therefore, one centimeter equals one percent of a meter. Likewise, 50 centimeters equals 50 percent of a meter and 25 centimeters equals 25 percent of a meter. In addition, the students will appreciate that fractions relate to percentage.

Initiation: I will hold up a rope one meter long. I will ask, “I am holding this rope, what percent refers to the entire (whole) rope. I will anticipate answers such as 100% or the whole thing. After a brief discussion about the percentage of the rope I will verify that the entire rope represents 100%, which is the whole rope represented by 1. I will print 100% on the top of an index card and 1 on the bottom of the card then ask for a volunteer to attach it to farthest point on the right of the clothes line at the back of the room. In addition, I will fill out a zero on another card and ask to have that added to the farthest point on the left of the number line.

Secondly, I will fold my rope in half and show the students two equal parts of the rope. The measurement of each half will be 50 centimeters as 50/100 = 1/2. Next, I will dangle one of the pieces such that I am holding only 1/2 of the rope. Then I will ask, “What fraction represents the piece of rope that I am currently holding?” I expect the students will know that 1/2 is the answer that I am looking for. I will then ask, “who can tell me what percentage this rope represents?” I trust some students will know that the rope is now just 50% of its former size. After some discussion, I will label 50% and 1/2 on the index card and ask for a volunteer to attach it to the middle of the clothes line at the back of the room. (At the five meter mark)

Thirdly, I will fold my rope in half again and ask, “What fraction represents the piece of rope I am holding now?” Responses should be 1/4 and 25%. (Attach to clothes line at the 2.3 meter mark) Next I will hold 1/4 of the rope and dangle the balance. I will ask, “Who can tell me what percentage is left over?” I expect answers of 3/4 or 75%. (Attach to clothes line at the 7.5 meter mark)

Finally, I will repeat the process with the students to include the following: 4/4 and 100%, 1/5 and 20%, 2/5 and 40%, 3/5 and 60%, 4/5 and 80%, 5/5 and 100%. The above fractions and corresponding percentages will be added to the class clothes line and the students’ individual number lines. (See Table VIII, IX, X)

Lesson 3

Goals: Students must appreciate the relationship between fractions, decimals, and percentage. Students will become comfortable with converting fractions and decimals to percentages and vice versa. When one has a fraction and desires to determine the percentage one can do the following. Take the original fraction and make an equivalent fraction with a denominator of 100. Rewrite the numerator and add a percent sign to determine the percentage. (See the left column below) This works because percentage is some number out of 100.

Percents can also be expressed as lowest-term fractions. Simply take the numerical percentage without the percent symbol and use this as the numerator with 100 as the denominator. Then find an equivalent fraction

by dividing the numerator and the denominator by the same number. This can be repeated until *one* is the only common factor of the numerator and the denominator, resulting in the lowest-term fraction. (See the right column below)

Fraction to Percent Percent to Fraction

1/2 = 50/100 = 50% 50% = 50/100 = 25/50 = 5/10 = 1/2

1/4 = 25/100 = 25% 25% = 25/100 = 5/20 = 1/4

3/4 = 75/100 = 75% 75% = 75/100 = 15/20 = 3/4

4/4 = 100/100 = 100% 100% = 100/100 = 1

If an equivalent fraction with a denominator of 100 is not easily determined then one may divide the fraction and calculate the decimal. The resulting number is not always an exact whole number percent. Therefore, one must approximate or round the answer. In fact, percentages allow amounts less than 1/100 of a given whole number to be small enough to ignore. When we have a number which would require a fraction of a percent to be expressed, we frequently round it to the nearest whole percent. Once the decimal is calculated and rounded then move the decimal two places to the right and add a percentage sign. (See column below on left) The same answer can be calculated by taking the decimal and multiply by 100 and added a percentage sign to the answer. (See column below on right)

Fraction to Percent Decimal to Percent

2/3 = 0.67 = 67% 0.67 x 100 = 67%

5/6 = 0.83 = 83% 0.83 x 100 = 83%

7/8 = 0.88 = 88% 0.88 x 100 = 88%

4/7 = 0.57 = 57% 0.57 x 100 = 57%

In addition, when one has a percentage one can remove the percentage sign and move the decimal two places to the left to determine the decimal. This formula works because it is the same outcome as if one took the decimal and multiplied it by 100. (See chart below)

