

WIN CAREER READINESS COURSEWARE

Skill building for tomorrow's workforce... today!



Applied Mathematics *Level 4*



WIN
W-WIN.COM

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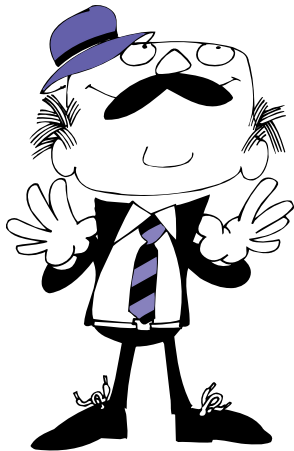


INTRODUCTION

WIN CAREER SOLUTIONS

Let me introduce you to Level 4 of *Applied Mathematics*. My name is EdWIN, and I will be your guide through this course. I remember some of you from Level 3, but for the newcomers, let me tell you a little about the WIN Instruction Solution for WorkKeys.

Hi! I'm EdWIN!



Together we will work through this course at your speed. Look for me, EdWIN, to pop up throughout your lessons to give you helpful tips, suggestions, and maybe even a pop quiz question or two. Don't worry, the answers are provided at the end of the course.

If the content of the lesson is something that you understand, you should be able to work through it at a faster pace. On the other hand, if the material is difficult, read the text several times and then try to work the exercises one at a time. After you try one problem, look at the solution. You can learn by reviewing each step that is provided in the solution and by concentrating on the process being illustrated. Now let's think positive; no negative attitudes allowed!!

Level 4 of *Applied Mathematics* builds on skills taught in Level 3. You will take a pretest to determine if you know the objectives taught at that level. You are encouraged to use your calculator when needed. If you do well on the pretest, you are ready to move forward. If you have trouble with the problems, I recommend you complete Level 3, if you have not done so before, or review the material if you have forgotten what you learned. It will help you remember what we do if you can find time to review some part of this course everyday, even if it is a few minutes. You will find the new material easier if you have a good understanding of the objectives we have already covered.



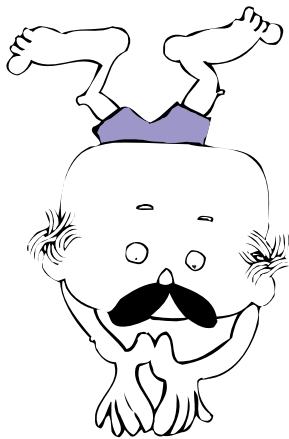
LESSON 1	Review of Prerequisite Skills
LESSON 2	Problem Solving Review
LESSON 3	Unit Conversions within a System
LESSON 4	Multistep Problems
LESSON 5	Averages, Rates, Ratios, and Proportions
LESSON 6	Percentages
LESSON 7	Addition of Common Fractions, Decimals, and Percents
LESSON 8	Multiplication of Fractions
LESSON 9	Charts and Graphs
LESSON 10	Posttest
REFERENCES	Workplace Problem Solving Glossary Test-Taking Tips Formula Sheet



REVIEW OF PREREQUISITE SKILLS

Before we begin, we really should review the skills that you should already know. The following pretest contains problems which emphasize the skills you will need to begin Level 4. The answers are provided following the test. Good luck!

Let's dive right in!





LESSON 1

EXERCISE – PRETEST

Instructions: *Solve the following problems.*

1. $6 \times 7 =$ _____

2. $15 \div 3 =$ _____

3. $17 + 24 =$ _____

4. $78.48 \times .2 =$ _____

5. $254 - 115 =$ _____

6. 360 minutes = _____ seconds

7. 78¢ = \$ _____



LESSON 1

8. $\$2.53 - \$0.02 =$ _____

9. $352 \times 81 =$ _____

10. $118 \div 4 =$ _____

11. $\$78.40 \times 12 =$ _____

12. $\$213.78 \div 15 =$ _____

13. $-15 - (+2) =$ _____

14. $8 + -2 =$ _____

15. $-12 - (-3) =$ _____



LESSON 1

Make the following conversions.

16. Convert $\frac{2}{3}$ to a decimal and a percent.

17. Change .80 to a fraction and a percent.

18. Change 60% to a decimal and a fraction.

Solve the following word problems.

19. A company pays 22¢ per mile for a vehicle's usage. If you drove 176 miles on a business trip, how much money should the company pay you?

20. You are a cashier at a department store. The customer hands you a \$10 bill for purchases totaling \$8.74. How much change should you give the customer?

**ANSWERS TO EXERCISE**

1. $6 \times 7 =$

Answer: 42

2. $15 \div 3 =$

Answer: 5

3. $17 + 24 =$

Answer: 41

4. $78.48 \times .2 =$

Answer: 15.696

5. $254 - 115 =$

Answer: 139

6. 360 minutes = _____ seconds

Answer: 21,600 seconds

7. 78¢ = \$_____

Answer: \$0.78

8. $\$2.53 - \$0.02 =$

Answer: \$2.51

9. $352 \times 81 =$

Answer: 28,512



LESSON 1

10. $118 \div 4 =$

Answer: 29.5

11. $\$78.40 \times 12 =$

Answer: \$940.80

12. $\$213.78 \div 15 =$

Answer: $\$14.252 = \14.25

13. $-15 - (+2) =$

Answer: -17

14. $8 + -2 =$

Answer: 6

15. $-12 - (-3) =$

Answer: -9

Make the following conversions.

16. Convert $\frac{2}{3}$ to a decimal and a percent.

Answer: $\frac{2}{3} = .667 = 66.7\%$ or 67% if rounding to a whole number.

If you have memorized common percentages, your answer may be $66\frac{2}{3}\%$.



LESSON 1

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17. Change .80 to a fraction and a percent.

$$\text{Answer: } .80 = \frac{80}{100} = \frac{4}{5}$$

$$.80 = \frac{80}{100} = 80\%$$

18. Change 60% to a decimal and a fraction.

$$\text{Answer: } 60\% = .60$$

$$60\% = \frac{60}{100} = \frac{3}{5}$$

Solve the following word problems.

19. A company pays 22¢ per mile for a vehicle's usage. If you drove 176 miles on a business trip, how much money should the company pay you?

$$\text{Answer: } 176 \times \$.22 = \$38.72$$

20. You are a cashier at a department store. The customer hands you a \$10 bill for purchases totaling \$8.74. How much change should you give the customer?

$$\text{Answer: } \$10 - \$8.74 = \$1.26$$

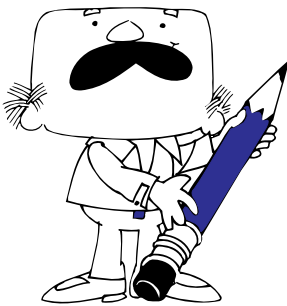
PROBLEM SOLVING REVIEW

I hope you did well on the pretest. Now, let's continue with a review of problem solving. If you were with me, we did several word problems in Level 3. They were, however, pretty straightforward problems. In this level, we'll work on problems that require a little more thinking.

Before we actually start the work, let's review the steps to problem solving:

Steps to Problem Solving

Tip!
This is important
information.



1) DEFINE THE PROBLEM

- What am I being asked to do or find?
- What information have I been given?
- Is there other information that I need to know or need to find?
- Will a sketch help?
- Can I restate the problem in my own words?
- Are there any key words?

2) DECIDE ON A PLAN

- What operations do I need to perform and in what order?
- On which numbers do I perform these operations?

3) CARRY OUT THE PLAN

4) EXAMINE THE OUTCOME

- Is this a reasonable outcome?
- Does the outcome make sense in the original problem?
- If I estimated the answer would it be close to the result?
- Does the outcome fall outside any limits in the problem? (too large or too small)



LESSON 2

WIN CAREER SOLUTIONS

The key words for word problems may be helpful as you determine the appropriate steps for solving problems.

In cases where word clues are not obvious, restate the question in your own words trying to use key words such as total, in all, difference, for each, etc., to determine which words best fit the meaning of the question.

Another way to determine what operation you need to solve word problems is to use the given information. If the given information includes a total value, the operation is most likely subtraction or division. If the problem asks for a total, the operation is always addition or multiplication. Multiplication is a shortcut for addition and should be used when the numbers being totaled are the same.

Key Words for Word Problems

ADDITION

added to
additional
all together
combined
gain of
how many all together
how many in all
how much all together
in all
increase of
increased by
more than
plus
sum
total

SUBTRACTION

change
decrease
decreased by
difference
dropped
have left
how many more
how many less
how many left
how many fewer
how many remain
how much more
how much less
less
less than
loss of
minus
remaining
save
take away

MULTIPLICATION

double
how many in all (with equal numbers)
how much (with equal amounts)
of (with fractions and percents)
product
times
total (of equal numbers)
triple
twice
twice as much

DIVISION

divided by
divided equally
divided into
evenly
how many in each
how many per
goes into
quotient
what's half

OPERATION SYMBOLS

+ **ADDITION**
- **SUBTRACTION**
× **MULTIPLICATION**
÷ **DIVISION**

(Multiplication may be indicated in several ways
i.e., •, ×, (). In this course we will use ×.)

SYMBOLS

\$ **DOLLAR**
¢ **CENT**
% **PERCENT**
NUMBER
@ **AT**
° **DEGREE**

One more tip:

Estimation may also be helpful to determine which operation to use. For instance, read the following word problem:

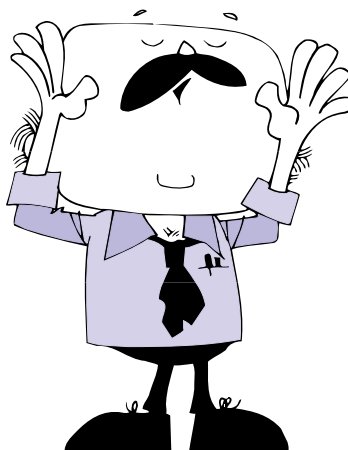
Five crates weigh 200 lb. Each crate weighs the same amount. How many lb does each crate weigh?

If you do not know which mathematical operation to use, you could estimate an answer by asking yourself if the answer should be larger or smaller than the facts given. By adding, 5 plus 200, you get 205 lb which is more than the total 5 crates weigh. By multiplying 5 times 200, you get 1,000 lb which is also more than the total 5 crates weigh. Your estimates should let you know these are the wrong operation. The correct operation is division indicated by the key words *how many does each*.

200 divided by 5 equals 40 lb

This is a reasonable answer for each crate to weigh.

*Estimation is often helpful
in solving problems.*





Some of the word problems in this lesson will have extra information. A few of them will even have information that needs to be expanded by you. For example, the problem may give you information about months but asks for your answer in years.

Here's an example:

Tom's monthly food bill is \$240. How much does he spend in one year?

For this problem, you need to know that there are 12 months in one year.

$$\$240 \times 12 = \$2,880$$

Tom spends \$2,880 on food in one year.



LESSON 2

WIN CAREER SOLUTIONS

As I said previously, you will also have problems that may contain extra information. You will need to decide which is information you need to work the problem and which is extra information.

For example:

Shirley charges \$5 for each cake she bakes in her catering business. She also bakes brownies, cookies, and makes candy. She charges \$2 for a dozen brownies, \$1.50 for a dozen cookies, and \$2.25 for one pound of candy.

Cynthia wanted to buy 3 pounds of candy and one-half dozen cookies. What is the total cost?

You are only asked about candy and cookies. You do not need to know about brownies or cake. That is the extra information.

Three pounds of candy at \$2.25 per pound would cost
 $3 \times \$2.25 = \6.75

One-half dozen cookies at \$1.50 for one dozen would be
 $\$1.50 \div 2 = \0.75

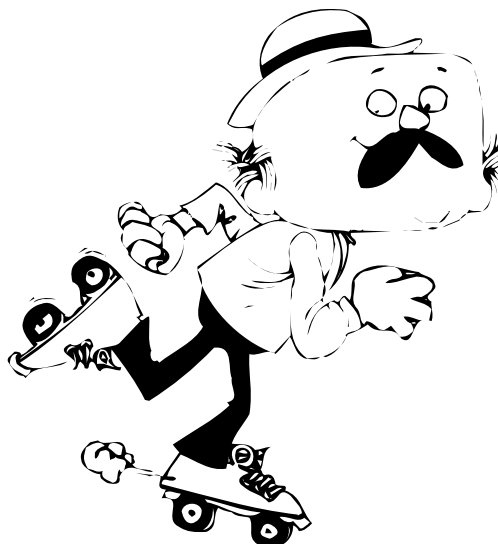
The total cost would be:

$$\$6.75 \text{ (candy)} + \$0.75 \text{ (cookies)} = \$7.50$$

So, you can see you will need to eliminate and expand information as required by each problem.

You should try some of these on your own. The only difference in Level 4 and the problems in Level 3 is that you must decide which information you will use to solve the problem. As always, I will provide the answers and some explanation after the problems.

On your mark, get set,
GO!



**EXERCISE – BASIC PROBLEM SOLVING**

Instructions: *Solve the following problems. Refer to your Steps to Problem Solving and your Key Words if you have difficulty.*

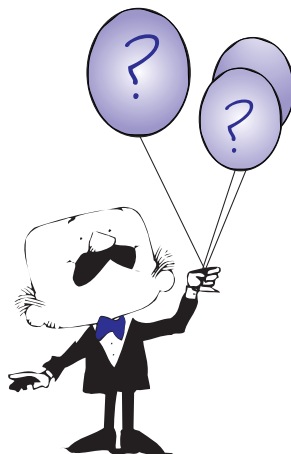
1. **E. Z. Rentals charges \$29 per day to rent a car plus \$.25 per mile. You need to rent a car for one week. You will drive the car 250 miles, and you will spend \$40 in gas. How much will E. Z. Rentals charge you for the car rental?**

2. **Your rate of pay is \$7.50 per hour. You work 2 eight-hour shifts this week. Your father has been sick, and you spent 12 hours with him. While you were at work, you took two breaks. Each break lasted one hour. How much is your pay?**

3. **Sam's birthday is tomorrow. His mom is giving him a pizza party. Twelve people will be at the party, in all. Sam's mom plans to cut the pizzas so that there will be 48 pieces. Sam's uncle came by, uninvited, but he didn't eat anything. How many pieces may each guest equally have?**

4. John Smith is a newspaper printer. He needs to print 10,000 copies of his paper in 36 hours. He makes \$35,000 each year, and he uses 120,000 ft of newsprint each week. Given the above statements, how many papers does he need to print per hour to meet his deadline?

Pop Quiz: If a work problem asks for a total, what are your two choices of operations to use to solve the problem?



**ANSWERS TO EXERCISE**

1. E. Z. Rentals charges \$29 per day to rent a car plus \$.25 per mile. You need to rent a car for one week. You will drive the car 250 miles, and you will spend \$40 in gas. How much will E. Z. Rentals charge you for the car rental?

Answer: $\$29 \times 7 \text{ days (one week)} = \203
 $\$.25 \times 250 \text{ miles} = \$62.50 \text{ for mileage}$
 $\$203 + \$62.50 = \text{\$265.50 total}$

You paid for the gas, so it is not included in the rental charge.

2. Your rate of pay is \$7.50 per hour. You work 2 eight-hour shifts this week. Your father has been sick, and you spent 12 hours with him. While you were at work, you took two breaks. Each break lasted one hour. How much is your pay?

Answer: Your rate of pay is \$7.50 per hour. You work 2 eight-hour shifts this week.

$2 \times 8 \text{ hours} = 16 \text{ hours}$
 $16 - 2 \text{ hours (breaks)} = 14 \text{ hours worked}$
 $\$7.50 \times 14 = \text{\$105}$

3. Sam's birthday is tomorrow. His mom is giving him a pizza party. Twelve people will be at the party, in all. Sam's mom plans to cut the pizzas so that there will be 48 pieces. Sam's uncle came by, uninvited, but he didn't eat anything. How many pieces may each guest equally have?

Answer: $12 \text{ people in all, } 48 \text{ pieces of pizza}$

Key words - how many, each

$48 \div 12 = \text{4 pieces}$



4. John Smith is a newspaper printer. He needs to print 10,000 copies of his paper in 36 hours. He makes \$35,000 each year, and he uses 120,000 ft of newsprint each week. Given the above statements, how many papers does he need to print per hour to meet his deadline?

Answer: John needs to print 10,000 copies of his paper in 36 hours. How many papers does he need to print per hour to meet his deadline?

Key words - how many per

$$10,000 \div 36 = 277.8 \text{ or } \mathbf{278 \text{ papers per hour}}$$



UNIT CONVERSIONS WITHIN A SYSTEM

Lesson 3 involves making conversions. First, we will look at conversions involving English units. You may need to refer to the *English Units* list to make the conversions.

ENGLISH UNITS

TIME

1 minute (min) = 60 seconds (sec)

1 hour (hr) = 60 minutes (min)

1 day = 24 hours (hr)

1 week (wk) = 7 days

LENGTH

1 foot (ft) = 12 inches (in)

1 yard (yd) = 3 feet (ft)

1 mile (mi) = 5,280 feet (ft)

WEIGHT

1 pound (lb) = 16 ounces (oz)

1 ton (T) = 2,000 pounds (lb)

CAPACITY

1 tablespoon (tbsp) = 3 teaspoons (tsp)

1 cup (c) = 16 tablespoons (tbsp)

1 cup (c) = 8 fluid ounces (fl oz)

1 pint (pt) = 2 cups (c)

1 quart (qt) = 2 pints (pt)

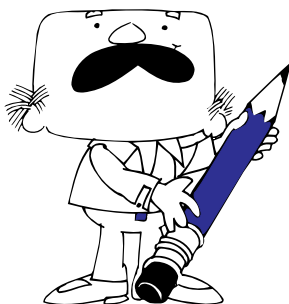
1 gallon (gal) = 4 quarts (qt)

One process to convert within the English system of measurement is to determine if the measure you start with is larger or smaller than the measure you are trying to convert to.

Follow these two rules to use this process:

- **To Convert from a Larger Unit to a Smaller Unit**

- Refer to an equivalency table to find a relationship using both quantities
- Multiply
- Add if necessary



- **To Convert from a Smaller Unit to a Larger Unit**

- Refer to an equivalency table to find a relationship using both quantities
- Divide
- Express any remainder as an equivalent, smaller unit



Let's look at some examples:

$$36 \text{ ft} = \underline{\hspace{2cm}} \text{ yards}$$

First, we look at the equivalency table to find $1 \text{ yard} = 3 \text{ feet}$. Since we are converting a smaller measure (feet) to a larger measure (yards), we will divide.

$$36 \text{ divided by } 3 = 12 \text{ yards}$$

$$8 \text{ gal} = \underline{\hspace{2cm}} \text{ cups}$$

Look at the equivalency table for gallons and cups. You might think, "Houston, we have a problem" since gallons and cups are not equivalent. But, we can make several conversions to find it.