Percent to Decimal Decimal to Percent

25% = 0.25 0.25 x 100 = 25%

50% = 0.50 0.50 x 100 = 50%

75% = 0.75 0.75 x 100 = 75%

100% = 1.00 1.00 x 100 = 100%

Lesson 4

Goal: Students will appreciate that when the total numbers add up to100 one can easily calculate the decimal and percentages. When students have the opportunity to see the relationship between the fractions, decimals and percentage then they are able to transfer that knowledge to more difficult problems. Listed below are problems which I have solved and would be useful to solve with the students during the initiation portion of the lesson. For example, write 30 out of 100 as 30/100 = 0.30 = 30% (For the problems involving pets in lesson assume that no student owns more than one pet)

Part of a Whole as a Percentage, using Totals of 100

Table I Number Of Pets Owned By Students

Number of students who own pet(s) 40
Number of students who do not own pet(s) 60
Total number of students 100

Problem 1.

A. What percent of the students own pets?

B. What percent of the students do not own pets?

Answers

A. 40/100 = 0.40 = 40%

B. 60/100 = 0.60 = 60%

Table II Number Of Pets Owned By Students

Number of students who own dog(s) 30
Number of students who own guinea pig(s) 25
Number of students who own fish 15
Number of students who own cat(s) 20
Number of students who do not own pets 10

Problem 2.

A. What percent of students own dog(s)?

B. What percent of students own guinea pig(s)?

C. What percent of students own fish?

D. What percent of students own cat(s)?

E. What percent of students do not own pets?

Answers

A. 30/100 = 0.30 = 30%

B. 25/100 = 0.25 = 25%

C. 15/100 = 0.15 = 15%

D. 20/100 = 0.20 = 20%

E. 10/100 = 0.10 = 10%

Parts of a Whole as a Percentage, using Totals other than 100:

Once the students have an understanding of calculating percentages with totals equaling

100 then I will introduce totals of different amounts.

Table III Number of Students Who Attend Summer Camp

Number of students who attend summer camp 60
Number of students who do not attend summer camp 20
Total number of students 80

Problem 3.

A. What percent of the students attend summer camp?

B. What percent of the students do not attend camp?

Answers

A.60/80 = 0.75 = 75%

B.20/80 = 0.25 = 25%

Table IV Number Of Pets Owned By Students

Number of students who own dog(s)	35
Number of students who own guinea pig(s)	40
Number of students who own fish	25
Number of students who own cat(s)	30
Number of students who do not own pets	20
Total number of students	150

Problem 4.

A What percent of students own dog(s)?

B What percent of students own guinea pig(s)?

C What percent of students own fish?

D What percent of students own cat(s)?

E What percent of students do not own pets?

Answers

A.35/150 = 0.23 = 23%

B.40/150 = 0.27 = 27%

C.25/150 = 0.17 = 17%

D.30/150 = 0.20 = 20%

E.20/150 = 0.13 = 13%

Adding percent quantities

To solve percentage problems which require addition one must either: (1) Add the number of items and then calculate the percentage. or (2) Find the percentages and add them together.

Problem 5 Utilize Table IV, what percentage of the students own fish and cats?

(1) fish owners = 15 & cat owners = 20 therefore,15 + 20 = 35 and 35/100 = 35%

(2) fish owners = 15% & cat owners = 20% therefore, 15% + 20% = 35%

Problem 6 Utilize Table IV solve the following utilizing (1) formula:

A. What percent of the students own dogs or fish?

B. What percent of the students own dogs or cats?

C. What percent of the students own dogs, cats, or fish?

D. What percent of the students own guinea pigs, cats, & fish?

Answers

A. 30 + 15 = 45/100 = 45%

B. 30 + 20 = 50/100 = 50%

C. 30+20 +15 = 65/100=65%

D. 25 + 20 + 15 = 60/100 = 60%

Problem 7 Utilize Table IV to solve the following utilizing (2) formula:

A. What percent of the students own dogs or fish?

B. What percent of the students own dogs or cats?

C. What percent of the students own dogs, cats, or fish?

D. What percent of the students own guinea pigs, cats, or fish?

Answers

A. 30% + 15% = 45%

B. 30% + 20% = 50%

C. 30% +20% +15% = 65%

D. 25%+ 20%+15%=60%

Table V Number of Pets owned by Students

Number of students who own dog(s) 35

Number of students who own cat(s) 40

Number of students who own both dog(s) and cat(s) 25

Number of students who do not own any pets 50

Problem 8 A. What percent of the students own either a dog, cat, or both?

35 dogs + 40 cats =75 dogs/cats - 25 dogs/cats = 50 dogs/cats

Answer: 50/100 = 0.50 = 50%

B. What percent of the students own both dogs/cats = 25/100 = 0.25 = 25%

Table VI Chores Percentage

Clean up room 35%

Wash dishes 10%

Take out trash 15%

Walk the dog 20%

Feed the cat 8%

No chores 12%

Utilizing the formulas above solve the following problems, utilizing Table VI. For ease of calculations one must assume that each child only performs one chore.

Problem 9

A. What fraction/decimal of the students clean up room?

B. What fraction/decimal of the students wash dishes?

C. What fraction/decimal of the students take out the trash?

D. What fraction/decimal of the students walk the dog?

E. What fraction/decimal of the students feed the cat?

F. What fraction/decimal of the students have no chores?

G. What fraction/decimal of the students walk the dog and clean up room?

H. What percent/decimal of the students feed the cat and wash dishes?

I. What percent/decimal of the students take out the trash, feed the cat, and walk the dog?

Table VII Ice Cream Preferences of Students

Flavors Preference

Rocky Road 1/15

Chocolate Chip Cookie Dough 1/9

Mint Chocolate Chip 1/18

Vanilla 1/3

Strawberry 1/10

Chocolate 4/36

Coffee 2/9

Problem 10

A. What percentage of students prefer Rocky Road?

B. What percentage of students Chocolate Chip Cookie Dough?

C. What percentage of students Mint Chocolate Chip?

D. What percentage of students Vanilla?

E. What percentage of students Strawberry?

F. What percentage of students Chocolate?

G. What percentage of students Vanilla?

Lesson 5

Goal: The students should have an understanding of the relationship between fractions and percentages. They should also be comfortable converting fractions to decimals and percentages and vice versa. At this point in the unit the students will be exposed to formulas to solve real world problems. When solving the word problems in this unit the following notations will be utilized.

Notation

Q = Whole Quantity
P = Percent
I = Incremental Part of the Whole Quantity
D = Decimal
T = Total

Decimal conversions

I will explain that many calculators do not have the “percent key” and that students should possess the knowledge to calculate percentage problems utilizing a decimal. Therefore, the earlier lessons of changing a percent to a decimal will be instrumental in order to solve the following problems. The corresponding formulas are listed below for conversions of Decimal to Percent and vice versa.

The Decimal is calculated by dividing the percent, without the% sign, by 100.

Decimal = P/100

0.75 = 75 / 100

Decimal = P/100

1.25 = 125/100

The Percent is calculated by multiplying the Decimal by 100, then adding a% sign to the answer. Listed below are the calculations.

Percent = D x 100

75% = 0.75 x 100

Percent = D x 100

125% = 1.25 x 100

Revisit the principal that Percent = Fraction=Decimal therefore, 75% = 75/100 = 0.75

Sales Tax

Students will appreciate how to determine the sales tax as a function of the cost of an item. In Connecticut the sales tax on non essential purchases is 6% and students should understand how the tax is calculated. The following lesson teaches the practical, real world aspects of calculating percent. When one encounters sales tax it is usually listed as a Percent of the Whole Quantity and therefore, added to the Total Cost.

Solving for the Incremental Part of the Whole “I” when the Percent “P” and the Whole Quantity “Q” are known:

The most common type of percentage problem is one in which the Percent and the Whole Quantity are known and the Incremental Part of the Whole must be calculated.

Solving for the Incremental Part of the Whole using Percent:

Problem 1. Tyesha purchased a CD for $20 and the sales tax was 6%, how much did Tyesha pay for the CD including the sales tax?

Whole Quantity Q x Percent P = Incremental Part of the Whole Quantity I

$20 x 6% = $1.20

Whole Quantity Q + Incremental Part of the Whole Quantity I = Total T

$20 + $1.20 = $21.20

Answer 1. Tyesha paid $21.20 for the CD including the sales tax.

Solving for the Incremental Part of the Whole using a Decimal:

Problem 2. Tyesha purchased a CD for $20 and the sales tax was 6%, how much did Tyesha pay for the CD including the sales tax?