Begin by changing gallons to quarts (larger to smaller, so multiply).

$$8 \text{ gal} \times 4 \text{ qt} = 32 \text{ quarts}$$

Now, change quarts to pints (larger to smaller, so multiply).

$$32 \text{ qt} \times 2 \text{ pt} = 64 \text{ pints}$$

. . . now, pints to cups, which is what we are looking for (again, larger to smaller unit, so multiply).

$$64 \text{ pt} \times 2 \text{ c} = 128 \text{ cups}$$



ENGLISH UNITS

TIME

1 minute (min) = 60 seconds (sec)

1 hour (hr) = 60 minutes (min)

1 day = 24 hours (hr)

1 week (wk) = 7 days

LENGTH

1 foot (ft) = 12 inches (in)

1 yard (yd) = 3 feet (ft)

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WEIGHT

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1 ton (T) = 2,000 pounds (lb)

CAPACITY

1 tablespoon (tbsp) = 3 teaspoons (tsp)

1 cup (c) = 16 tablespoons (tbsp)

1 cup (c) = 8 fluid ounces (fl oz)

1 pint (pt) = 2 cups (c)

1 quart (qt) = 2 pints (pt)

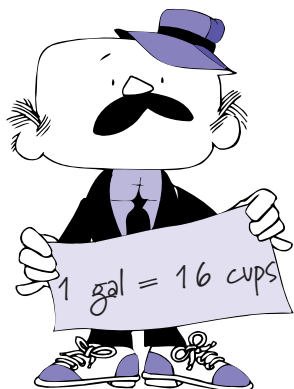
1 gallon (gal) = 4 quarts (qt)

It took a little effort, but we can convert measures not on our table. If you frequently use certain conversions at your workplace, it is a good idea to post an equivalency table with the most common conversions you use.

For instance, you could add the equivalency $1 \text{ gal} = 16 \text{ cups}$ if this is a frequent conversion you are required to make.

Post conversions near your workstation.

There are other ways to make the conversions. One is the process called dimensional analysis. I will show you how to use this method, but you will have to choose which way seems easiest to you.





LESSON 3

ENGLISH UNITS

TIME

1 minute (min) = 60 seconds (sec)

1 hour (hr) = 60 minutes (min)

1 day = 24 hours (hr)

1 week (wk) = 7 days

LENGTH

1 foot (ft) = 12 inches (in)

1 yard (yd) = 3 feet (ft)

1 mile (mi) = 5,280 feet (ft)

WEIGHT

1 pound (lb) = 16 ounces (oz)

1 ton (T) = 2,000 pounds (lb)

CAPACITY

1 tablespoon (tbsp) = 3 teaspoons (tsp)

1 cup (c) = 16 tablespoons (tbsp)

1 cup (c) = 8 fluid ounces (fl oz)

1 pint (pt) = 2 cups (c)

1 quart (qt) = 2 pints (pt)

1 gallon (gal) = 4 quarts (qt)



LESSON 3

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Let's look at the same examples:

$$36 \text{ ft} = \underline{\hspace{2cm}} \text{ yards}$$

First, we write down the problem:

$$36 \text{ ft}$$

Then we look at our table and find something about feet and yards. We see that 1 yard = 3 feet. We put this beside our problem, but in fractional form.

Notice that “ft” goes on the bottom. This is so the word “ft” will “cancel.”

$$36 \text{ ft} \times \frac{1 \text{ yd}}{3 \text{ ft}}$$

Now, do the math.

$$36 \cancel{\text{ft}} \times \frac{1 \text{ yd}}{3 \cancel{\text{ft}}} \rightarrow 36 \times 1 = 36$$

$$36 \div 3 = 12 \text{ yd}$$

or

$$36 \cancel{\text{ft}} \times \frac{1 \text{ yd}}{3 \cancel{\text{ft}}} = \frac{36 \times 1 \text{ yd}}{3} = \frac{36}{3} = 12 \text{ yd}$$

Notice that the word “ft” has been crossed out. This means the answer is 12 yd.

$$8 \text{ gal} = \underline{\hspace{1cm}} \text{ cups}$$

$$8 \text{ gallons} \times (\text{how many cups})$$

We have a problem here. There is nothing about gallons and cups on our chart. We must use what we have. We know
1 gallon = 4 quarts.

$$8 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}}$$

Now our answer is in quarts (still no help).

$$8 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} \times \frac{2 \text{ pt}}{1 \text{ qt}}$$

Now our answer is in pints. There are 2 cups in one pint.

$$8 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} \times \frac{2 \text{ pt}}{1 \text{ qt}} \times \frac{2 \text{ c}}{1 \text{ pt}}$$

$$8 \times 4 \times 2 \times 2 = 128 \text{ cups}$$

You may have to try several steps before you get your answer. Using the examples that I just gave, do the problems in the next exercise. You may select either method. The answers will follow.

**EXERCISE - ENGLISH CONVERSIONS**

Instructions: *Use the English Units Chart to make the following conversions.*

1. 4 feet = _____ inches
2. 72 feet = _____ yards
3. 3 miles = _____ feet
4. 1 yard = _____ inches
5. 6,500 pounds = _____ tons
6. 4 pounds = _____ ounces
7. 112 ounces = _____ pounds
8. 144 cups = _____ pints
9. 144 cups = _____ quarts
10. 144 cups = _____ gallons
11. 3 cups = _____ teaspoons
12. 5 cups = _____ fluid ounces
13. 6 gallons = _____ quarts
14. 6 gallons = _____ pints
15. 6 gallons = _____ cups



ANSWERS TO EXERCISE

1. 4 feet = _____ inches

Answer: larger unit to smaller unit – multiply
 $4 \times 12 = 48 \text{ in}$

or

$$4\cancel{\text{ft}} \times \frac{12 \text{ in}}{1\cancel{\text{ft}}} = 48 \text{ in}$$

48 inches

2. 72 feet = _____ yards

Answer: smaller to larger – divide
 $72 \div 3 = 24 \text{ yd}$

or

$$72\cancel{\text{ft}} \times \frac{1 \text{ yd}}{3\cancel{\text{ft}}}$$

24 yards

3. 3 miles = _____ feet

Answer: larger to smaller – multiply
 $3 \times 5,280 = 15,840 \text{ ft}$

or

$$3 \cancel{\text{mi}} \times \frac{5,280 \text{ ft}}{1\cancel{\text{mi}}}$$

15,840 ft



LESSON 3

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4. 1 yard = _____ inches

Answer: *larger to smaller – multiply*

$$1 \times 3 = 3 \text{ ft}$$

$$3 \times 12 = 36 \text{ in}$$

or

$$1 \cancel{\text{yd}} \times \frac{3 \cancel{\text{ft}}}{1 \cancel{\text{yd}}} \times \frac{12 \text{ in}}{1 \cancel{\text{ft}}}$$

36 inches

5. 6,500 pounds = _____ tons

Answer: *smaller to larger – divide*

$$6,500 \div 2,000 = 3.25 \text{ ton} = 3 \text{ ton}, 500 \text{ lb}$$

or

$$6,500 \cancel{\text{lb}} \times \frac{1 \cancel{\text{T}}}{2,000 \cancel{\text{lb}}}$$

3.25 tons

You can change .25 tons to pounds

$$.25 \cancel{\text{T}} \times \frac{2,000 \text{ lb}}{1 \cancel{\text{T}}} = 500 \text{ lb}$$



LESSON 3

6. 4 pounds = _____ ounces

Answer: *larger to smaller – multiply*
 $4 \times 16 = 64 \text{ oz}$

or

$$4\cancel{\text{lb}} \times \frac{16 \text{ oz}}{1\cancel{\text{lb}}}$$

64 ounces

7. 112 ounces = _____ pounds

Answer: *smaller to larger – divide*
 $112 \div 16 = 7 \text{ lb}$

or

$$112\cancel{\text{oz}} \times \frac{1\cancel{\text{lb}}}{16\cancel{\text{oz}}}$$

7 pounds

8. 144 cups = _____ pints

Answer: *smaller to larger – divide*
 $144 \div 2 = 72 \text{ pt}$

or

$$144\cancel{\text{c}} \times \frac{1\cancel{\text{pt}}}{2\cancel{\text{c}}}$$

72 pints



LESSON 3

WIN CAREER SOLUTIONS

9. 144 cups = _____ quarts

Answer: smaller to larger – divide

$$144 \div 2 = 72 \text{ pt}$$

$$72 \div 2 = 36 \text{ qt}$$

or

$$144\cancel{c} \times \frac{1\cancel{pt}}{2\cancel{c}} \times \frac{1\text{qt}}{2\cancel{pt}}$$

36 quarts

10. 144 cups = _____ gallons

Answer: smaller to larger – divide

$$144 \div 2 = 72 \text{ c}$$

$$72 \div 2 = 36 \text{ pt}$$

$$36 \div 4 = 9 \text{ gal}$$

or

$$144\cancel{c} \times \frac{1\cancel{pt}}{2\cancel{c}} \times \frac{1\cancel{qt}}{2\cancel{pt}} \times \frac{1\text{gal}}{4\cancel{qt}}$$

9 gallons



LESSON 3

WIN CAREER SOLUTIONS

11. 3 cups = _____ teaspoons

Answer: *larger to smaller – multiply*

$$3 \times 16 = 48 \text{ tbsp}$$

$$48 \times 3 = 144 \text{ tsp}$$

or

$$3 \cancel{c} \times \frac{16 \text{ tbsp}}{1 \cancel{c}} \times \frac{3 \text{ tsp}}{1 \text{ tbsp}}$$

144 teaspoons

12. 5 cups = _____ fluid ounces

Answer: *larger to smaller – multiply*

$$5 \times 8 = 40 \text{ oz}$$

or

$$5 \cancel{c} \times \frac{8 \text{ oz}}{1 \cancel{c}}$$

40 fluid ounces

13. 6 gallons = _____ quarts

Answer: *larger to smaller – multiply*

$$6 \times 4 = 24 \text{ qt}$$

or

$$6 \cancel{\text{gal}} \times \frac{4 \text{ qt}}{1 \cancel{\text{gal}}}$$

24 quarts



LESSON 3

WIN CAREER SOLUTIONS

14. 6 gallons = _____ pints

Answer: larger to smaller – multiply

$$6 \times 4 = 24 \text{ qt}$$

$$24 \times 2 = 48 \text{ pt}$$

or

$$6 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} \times \frac{2 \text{ pt}}{1 \text{ qt}}$$