Whole Quantity Q x Decimal D = Incremental Part of the Whole Quantity I

$20 x 0.06 = $1.20

Whole Quantity Q + Incremental Part of the Whole Quantity I = Total T

$20 + $1.20 = $21.20

Answer2. Tyesha paid $21.20 for the CD including the sales tax.

Solving for the Incremental Part of the Whole Quantity, using Percent:

Problem 3. Hercules purchased a basketball for $18.50, the sales tax was 6%. How much did Hercules pay for the basketball including the sales tax?

Q x P = I

$18.50 x 6% = $1.11

Q + I = T

$18.50 + $1.11 = $19.61

Answer 3. Hercules spent $19.61 for the basketball including the sales tax.

Solving for the Incremental Part of the Whole, using a Decimal:

Problem 4. Hercules purchased a basketball for $18.50, the sales tax was 6%. How much did Hercules pay for the basketball including the sales tax?

Q x D = I

$18.50 x .06 = $1.11

Q + I = T

$18.50 + $1.11 = $19.61

Answer 4. Hercules spent $19.61 for the basketball including the sales tax.

Solving for Percent “P” when the Whole Quantity “Q” and the Incremental Part of the Whole Quantity “I” are Known.

One may encounter problems where knowledge of the Whole Quantity Q and Incremental Part of the Whole Quantity I are given and the Percent P must be determined. In this case the formula is listed below:

Decimal D = Incremental Part of the Whole Quantity I / Whole Quantity Q D = I / Q

Percent P = Decimal D x 100

Problem 5. Assume that Juanita purchased a baseball cap for $15.00 and the sales tax was $0.90, what percentage was the sales tax.

D = I / Q

D = $0.90 / $15.00

.06 = $0.90 / $15.00

D = .06

P = D x 100

P = 0.06 x 100 = 6%

Answer 5. Juanita was charged 6% sales tax on the purchase of a baseball cap.

Problem 6. Miguel mows lawns in the neighborhood and earns $25.00 per week. He gives $2.00 to his church each week, what percentage of his earnings does he contribute to his church weekly?

D = I / Q

D = $2.00 / $25.00

D = 0.08

P = D x 100

P = 0.08 x 100 = 8%

Answer 6. Miguel contributes 8% of his earnings to church each week.

Solving for the Whole Quantity “Q” when the Percent “P” and the Incremental Part of the Whole Quantity “I” are Known:

A third situation occurs when the Percent and Incremental Part of the Whole Quantity are known and the Whole Quantity must be calculated. In this case the formula is listed below.

Solving for the Whole Quantity utilizing percent:

Problem 7. Carlos ate lunch at his favorite restaurant and left a $12.00 tip. The tip represents 20% of the cost of the meal, how much did the meal cost?

Q = I / P

Q = $12.00 / 20%

Q = $60.00

Answer 7. Carlos spent $60.00 on his lunch without the tip. The entire cost for the lunch including the tip was $60.00 + $12.00 = $72.00

Solving for the Whole Quantity utilizing a decimal:

Problem 8. Carlos ate lunch at his favorite restaurant and left a $12.00 tip. The

tip represents 20% of the cost of meal, how much did the meal cost?

Q = I / D

Q = $12.00 / 0.20

Q = $60.00

Answer 8. Carlos spent $60.00 on his lunch without the tip. The entire cost for the lunch including the tip was $60.00 + $12.00 = $72.00

Solving for the Whole Quantity utilizing percent:

Problem 9. Janaya is a waitress at the Rusty Scupper. She earns 15% of the dinner bill in tips for parties of eight and over. Saturday night she made $37.50 in tips for a party of ten. How much was the dinner bill? How much did the party of ten pay for dinner including the tip?

Q = I / P

Q = $37.50 / 15%

Q = $250.00

Answer 9. Janaya's party of ten spent $250 for dinner. The total bill including the tip was $250 + $37.50 = $287.50.

Solving for the Whole Quantity utilizing a decimal

Problem 10. Janaya is a waitress at the Rusty Scupper. She earns 15% of the dinner bill in tips for parties of eight and over. Saturday night she made $37.50 in tips for a party of ten. How much was the dinner bill? How much did the party of ten pay for dinner including the tip?

Q = I / D

Q = $37.50 / 0.15

Q = $250.00

Answer 10. Janaya's party of ten spent $250 for dinner. The total bill including the tip was $250 + $37.50 = $287.50.