48 pints

15. 6 gallons = _____ cups

Answers: larger to smaller - multiply

$$6 \times 4 = 24 \text{ qt}$$

$$24 \times 2 = 48 \text{ pt}$$

$$48 \times 2 = 96 \text{ c}$$

or

$$6 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} \times \frac{2 \text{ pt}}{1 \text{ qt}} \times \frac{2 \text{ c}}{1 \text{ pt}}$$

96 cups



The next part of this lesson will focus on making conversions within the metric system. The standard units for the metric system are meters, liters, and grams.

m .. meter ... measures distance or length..... (ft or yd)
l liter..... measures liquid or volume (qt or gal)
g ... gram..... measures weight or mass..... (oz or lb)

Prefixes for the metric system are as follows:

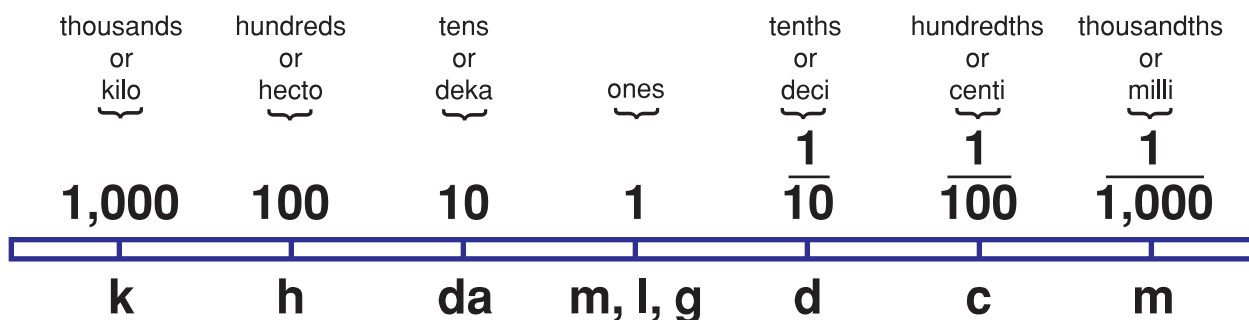
k - kilo	1,000	d - deci	$\frac{1}{10}$
h - hecto	100	c - centi	$\frac{1}{100}$
da - deca	10	m - milli	$\frac{1}{1,000}$

An example:

1 *kilometer* = 1,000 meters

Any prefix can be placed in front of any unit (*milligram, deciliter, centimeter*).

The simplest way to make conversions within the metric system is to use the *Metric Bar*.

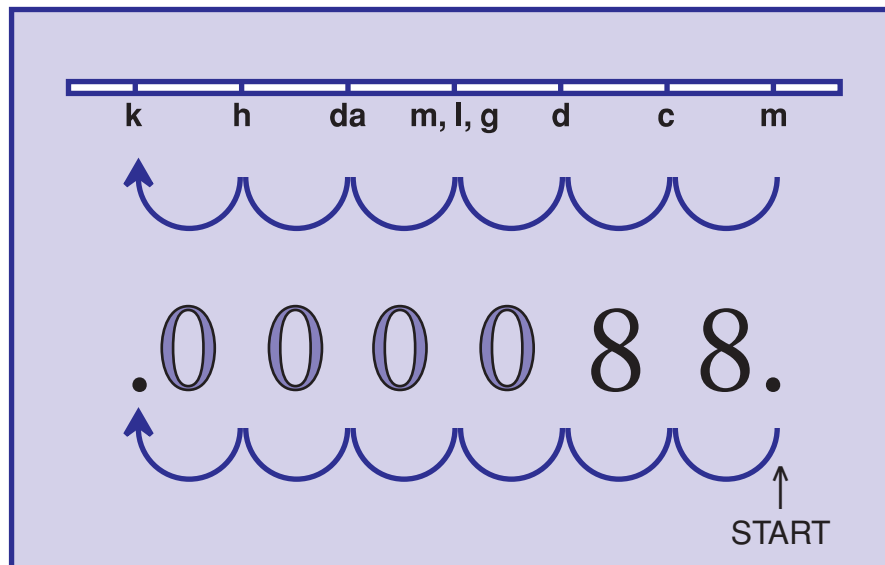


When you make conversions, you must count the units between prefixes.

For example:

$$88 \text{ mm} = \underline{\hspace{2cm}} \text{ km}$$

Start at the decimal in the original number 88. According to our *Metric Bar*, we will move from the prefix “m” on the right, 6 units to the left to the prefix “k.”



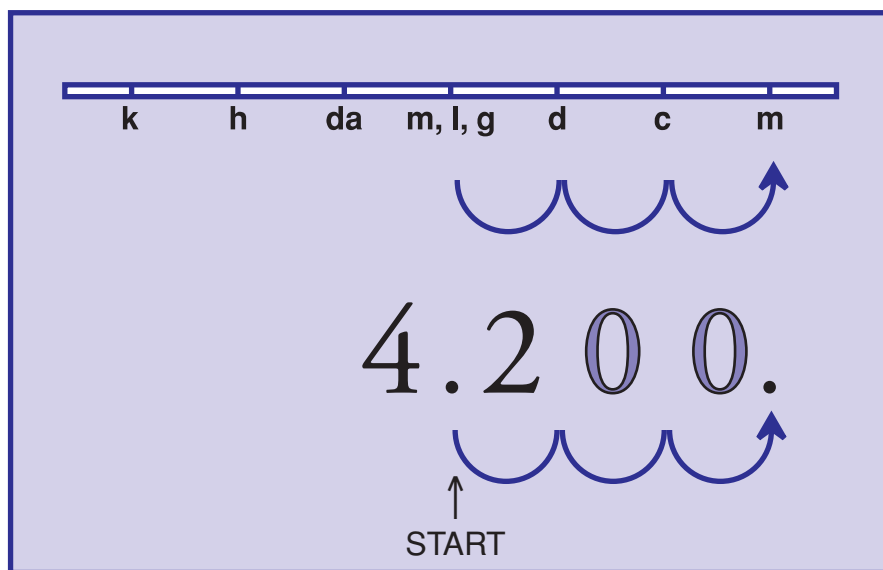
So, move the decimal 6 places to the left, inserting zeros as needed.

$$88 \text{ mm} = .000088 \text{ km}$$

Let's try another:

$$4.2 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$$

Start at the decimal in the original number 4.2. According to our *Metric Bar*, we will move from “g” in the center, 3 steps to the right to the prefix “m.”



$$4.2 \text{ g} = 4,200 \text{ mg}$$

**EXERCISE – METRIC CONVERSIONS**

Instructions: *Convert the following metric units using a metric bar.*



1. 5.23 l = _____ dl
2. 92 mm = _____ m
3. 86.3 kg = _____ g
4. 54 cm = _____ mm
5. 0.5 l = _____ ml
6. 34,596 g = _____ kg
7. 14 hm = _____ dm
8. 95 cg = _____ dag
9. 123 dl = _____ l
10. 2 km = _____ mm

When you take the ACT™ WorkKeys® *Applied Mathematics* assessment, you will receive a formula sheet to assist you in conversions of measurements required by the test. A copy of the formula sheet is located in the last section of this workbook. Only a few metric conversions are included on the list. The Metric Bar will not be given to you, but it can be easily memorized using a few mnemonics.

The abbreviations for the prefixes can be memorized using silly sentences like:

over

k	h	da	m, l, g	d	c	m	
<i><u>k</u>ids</i>	<i><u>h</u>ave</i>	<i><u>d</u>ropped</i>		<i><u>d</u>ead</i>	<i><u>c</u>onverting</i>	<i><u>m</u>etrics</i>	

OR

k	h	da	m, l, g	d	c	m	
<i><u>k</u>ind</i>	<i><u>h</u>earted</i>	<i><u>d</u>ads</i>	<i><u>m</u>ust</i>	<i><u>d</u>rink</i>	<i><u>c</u>hocolate</i>	<i><u>m</u>ilk</i>	

**ANSWERS TO EXERCISE**

1. $5.23 \text{ l} = \underline{\hspace{2cm}} \text{ dl}$

Answer: $5.23 \text{ l} = 52.3 \text{ dl}$

2. $92 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$

Answer: $92 \text{ mm} = .092 \text{ m}$

3. $86.3 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

Answer: $86.3 \text{ kg} = 86,300 \text{ g}$

4. $54 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$

Answer: $54 \text{ cm} = 540 \text{ mm}$

5. $0.5 \text{ l} = \underline{\hspace{2cm}} \text{ ml}$

Answer: $0.5 \text{ l} = 500 \text{ ml}$

6. $34,596 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$

Answer: $34,596 \text{ g} = 34.596 \text{ kg}$

7. $14 \text{ hm} = \underline{\hspace{2cm}} \text{ dm}$

Answer: $14 \text{ hm} = 14,000 \text{ dm}$

8. $95 \text{ cg} = \underline{\hspace{2cm}} \text{ dag}$

Answer: $95 \text{ cg} = .095 \text{ dag}$

9. $123 \text{ dl} = \underline{\hspace{2cm}} \text{ l}$

Answer: $123 \text{ dl} = 12.3 \text{ l}$

10. $2 \text{ km} = \underline{\hspace{2cm}} \text{ mm}$

Answer: $2 \text{ km} = 2,000,000 \text{ mm}$

How many kilometers do you
think I can ski cross-country?





Now that you know how to do the actual conversions, let's see if you can use the process in application problems. Read the problems to find numbers that should be converted. Refer to the *English Units Conversion Chart* or use the *Metric Bar* as needed. As always, the answers and solutions will follow. But, don't peek until you give it a good try!

ENGLISH UNITS

TIME

1 minute (min) = 60 seconds (sec)

1 hour (hr) = 60 minutes (min)

1 day = 24 hours (hr)

1 week (wk) = 7 days

LENGTH

1 foot (ft) = 12 inches (in)

1 yard (yd) = 3 feet (ft)

1 mile (mi) = 5,280 feet (ft)

WEIGHT

1 pound (lb) = 16 ounces (oz)

1 ton (T) = 2,000 pounds (lb)

CAPACITY

1 tablespoon (tbsp) = 3 teaspoons (tsp)

1 cup (c) = 16 tablespoons (tbsp)

1 cup (c) = 8 fluid ounces (fl oz)

1 pint (pt) = 2 cups (c)

1 quart (qt) = 2 pints (pt)

1 gallon (gal) = 4 quarts (qt)

Instructions: *Solve the following word problems. Remember the steps to problem solving as you work. Use the English Unit Conversion Chart and Metric Bar as needed.*

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- Applied Mathematics*



LESSON 3

WIN CAREER SOLUTIONS

4. You work for an exterminator. You have a package of pesticide powder that must be diluted with 2 gallons of water. The only accurate measure you have holds a quart. How many quarts will you need to mix with the pesticide?

5. You and four friends buy a 2 liter bottle of Coke. How many centiliters will each of you get if you divide it equally?

6. You work in the packing department of Regal China. You can pack a crate of dishes in 20 minutes. How many crates can you pack in 4 hours?

7. A nickel weighs about 5 grams. If you had a kilogram of nickels, how much money would you have?

8. Your company manufactures dolls. Each doll requires 2 feet of ribbon for bows. How many yards of ribbon will be required to make 600 dolls?
9. The owner of the plant nursery where you work tells you to fill 200 ml bottles from a 30 l drum of fertilizer. How many 200 ml bottles should you bring from the supply room?



**ANSWERS TO EXERCISE**

1. While helping to finish woodwork on a Habitat for Humanity house, you find that you need to cut a board 5 feet 8 inches long. The board is how many inches long?

Answer: 68 inches

Define problem:

We need to convert 5 feet to inches to determine how many inches

Decide on plan:

Choose the conversion method you prefer:

We are converting larger measure to a smaller measure (ft to in). Multiply.

Carry out plan:

$$5 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} = 60 \text{ in}$$

or

$$5 \text{ (ft)} \times 12 \text{ (in)} = 60 \text{ in}$$

$$60 \text{ (in)} + 8 \text{ (in)} = 68 \text{ in}$$

*Examine result: **68 in** is a reasonable length for a board.*

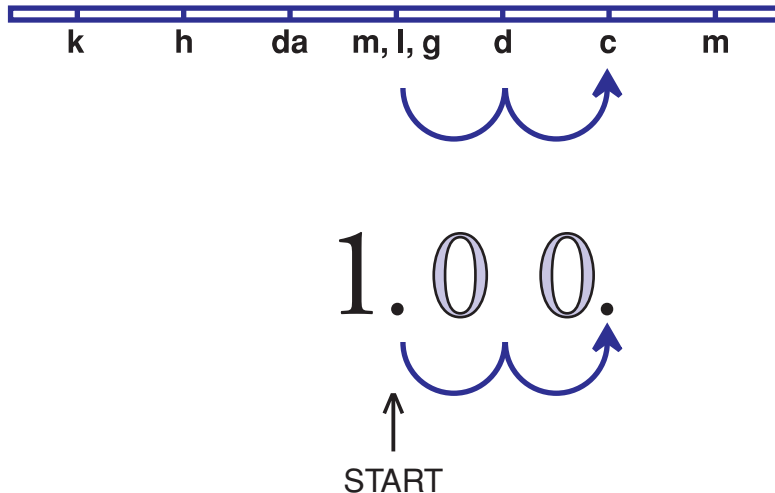
2. You are shipping a box that weighs 13 pounds. How many ounces does the box weigh?

Answer: larger to smaller – multiply

$$13 \cancel{\text{lb}} \times \frac{16 \text{ oz}}{1 \cancel{\text{lb}}} = \mathbf{208 \text{ oz}}$$

3. You plan to cut 2 pieces of pipe, each 37 centimeters long from a piece of pipe that is 1 meter long. How much pipe will you have left after cutting the two pieces? (Assume no waste during cutting.)

Answer: First, convert 1 meter to centimeters



(you may use $\frac{100 \text{ cm}}{1 \text{ m}}$ to convert m to cm if you

choose... $1 \cancel{m} \times \frac{100 \text{ cm}}{1 \cancel{m}} = 100 \text{ cm}$)

You need 2 pieces 37 cm long, so you need 37×2 or

$$37 + 37 = 74 \text{ cm}$$

Key word - left - indicates subtraction

$$100 - 74 = \mathbf{26 \text{ cm}}$$

You will have **26 cm** left.

4. You work for an exterminator. You have a package of pesticide powder that must be diluted with 2 gallons of water. The only accurate measure you have holds a quart. How many quarts will you need to mix with the pesticide?

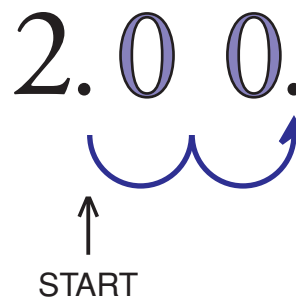
Answer: larger to smaller – multiply
 $2 \text{ (gal)} \times 4 \text{ (qt)} = 8 \text{ (qt)}$

or

$$2 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} = 8 \text{ qt}$$

5. You and four friends buy a 2 liter bottle of Coke. How many centiliters will each of you get if you divide it equally?

Answer: Convert 2 liters to centiliters



$$2 \text{ l} = 200 \text{ cl}$$

Now, divide it among the 5 of you.
 $200 \div 5 \text{ (you and 4 friends)}$

$$= 40 \text{ cl each}$$



LESSON 3

WIN CAREER SOLUTIONS

6. You work in the packing department of Regal China. You can pack a crate of dishes in 20 minutes. How many crates can you pack in 4 hours?

Answer: First, convert hours to minutes

larger to smaller – multiply

$$4 \times 60 = 240 \text{ minutes}$$

or

$$4 \cancel{\text{hr}} \times \frac{60 \text{ min}}{1 \cancel{\text{hr}}} = 240 \text{ min}$$

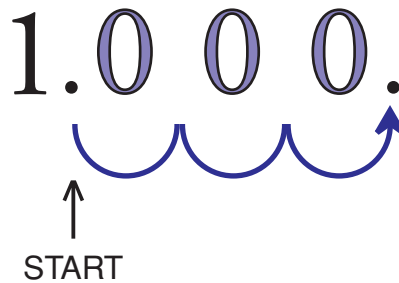
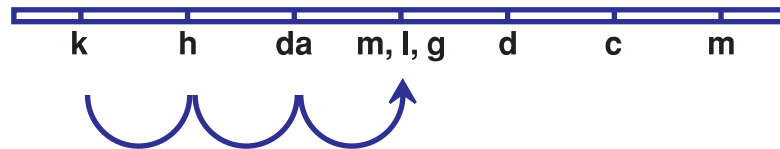
Reword question - how many 20 min segments in 4 hr

Divide 4 hr (240 min) equally into 20 min segments - a sketch may help

$$240 \text{ min} \div 20 \text{ min} = \mathbf{12 \text{ crates of dishes}}$$

7. A nickel weighs about 5 grams. If you had a kilogram of nickels, how much money would you have?

Answers: Convert kg to g



$$1 \text{ kg} = 1000 \text{ g}$$

or

$$1 \text{ kg} \times \frac{1,000 \text{ g}}{1 \text{ kg}} = 1,000 \text{ g}$$

Each nickel weighs 5 g, so we divide the given total
 $1,000 \div 5 = 200$ nickels

The question asks "how much money would you have?"
 $200 \times \$0.05 = \text{\textbf{\$10}}$



LESSON 3

8. Your company manufactures dolls. Each doll requires 2 feet of ribbon for bows. How many yards of ribbon will be required to make 600 dolls?

Answer: Convert feet to yards

smaller to larger – divide

$$2 \div 3 \text{ or } \frac{2}{3} \text{ yd for each doll}$$

or

$$2 \text{ ft} \times \frac{1 \text{ yd}}{3 \text{ ft}} = \frac{2}{3} \text{ yd}$$

key words - how many (for the total of 600)

$$\frac{2}{3} \times 600 \text{ (dolls)} = \mathbf{400 \text{ yd}}$$

Alternate solution:

Key words: how many (for the total of 600)

$$600 \text{ dolls} \times 2 \text{ ft per doll} = 1,200 \text{ ft}$$

Convert feet to yards

smaller to larger - divide

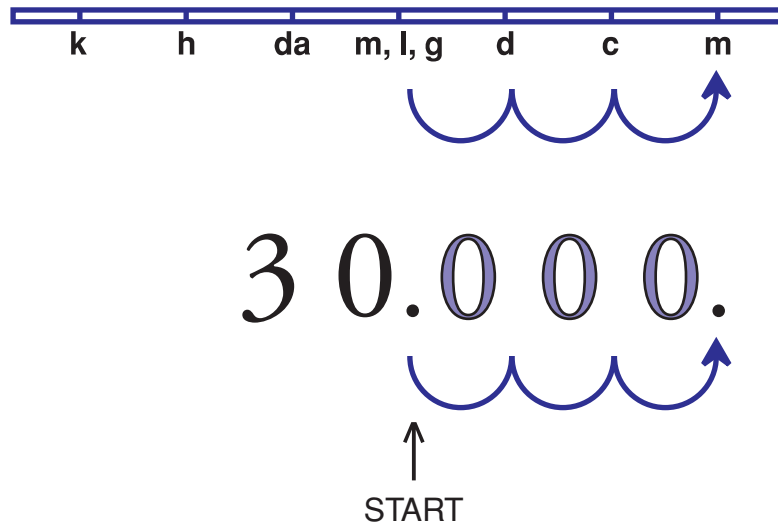
$$1,200 \div 3 = 400 \text{ yd for the total of 600}$$

or

$$1,200 \text{ ft} \times \frac{1 \text{ yd}}{3 \text{ ft}} = \mathbf{400 \text{ yd}}$$

9. The owner of the plant nursery where you work tells you to fill 200 ml bottles from a 30 l drum of fertilizer. How many 200 ml bottles should you bring from the supply room?