Lesson 6

Goal: Students will appreciate that a percentage of one quantity can relate to another quantity and vice versa. This concept is important when comparing one quantity to another such as the savings of one person in relationship to the savings of another.

Whole Quantity as a Percentage of Another Quantity

Problem 1.A Sharrard and Leighton are saving money to purchase a motorcycle Sharrard has saved $250 and Leighton has saved $400. Express Leighton's savings as a percentage of Sharrard's savings.

Answer 1. A. Sharrard's savings of $250 equals 100% therefore, 100/250 x $400 = 160%. Leighton's savings is 160% of Sharrard's savings. Leighton saved $150 more than Sharrard, which represents a savings of 60% more than Sharrard.

Problem 1. B.Express Sharrard's savings as a percentage of Leighton's savings.

Answer 1. B. Leighton's savings of $400 equals 100% therefore,100/400 x $250 = 62.5%

Sharrard's savings is 62.5% of Leighton's savings. Sharrard saved $150 less than Leighton, which represents a savings of 37.5% less than Leighton.

Problem 2. A. Jackie and Erika are saving money to purchase a sailboat. Jackie saved $1,200 and her sister Erika saved $800. Express Jackie's savings as a percentage of Erika's savings.

Answer 2. A. Erika's savings of $800 equals 100% therefore, 100/800 x $1,200 = 150%.

Jackie's savings is 150% of Erika's savings. Jackie saved $400 more than Erika which represents a savings of 50% more than Erika.

Problem 2. B. Express Erika's savings as a percentage of Jacki's savings.

Answer 2. B. Jacki's savings of $1,200 equals 100% therefore,100/$1,200 x $800 = 66.7%. Erika's savings is 66.7% of Jacki's savings. Erika saved $400 less than Jackie, which represents a savings of 33.3% less than Jackie.

Percentage Change

Goal: Students should be able to calculate a percentage change such as an increase or decrease of a given item. If the percentage change is an increase then add the percentage increase to 100 percent. Then multiply

the new rate by the current price to obtain the new price. If the percentage change is a decrease then subtract the percentage decrease from 100 percent. Then multiply the new rate by the current price to obtain the new price.

Problem 3. If gas costs $1.85 per gallon and the gas prices increase by 4%, what is the new price of the gas?

Answer 3. Take 100% plus 4% = 104%

The resulting rate is 104% of $1.85 = 1.04 x $1.85 = $1.92 per gallon.

Problem 4. If gas costs $1.79 per gallon and the gas prices increase by 3%, what is the new price of the gas?

Answer 4. Take 100% plus 3% = 103%

The resulting rate is 103% of $1.79 = 1.03 x $1.79 = $1.84 per gallon.

Problem 5. If gas costs $1.97 per gallon and the gas prices decrease by 5%, what is the new price of the gas?

Answer 5. Take 100% less 5% = 95%

The resulting rate is 95% of $1.97 = 0.95 x $1.97 = $1.87 per gallon.

Problem 6. If gas costs $1.95 per gallon and the gas prices decrease by 7%, what is the new price of the gas?

Answer 6. Take 100% less 7% = 93%

The resulting rate is 93% of $1.95 = 0.93 x $1.95 = $1.81 per gallon.

Problem 7. Antwayne wanted to purchase a basketball with an original price of $36. His mother said he could purchase it only if it was reduced by 12%. What price must the basketball become before Antwayne's mother will allow him to purchase it?

Answer 7. Take 100% less 12% = 88%

The resulting rate is 88% of $36 = 0.88 x $36 = $31.68 for the basketball.

Problem 8. Chantelle was selling a hand knit sweater for $42. She claimed the price would increase by 15% in two weeks. What will be the new price in two weeks?

Answer 8. Take 100% plus 15% = 115%

The resulting rate is 115% of $42 = 1.15 x $42 = $48.3 for the sweater.

Simple Interest

Goals: The students will appreciate that interest is a sum of money earned or charged as a percentage of a given amount. Banks will pay a customer a rate of interest in the form of a percentage of money which the customer allows the bank to borrow. In addition, if one borrows money from a bank in the form of a loan. The borrower agrees to pay back the amount borrowed plus interest, which is an agreed upon percentage rate. In addition, the time period is usually specified, ie the term of the loan may be 1, 2, 5, or $15 years. Also, an

individual may desire to put a large sum of money into a certificate of deposit, which yields higher than normal rates of interest, usually for more than two years. The formula for solving Simple Interest is as follows: Interest Earned = Money x Interest Rate x Time

Problem 9. Find the simple interest on $950 at 8% per year for 3 years.