Answer: Convert liters to milliliters



$$30 \text{ l} = 30,000 \text{ ml}$$

*Implied key words - need to fill each,
given total amount – implies division*

$$30,000 \div 200 = \mathbf{150 \text{ bottles}}$$



LESSON 4

MULTISTEP PROBLEMS

The very last part of this lesson will require practice with word problems that require several different steps. You have already been required to do 2 steps in several problems.

Let me show you what I mean.

Your boss at the body shop has put together a super paint package. It includes the basic paint job for \$265, painting the door jambs for \$60, and special metallic paint worth \$45. The price of the package will be \$199. A customer calls and asks how much the super paint package will save him. What do you answer?

You first have to determine what the price of the package would have been.

\$265	-	basic paint
\$ 60	-	door jambs
<u>+ \$ 45</u>	-	metallic paint
\$370	-	this is what the job would have cost the customer

The package price is \$199.

This is a *savings* of $\$370 - \$199 = \$171$

In that problem you had to add *and* subtract.



LESSON 4

WIN CAREER SOLUTIONS

Here's another example:

You work part-time in the box office at Royal Cinemas. One evening you sell 836 adult tickets at \$4.50 each and 328 children's tickets at \$3.00 each. How much did you take in that evening?

First, you must find out how much you collected in adult tickets:

$$\$4.50 \times 836 = \$3,762 \text{ (adult)}$$

Then you must do the same for the children's tickets:

$$\$3.00 \times 328 = \$984 \text{ (children)}$$

The question is how much money you took in all together.

\$3,762	(adult)
<u>+\$ 984</u>	(children)
\$4,746	(total)

You had to multiply twice and add in this problem.

Having several steps is the only difference between these problems and any previous problems. Practice multipart problems by completing the next exercise.



LESSON 4

EXERCISE – MULTISTEP PROBLEMS

Instructions: *Solve the following word problems. Remember the steps to problem solving as you work. Use the English Unit Conversion Chart as needed.*

- 1. You work at a car dealership that is advertising a used 1992 Toyota Tercel for only \$400 down and \$170 per month for 4 years. What is the total cost of this car?**
- 2. One month Steve deposited \$400, \$700, \$2,542, and \$2,785 in his checking account. The same month he wrote checks for \$427, \$935, and \$3,257. What was the change in his balance?**
- 3. You work on an assembly line making electronic circuits. You can assemble 39 circuits in one hour. How many do you assemble in a 5-day work week working 8 hours each day?**



LESSON 4

WIN CAREER SOLUTIONS

4. You work at a car dealership and are told that a certain car is to sell for \$16,580 which will include financing for 5 years. There will be a \$500 down payment and the remainder in equal monthly payments. Find the amount of the monthly payment.

5. Your monthly salary is \$1,587.94. Your paycheck stub shows deductions of \$396.99 for federal tax, \$121.48 for social security, and \$32.59 for insurance. What is your take home pay?

6. Your plant runs 2 assembly lines. Line A produces 427 units per hour and line B produces 519 units per hour. How many more units will line B produce than line A during an eight-hour work day?



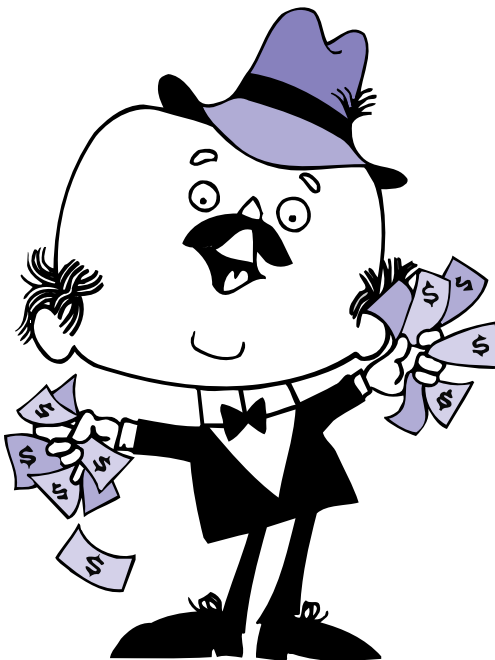
LESSON 4

7. You are in charge of inventory in a large computer center. One week three shipments of 10, 13, and 17 boxes of paper were delivered to the center and 12 boxes of paper were used. What was the change in inventory?

8. Your store sells two models of VCRs; the standard model sells for \$179.95 and the deluxe model sells for \$295. One day you sell 5 of the standard model and 3 of the deluxe model. What was the total revenue from these sales?

9. At the beginning of the year, a company had 40 employees. During January, 3 employees quit and 5 were hired. During February, 2 employees quit and 1 was hired. How many employees did the company have at the end of February?

10. You are the treasurer for a local charity. At the beginning of the month, the account balance for the charity was \$5,300. During the month you received \$500, \$900, and \$600 donations from industry and \$50, \$10, \$100, and \$150 donations from private sources. If \$2,200 was spent by the charity during the same month, what is the balance at the end of the month?



11.

COUGAR DRIVE-IN
Prices Include Tax

Cougar Burger	\$1.95
with Cheese	\$2.15
Ham and Cheese	\$2.15
Hoagie	\$2.15
Turkey Sandwich	\$2.15
Hot Dog	\$1.25
with Chili	\$1.45
with Chili and Slaw	\$1.65
French Fries	\$1.05
TaterTots	\$1.05
Onion Rings	\$1.15
Coke, Sprite, Diet Coke	\$.80
Iced Tea, Coffee	\$.75
Shakes	\$1.25

A customer orders a hot dog with chili and slaw, 2 cougar burgers, 2 onion rings and 3 Cokes. How much does he owe? He hands you a \$20 bill. How much change do you owe him?

**ANSWERS TO EXERCISE**

1. You work at a car dealership that is advertising a used 1992 Toyota Tercel for only \$400 down and \$170 per month for 4 years. What is the total cost of this car?

Answer: $4 \text{ years} \rightarrow 4 \times 12 = 48 \text{ months}$
 $48 \times \$170 = \$8,160$
 $\$8,160 + \$400 \text{ down} = \text{\textcolor{blue}{\$8,560}}$

2. One month Steve deposited \$400, \$700, \$2,542, and \$2,785 in his checking account. The same month he wrote checks for \$427, \$935, and \$3,257. What was the change in his balance?

Answer: $\$400 + \$700 + \$2,542 + \$2,785 = \$6,427 \text{ deposited}$
 $\$427 + \$935 + \$3,257 = \$4,619 \text{ deducted from account}$
 $\$6,427 - \$4,619 = \text{\textcolor{blue}{\$1,808}} \text{ change in his balance}$

3. You work on an assembly line making electronic circuits. You can assemble 39 circuits in one hour. How many do you assemble in a 5-day work week working 8 hours each day?

Answer: $39 \times 8 = 312 \text{ daily}$
 $312 \text{ daily} \times 5 \text{ days} = \text{\textcolor{blue}{1,560}} \text{ circuits in 5 days}$



4. You work at a car dealership and are told that a certain car is to sell for \$16,580 which will include financing for 5 years. There will be a \$500 down payment and the remainder in equal monthly payments. Find the amount of the monthly payment.

Answer: $\$16,580 - \$500 = \$16,080$
 $\$16,080 \div 60 = \text{\textcolor{blue}{\$268 per month}}$

or, for more detail:

$\$16,580$ (selling price) - $\$500$ (down payment) = $\$16,080$ (remainder owed)
Number of payments = 5 years \times 12 months per year = 60 payments
 $\$16,080 \div 60$ (equal payments) = $\$268$

5. Your monthly salary is \$1,587.94. Your paycheck stub shows deductions of \$396.99 for federal tax, \$121.48 for social security, and \$32.59 for insurance. What is your take home pay?

Answer: $\$1,587.94 - \$396.99 - \$121.48 - \$32.59 = \text{\textcolor{blue}{\$1,036.88}}$

6. Your plant runs 2 assembly lines. Line A produces 427 units per hour and line B produces 519 units per hour. How many more units will line B produce than Line A during an eight-hour work day?

Answer: $A = 427 \times 8 \text{ hr} = 3,416 \text{ units}$
 $B = 519 \times 8 \text{ hr} = 4,152 \text{ units}$
 $4,152 - 3,416 = \text{\textcolor{blue}{736}} \text{ more for line B}$



LESSON 4

WIN CAREER SOLUTIONS

7. You are in charge of inventory in a large computer center. One week three shipments of 10, 13, and 17 boxes of paper were delivered to the center and 12 boxes of paper were used. What was the change in inventory?

Answer: $10 + 13 + 17 - 12 = 28$ more boxes

8. Your store sells two models of VCRs; the standard model sells for \$179.95 and the deluxe model sells for \$295. One day you sell 5 of the standard model and 3 of the deluxe model. What was the total from these sales?

Answer: $(\$179.95 \times 5) + (\$295 \times 3) = \$899.75 + \$885 =$
\$1,784.75 total revenue

9. At the beginning of the year, a company had 40 employees. During January, 3 employees quit and 5 were hired. During February, 2 employees quit and 1 was fired. How many employees did the company have at the end of February?

Answer: $40 - 3 + 5 - 2 - 1 = 39$ employees

10. You are the treasurer for a local charity. At the beginning of the month, the account balance for the charity was \$5,300. During the month you received \$500, \$900, and \$600 donations from industry and \$50, \$10, \$100, and \$150 donations from private sources. If \$2,200 was spent by the charity during the same month, what is the balance at the end of the month?

Answer: $\$5,300 + 500 + 900 + 600 + 50 + 10 + 100 + 150 - 2200 =$
\$5,410 balance



11.

COUGAR DRIVE-IN
Prices Include Tax

Cougar Burger	\$1.95
with Cheese	\$2.15
Ham and Cheese	\$2.15
Hoagie	\$2.15
Turkey Sandwich	\$2.15
Hot Dog	\$1.25
with Chili	\$1.45
with Chili and Slaw	\$1.65
French Fries	\$1.05
TaterTots	\$1.05
Onion Rings	\$1.15
Coke, Sprite, Diet Coke	\$.80
Iced Tea, Coffee	\$.75
Shakes	\$1.25

A customer orders a hot dog with chili and slaw, 2 cougar burgers, 2 onion rings and 3 Cokes. How much does he owe? He hands you a \$20 bill. How much change do you owe him?

Answer: $\$1.65 + 1.95 + 1.95 + 1.15 + 1.15 + .80 + .80 + .80 = \textbf{\$10.25}$

or

$\$1.65 + (1.95 \times 2) + (1.15 \times 2) + (.80 \times 3) = \textbf{\$10.25}$

$\$20.00 - 10.25 = \textbf{\$9.75 change}$



AVERAGES, RATES, RATIOS, AND PROPORTIONS

AVERAGES

In Lesson 5 we will begin to calculate averages. Averages are calculated by adding all the numbers to be averaged and then dividing the sum by the total number of items.

For example:

The average of 10, 15, 25, 30, and 45 is:

$$\begin{array}{r} 10 \\ 15 \\ 25 \text{ (5 items)} \\ 30 \\ \hline +45 \\ \hline 125 \end{array}$$

$$125 \text{ (sum)} \div 5 \text{ (number of items)} = 25 \text{ (average)}$$

Some numbers may be less than 25 or more than 25. Twenty-five is simply an *average* figure.

Let's try another one:

While replacing underground cable, 256 yards were replaced on Monday, 243 yards on Tuesday, it rained all day on Wednesday, 295 yards on Thursday, and 260 yards on Friday. What was the average number of yards of cable replaced each day worked?

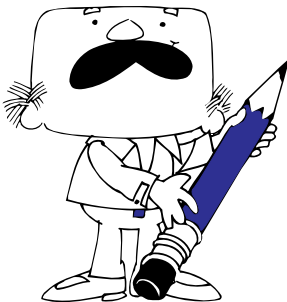
$$\begin{array}{r}
 256 \\
 243 \\
 295 \quad (4 \text{ items}) \\
 +260 \\
 \hline
 1,054
 \end{array}$$

$$1054 \div 4 = 263.5 \text{ yards averaged each day worked}$$

To find an average, add the numbers and divide by the total number of items

$$\text{average} = \frac{\text{sum of the numbers}}{\text{total \# of items}}$$

Practice makes perfect!



Why don't you practice averages by doing the following problems. Learning to solve word problems will help you score higher on the ACT™ WorkKeys® *Applied Mathematics* assessment. So practice... practice.

EXERCISE – AVERAGES

Instructions: Solve the following word problems which include finding averages. Round answers to the nearest tenth.

1. During the month of June, you worked 42 hours the first week, 51 hours the second week, 46 hours the third week, and 41 hours the last week. Find the average number of hours per week you worked during the month of June.
2. On the morning of January 1, the odometer on the county garbage truck read 117,332.2 miles. After the run was finished on January 31, the odometer read 121,299.1 miles. What was the average number of miles driven each day during the month of January?



LESSON 5

3. During five workdays you produced 286, 340, 197, 432, and 263 parts per day. What was the average number of parts produced per day?

4. An employee worked 8.6 hours on Monday, 5.2 hours on Tuesday, 7.2 hours on Wednesday, 9 hours on Thursday, and 7.3 hours on Friday. What was the average number of hours that he worked each day?

5. A driver loaded his truck with 7 crates weighing 138.4 lb, 258.0 lb, 212.9 lb, 371.6 lb, 157.9 lb, 197.2 lb, and 164.5 lb. What was the average weight of the crates?



LESSON 5

WIN CAREER SOLUTIONS

6. In the last five months, county residents have recycled 1,100 lb, 1,350 lb, 1,605 lb, 890 lb, and 735 lb of newspaper at the local recycling center. What was the average amount of newspaper recycled per month?
7. Aluminum is being used more and more in the American automobile industry. A certain model of car contained 54 pounds of aluminum in 1990, 78 pounds in 1991, 130 pounds in 1992, and 190 pounds in 1993. What was the average amount of aluminum used in these four years?



LESSON 5

ANSWERS TO EXERCISE

1. During the month of June, you worked 42 hours the first week, 51 hours the second week, 46 hours the third week, and 41 hours the last week. Find the average number of hours per week you worked during the month of June.

Answer: $42 + 51 + 46 + 41 = 180$ total hours worked for 4 weeks
 $180 \div 4 = \mathbf{45 \text{ hours}}$ averaged each week

2. On the morning of January 1, the odometer on the county garbage truck read 117,332.2 miles. After the run was finished on January 31, the odometer read 121,299.1 miles. What was the average number of miles driven each day during the month of January?

Answer: 31 days
 $121,299.1 - 117,332.2 = 3,966.9$ miles driven in January
 $3,966.9 \div 31 \text{ days} = 127.96$
127.96 rounds to $\mathbf{128.0 \text{ miles}}$ averaged per day

3. During five workdays you produced 286, 340, 197, 432, and 263 parts per day. What was the average number of parts produced per day?

Answer: $286 + 340 + 197 + 432 + 263 = 1,518$
 $1,518 \div 5 = \mathbf{303.6 \text{ parts}}$ per day

4. An employee worked 8.6 hours on Monday, 5.2 hours on Tuesday, 7.2 hours on Wednesday, 9 hours on Thursday, and 7.3 hours on Friday. What was the average number of hours that he worked each day?

Answer: $8.6 + 5.2 + 7.2 + 9 + 7.3 = 37.3$
 $37.3 \div 5 \text{ (days)} = 7.46$
7.46 rounds to $\mathbf{7.5 \text{ hours}}$ per day



LESSON 5

WIN CAREER SOLUTIONS

5. A driver loaded his truck with 7 crates weighing 138.4 lb, 258.0 lb, 212.9 lb, 371.6 lb, 157.9 lb, 197.2 lb, and 164.5 lb. What was the average weight of the crates?

$$\begin{aligned}\text{Answer: } & 138.4 + 258 + 212.9 + 371.6 + 157.9 + 197.2 + 164.5 = \\ & 1,500.5 \\ & 1,500.5 \div 7 = \mathbf{214.4 \text{ lb}} \text{ per crate}\end{aligned}$$

6. In the last five months, county residents have recycled 1,100 lb, 1,350 lb, 1,605 lb, 890 lb, and 735 lb of newspaper at the local recycling center. What was the average amount of newspaper recycled per month?

$$\begin{aligned}\text{Answer: } & 1,100 + 1,350 + 1,605 + 890 + 735 = 5,680 \\ & 5,680 \div 5 = \mathbf{1,136 \text{ lb}} \text{ per month}\end{aligned}$$

7. Aluminum is being used more and more in the American automobile industry. A certain model of car contained 54 pounds of aluminum in 1990, 78 pounds in 1991, 130 pounds in 1992, and 190 pounds in 1993. What was the average amount of aluminum used in these four years?

$$\begin{aligned}\text{Answer: } & 54 + 78 + 130 + 190 = 452 \\ & 452 \div 4 = \mathbf{113 \text{ pounds}}\end{aligned}$$

***RATES, RATIOS, AND PROPORTIONS***

I hope you did well with averages. The remainder of this lesson will deal with rates, ratios, and proportions. You will see as you finish this lesson that these three terms are related to one another.

Let's start with ratios and rates. A ratio is a comparison of two values. Ratios are two numbers written in fractional form. The ratio of my height to

yours might be $\frac{5\text{ ft}}{6\text{ ft}}$ which can also be written as 5

ft to 6 ft or 5:6. The important thing to remember is that the first number or quantity referred to in the ratio is the number that goes on top of the fraction.

Find the ratio of masons to laborers when there are 45 masons and 80 laborers.

$$\frac{45}{80} = \frac{9}{16} \text{ (reduce the fraction)}$$

or 9 to 16 or 9:16



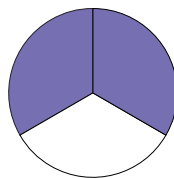
A rate is similar, but the fraction is converted to a decimal or a whole number by division. A rate compares 2 different kinds of measures. For example, miles per gallon is a rate. If I drive 200 miles on 20 gallons of

gas, the rate is $\frac{200}{20} = 200 \div 20$ or 10 miles per gallon.