Answer 9. Interest Earned = $950 x 8% = $950 x 0.08 = $76/year

Interest Earned = $76 x 3 years = $228

Problem 10. Find the simple interest on $1,578 at 5% per year for 8 years.

Answer 10. Interest Earned = $1,578 x 5% = $1,578 x 0.05 = $78.90/ year

Interest Earned = $78.90 x 8 years = $631.20

Problem 11. Find the simple interest on $1,460 at 3% per year for 9 months.

Answer 11. Interest Earned = $1,460 x 3% = $1,460 x 0.03 = $43.8

Interest Earned = $43.8 x 9/12 months = $32.85

Percent Problems

1. Forty fifth graders were planning a class trip. Half (1/2) of the students wanted to go to the movies.

A. What percent of the students wanted to go to the movies?

B. How many students wanted to go to the movies?

2. Sixty fifth graders were planning a class trip. Three fourths (3/4) of the students wanted to go the new Harry Potter movie.

A. What percent of the students wanted to see the Harry Potter movie?

B. How many students wanted to see the Harry Potter movie?

C. How many students did not want to see the Harry Potter movie?

3. One hundred sixth graders were planning a class trip. One half of the students wanted to go to Six Flags Amusement Park, one fourth of the students wanted to go bowling, the rest of the students wanted to have lunch and play games at the park.

A. What percent of the students wanted to go to Six Flags?

B. How many students wanted to go to Six Flags?

C. What percent of the students wanted to go bowling?

D. How many students wanted to bowling?

E. What percentage of the students wanted to have lunch and play games at the park?

F. How many students wanted to have lunch and play games at the park?

4. Express each fraction as a decimal and percent.

A. 8/100

B 35/100

C 76/100

D 43/100

E 69/100

F 97/100

5. Express each percentage as a fraction and then write the fraction in its simplest form.

A. 6%

B. 18%

C. 45%

E. 78%

F. 86%

G. 94

6. If 65 out of 125 students ride the bus to school, what percentage of the students ride the school bus?

7. Tanika walks to school 20 out of 25 mornings. Express this ratio as a lowest term fraction and a percentage.

8. Gerald washed 10 out of the 25 cars during a fund raiser. Express this ratio as a fraction and a percentage.

9. Cecil washed 2/3 of the cars during a fund raiser. If 30 cars were washed what percentage of the cars did Cecil wash?

10. Johnny is playing Super Nintendo with his friend Rahim. Johnny won 12 games and Rahim won 18 games. What percentage of the games has Rahim won?

11. Shawnice bought a pair of Nike sneakers for $35.00, tax was 5%.

A. How much tax did Shawnice pay?

B. What was the total cost for the sneakers plus the tax?

12. Taniqua bought a pair of jeans for $25.00, tax was 6%.

A. How much tax did Taniqua pay?

B. What was the total cost for the jeans plus the tax?

13. Kylon bought a Yankees sweatshirt on sale. The original price was $50.00, the discounted price was 15% off the original price.

A. How many dollars was the discount?

B. What amount did Kylon pay for the sweatshirt?

14. Allen bought a Michael Jordan T-shirt on sale. The original price was $30.00, the discounted price was 18% off of the original price.

A. How many dollars was the discount?

B. What amount did Allen pay for the T-shirt?

15. Dr. Carberry took her girls leadership group of 20 students to lunch. The bill for lunch was $200.00. Dr. Carberry was pleased with the service and wanted to leave a 20% tip.

A.How many dollars should Dr. Carberry leave as a tip for the waitress?

B.How much money will the lunch cost including the tip?

16. Jack and Jill are playing marbles together. Jack has 35 green marbles and Jill has 60 red marbles; together they have 95 marbles. If Jack wins 25% percent of Jill's marbles, how many marbles will Jill have?

17. Kendall brings $2.69 to the local toy store. She wants to buy a "Super Ball". The ball costs $2.50 plus six percent sales tax. Does Kendall have enough money to buy the "Super Ball"?

18. JRMS boys basketball team played a game against West Haven. The total number of points scored by JRMS was 28. West Haven scored only 50% as many points as JRMS

A. How many points did West Haven score?

B. How many more points did JRMS score than West Haven?

19. JRMS girls basketball team played East Haven. JRMS scored 56 points and East Haven scored 25% as many points as JRMS.

A. How many points did East Haven score?

B. How many more points did JRMS score than East Haven?

20. One student gave her teacher a bouquet of flowers. There were 10 red carnations, 18 pink carnations, 5 yellow carnations and 7 daffodils. How many of the total flowers, to the nearest whole percent, were pink carnations?

21. At a gymnastics meet 65 medals were given to exceptional performers. There were

22 silver medals and 17 gold medals. The balance of the medals were bronze. What percentage of the medals were bronze?

22. Marty found a CD player on sale for $45 off of the original price, which represents a discount of 15%. What was the original price?

23. On the last day of school before Christmas, Julie brought 25 candy canes to her class. At the end of the day, 14 of the candy canes have been eaten, what percent are left?

24. Tim, Jim and Tom are all sharing a big blueberry pie. Tim takes the first slice and ends up taking 20 percent of the pie. Jim then takes 50 percent of the remaining amount of pie. What percent of the pie does Tom get?

25. Tyler, James, and Ralph share a pizza. Tyler takes the first slice, which is 40 percent of the pizza. James takes 30 percent of the remaining amount of the pizza. What percent of the pizza is left for Ralph?

26.Joshua spends 35 percent of his weekly allowance on entertainment, 45 percent on eating out, and 8 percent on new clothes. He saves the balance of his allowance, what percentage does he save each week?

27. Using the information from #26 and assuming Joshua has $50.00 from his allowance.

A. How much money does Joshua spend on entertainment?

B. How much money does Joshua save from his $50.00 in allowance?

28. At the New Haven Hotel 108 rooms have window views which represents 80% of the rooms. The rest of the rooms have views of the hallway. How many rooms do not have window views?

29. Lauren bought a pair of roller blades with an original price of $56.00. She was able to reduce the cost by 15% by using her discount coupon. How much money did Lauren pay for the roller blades?

30. Marcus bought a skate board on sale for $38.40, it was originally $48.00. What percentage was the discount?

31. Miles correctly answered 90% of the 80 questions on a math test. Jordan correctly answered 85% of the questions on the same test. How many more questions did Miles answer correctly.

32. Elena found a designer purse on sale, for 30% off the regular price of $19.95. The same purse is selling for $15.50 at a local boutique. Which purse is less expensive and by how much?

33. Cordell was planning to purchase a digital camera and began to comparison shop. At the camera shop the model he preferred was 25% off the original price of $124.00.

Then Cordell found a coupon which allowed him to take an additional15% off of the reduced price.

A. Is the discounted price more or less than $75.00 and by how much?

B. Is taking 25% and 15% the same as taking 40%? Explain?

34. Allen and Mustafa are saving money to purchase a go-cart. Allen has saved $75 and

Mustafa has saved $50.

A. Express Allen's savings as a percentage of Mustafa's savings.

B. Express Mustafa's savings as a percentage of Allen's.

35. Michale and Quaniesha are saving money to purchase a puppy. Quaniesha has saved

$65 and Michale has saved $105.

A. Express Quaniesha's savings as a percentage of Michale's savings.

B. Express Michale's savings as a percentage of Quaniesha's savings.

36. August and Taylor are saving money to attend a Mets game. August has saved $65 and Taylor has saved $35. August claims that she has saved 50% more than Taylor, is August correct?

37. If gas costs $1.87 per gallon and the gas prices increase by 6%, what is the new price of the gas?

38. If gas costs $1.77 per gallon and the gas prices decrease by 8%, what is the new price of the gas?

39. Angeline saw a backpack for $35 and the price decreased by 5% on sale, what is the new price of the backpack?

40. Carlos wanted to purchase a baseball cap for $23, the price was going to increase by 5% in one week. How much will the baseball cap cost in one week?

41. Mary wanted to deposit $450 in the bank at an interest rate of 5% for one year. How much interest will Mary earn in one year?

42.Calvin deposited $1,980 in a certificate of deposit at an interest rate of 7% for 3 years.

A. How much interest will Calvin earn in three years?

B. How much money will Calvin have including interest in three years?

43. Marcus borrowed $4,500 from a local bank at a 12% interest rate for 9 months.

How much interest will Marcus have to pay the bank after 9 months?

TABLE VIII NUMBER LINE

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

0 1/2 2/2

0 1/3 2/3 3/3

0 1/4 2/4 3/4 4/4

0 1/5 2/5 3/5 4/5 5/5

0 1/6 2/6 3/6 4/6 5/6 6/6

0 1/8 2/8 3/8 4/8 5/8 6/8 7/8 8/8

0 1/10 2/10 3/10 4/10 5/10 6/10 7/10 8/10 9/10 10/10

0 1/12 2/12 3/12 4/12 5/12 6/12 7/12 8/12 9/12 10/12 11/12 12/12

@1H: TABLE IX METRIC MEASUREMENT 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 meter

0 1 2 3 4 5 6 7 8 9 10 dm

0 10 20 30 40 50 60 70 80 90 100 cm

Key: 1 m (meter) = 10 dm (decimeters) = 100 cm (centimeters)

TABLE X METRIC MEASUREMENT

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

0 1 2 3 4 5 6 7 8 9 10 meters

0 1/2 2/2

0 1/3 2/3 3/3

0 1/4 2/4 3/4 4/4

0 1/5 2/5 3/5 4/5 5/5

0 1/6 2/6 3/6 4/6 5/6 6/6

0 1/8 2/8 3/8 4/8 5/8 6/8 7/8 8/8

0 1/10 2/10 3/10 4/10 5/10 6/10 7/10 8/10 9/10 10/10

0 1/12 2/12 3/12 4/12 5/12 6/12 7/12 8/12 9/12 10/12 11/12 12/12

Standards

Listed below are the New Haven Mathematics Framework Performance Standards, which

“The Art of Interpreting Percent” curriculum unit is derived from.

Content Standard 1.0: Number Concepts, Arithmetic, and Operation Concepts:

Students will work comfortably and confidently within the real number system and its Operations. They will make comparisons, recognize patterns, and use multiple Representations of the same number.

Performance Standard 1.2:

Students will describe and compare quantities and compute using fractions and decimals.

a. Students will consistently and accurately compute with, apply, and convert among the different kinds and forms of rational numbers, including negative numbers, numbers written as decimals or percents and or proper and improper or mixed fractions.

Performance Standard 1.4:

Students will interpret percent as part of 100 and as a means of comparing quantities of different sizes or changing sizes.

a. Students will interpret percent as part of 100.

b. Students will use percents to compare quantities of different or changing sizes.

c. Students will apply percent concepts to solve problems.

Performance Standard 1.6:

Students will order numbers.

b. Students will locate numbers on a number line.

c. Students will demonstrate a sense of magnitudes and relative magnitudes.

Content Standard 5.0: Problem Solving and Mathematical Reasoning:

Problem solving concepts and strategies lie at the heart of mathematics. Students will use them in the formulation of problems and the solution of problems. They will appropriately test problem conclusions against conditions. They will reason mathematically.

Performance Standard 5.3:

Students will use and invent a variety of approaches and understand and evaluate those of others.

a. Students will invoke problem solving strategies, such as illustrating with sense- making sketches to clarify situations or organizing information in a table.

b. Students will determine, where helpful, how to break a problem into simple parts.

c. Students will solve for unknown or undecided quantities using algebra, graphing, sound reasoning, and other strategies.

d. Students will integrate concepts and techniques from different areas of mathematics.

e. Students will work effectively in teams when the nature of the task or the allotted time makes this an

appropriate strategy.

f. Students will make sensible, reasonable estimates.

g.Student will make justifies, logical statements.

Bibliography

Beckmann, Sybilla. *Mathematics for Elementary Teachers* . USA: Addison-Wesley, 2003.

Carpenter, Thomas et al. *Thinking Mathematically* . Portsmouth, NH: Heinemann, 2003.

Foresman, Scott. *Scott Foresman-Addison Wesley Mathematics* . NY, NY: Scott Foresman, 2002.

Hong,Kho Tek, et al. *Primary Mathematics 6A* . Singapore: Times Media Private Limited, 2003.

Hong, Kho Tek, et al. *Primary Mathematics 6B* Singapore: Times Media Private Limited, 2003.

Lampert, Magdalene. *Teaching Problems and the Problems of Teaching* . New Haven, CT: Yale University Press, 2001

Loyd, Sam. *Mathematical Puzzles* . New York: Dover Publications, 1959.