Prices can also be rates. You buy meat per pound. If you buy 8 pounds of meat for \$21, the rate of dollars per pound is $\$21 \div 8 = \2.63 per pound. Notice, you are finding the rate of dollars per pound. Dollars is listed first so it goes on top of the fraction or $21 \div 8$.

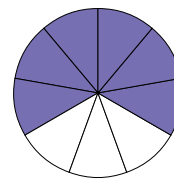
Proportions are two equal ratios. You can use proportions to solve for an unknown quantity.

For example, a proportion might be:



$$\frac{2}{3}$$

=



$$\frac{6}{9}$$

The shaded areas are equal.

$\frac{2}{3}$ measures the same amount as $\frac{6}{9}$.

You can check proportions by cross multiplying:

$$\frac{2}{3} \times \frac{6}{9}$$

Does $2 \times 9 = 3 \times 6$?

$18 = 18$ Yes, this is a proportion.

If we did not know one part of the proportion, we could “solve” it.

$$\frac{2}{3} = \frac{6}{x}$$

x would represent the number we didn’t know.

By using cross multiplication again, we can find the value we do not know.

$$\begin{array}{ccc} 2 & & 6 \\ & \searrow & \nearrow \\ 3 & & x \end{array}$$

Multiply 2 times x and 3 times 6

$$2x = 18$$

Then divide by the number beside the x .

$$18 \div 2 = 9 \quad \text{or} \quad \frac{2x}{2} = \frac{18}{2} (\text{reduce})$$

$$x = 9 \quad \quad \quad x = 9$$

$$\text{so, } \frac{2}{3} = \frac{6}{9}$$

Here’s another one:

$$\frac{5}{8} = \frac{x}{24}$$

$$8x = 120$$

$$\frac{8x}{8} = \frac{120}{8}$$

$$x = 15$$



LESSON 5

WIN CAREER SOLUTIONS

Now, let's put some of these rates, ratios, and proportions to practice. I'll do a few first, and then you can practice.

The trail you are helping the local Sierra Club to construct rises 200 feet vertically for every 1,200 feet horizontally. What is the ratio of the vertical rise to the horizontal run of this trail?

$$\frac{200 \text{ ft vertical}}{1,200 \text{ ft horizontal}} = \frac{1}{6} \text{ or } 1:6 \text{ or } 1 \text{ to } 6$$

Notice: vertical to horizontal means vertical is first

On a sales route, 15 gallons of gas are needed to go 225 miles. Find the number of miles driven per gallon.

$$225 \div 15 = 15$$

15 miles per gallon

or

$$\frac{225 \text{ miles}}{15 \text{ gallon}} = 15 \text{ miles per gallon}$$



LESSON 5

WIN CAREER SOLUTIONS

When you calculate proportions from a word problem, you must remember that what measurement is “on top” on the left fraction must be “on top” on the right. For instance:

**A truck driver can travel 560 miles on 28 gallons of gas.
How far can he travel on 35 gallons of gas?**

$$\frac{560mi}{28gal} = \frac{x\ mi}{35gal} \text{ (we don't know the other miles)}$$

Since *miles* is on top in the left fraction, *miles* must go on top in the right fraction. Now cross multiply.

$$28x = 19,600$$

$$\frac{28x}{28} = \frac{19,600}{28}$$

$$x = 700 \text{ miles}$$

So, the truck driver can travel 700 miles on 35 gallons of gas.

The best way to learn is to practice.

**EXERCISE – RATIOS, RATES, AND PROPORTIONS**

Instructions: *Work the following problems. You may find it helpful to refer to the previous examples.*

- 1. To make fuel for your lawnmower you mix one pint of oil with 2 gallons of gasoline. What is the ratio of oil to gasoline?**

- 2. Your plant runs two assembly lines. The first line produces 1,250 units a day and the second produces 2,825 units a day. What is the ratio of production of the first line to the second line?**

- 3. If the amount of waking time 4-year-old children spend alone with their fathers each day is 42 minutes while the daily waking time spent in daycare is 6 hours, what is the ratio of time with father to time in daycare?**

- 4. An acid mixture measures 35 liquid ounces. Of that, 7 ounces are pure acid and the rest is water. What is the ratio of acid to water?**



LESSON 5

5. A store buys an item wholesale for \$175 and sells it for \$300. What is the ratio of the cost to the selling price?

6. Your living room is 21 feet long and 3 yards high. What is the ratio of length to height?

7. Your assembly line produces 500 toasters in 4 hours. What is the rate of toasters per minute?

8. One of the vats at your plant has a leak. At 8:00 a.m. the vat was full, but by 10:00 a.m. it had lost 5 gallons. What is the rate of loss per hour?

9. A butcher sells 4 pounds of meat for \$14. Find the price per pound.



LESSON 5

WIN CAREER SOLUTIONS

10. On a survey map, 5 inches represents 400 yards. Find the number of yards per inch.
11. A dietician tells her patients there are 640 calories in a 20 ounce serving of ice cream. How many calories would be in a 35 ounce serving of ice cream?
12. A model of a building has a scale of 15 feet to 2 inches. How many inches on the model are needed to represent 60 feet on the building?
13. A machine can produce 576 units in 18 hours. How many units will it produce in 28 hours?

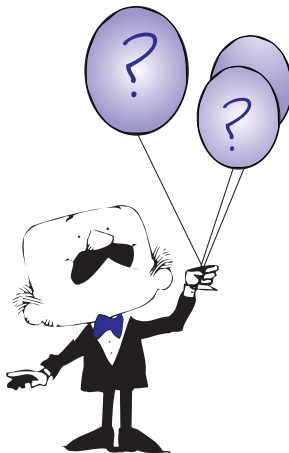


LESSON 5

14. If 6 bags of fertilizer are needed for 9 baseball fields, how many bags of fertilizer are needed for 24 fields?
15. How much would 75 pens cost if 30 pens cost \$12.80?

Pop Quiz:

If the temperature was 75° day before yesterday, 82° yesterday, and 80° today, what is the average temperature for the time you have recorded?





ANSWERS TO EXERCISE

1. To make fuel for your lawnmower you mix one pint of oil with 2 gallons of gasoline. What is the ratio of oil to gasoline?

Answer: **Convert:**

$$\frac{1 \text{ pt}}{2 \text{ gal}} \text{ change the gallons to pints}$$

larger to smaller – multiply

$$2 \text{ gal} \times 4 \text{ qt} = 8 \text{ qt}$$

$$8 \text{ qt} \times 2 \text{ pt} = 16 \text{ pt}$$

or

$$2 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} \times \frac{2 \text{ pt}}{1 \text{ qt}} = 16 \text{ pt}$$

Ratio:

$$\frac{1 \text{ pt oil}}{16 \text{ pt gas}} \text{ or } 1:16 \text{ or } 1 \text{ to } 16$$

2. Your plant runs two assembly lines. The first line produces 1,250 units a day and the second produces 2,825 units a day. What is the ratio of the production of the first line to the second line?

Answer: **Ratio:**

$$\frac{1,250}{2,825} \text{ reduce}$$

$$\frac{1,250}{2,825} = \frac{250}{565} = \frac{50 \text{ first line units}}{113 \text{ second line units}}$$

$$\frac{50}{113} \text{ or } 50:113 \text{ or } 50 \text{ to } 113$$



3. If the amount of waking time 4-year-old children spend alone with their fathers each day is 42 minutes while the daily waking time spent in daycare is 6 hours, what is the ratio of time with father to time in daycare?

Answer: **Convert:**

$$\frac{42 \text{ min}}{6 \text{ hr}} \text{ change hours to minutes}$$

$$\text{larger to smaller – multiply} \\ 6 \text{ hr} \times 60 \text{ min} = 360 \text{ min}$$

or

$$6 \cancel{\text{hr}} \times \frac{60 \text{ min}}{1 \cancel{\text{hr}}} = 360 \text{ min}$$

Ratio:

$$\frac{42 \text{ min}}{360 \text{ min}} = \frac{7 \text{ min father's time}}{60 \text{ min daycare time}} \text{ or } 7:60 \text{ or } 7 \text{ to } 60$$

4. An acid mixture measures 35 liquid ounces. Of that, 7 ounces is pure acid and the rest is water. What is the ratio of acid to water?

Answer: **Calculate amount of water:**

$$35 \text{ oz} - 7 \text{ oz acid} = 28 \text{ oz water}$$

Ratio:

$$\frac{7}{28} = \frac{1 \text{ oz acid}}{4 \text{ oz water}} \text{ or } 1:4 \text{ or } 1 \text{ to } 4$$



LESSON 5

WIN CAREER SOLUTIONS

5. A store buys an item wholesale for \$175 and sells it for \$300. What is the ratio of the cost to the selling price?

Answer: *Ratio:*

$$\frac{\$175}{\$300} = \frac{7 \text{ cost (wholesale)}}{12 \text{ selling price (retail)}} \text{ or } 7:12 \text{ or } 7 \text{ to } 12$$

6. Your living room is 21 feet long and 3 yards high. What is the ratio of length to height?

Answer: **Convert:**
change yd to ft

larger to smaller – multiply
 $3 \text{ yd} \times 3 \text{ ft} = 9 \text{ ft}$

or

$$3\cancel{\text{yd}} \times \frac{3\text{ft}}{1\cancel{\text{yd}}} = 9\text{ft}$$

Ratio:

$$\frac{21}{9} = \frac{7 \text{ length}}{3 \text{ height}} \text{ or } 7:3 \text{ or } 7 \text{ to } 3$$

**Rates**

The following problems are rates, so the ratios are divided. You will recognize rates because they compare 2 different kinds of measures which cannot be converted to each other.

7. Your assembly line produces 500 toasters in 4 hours. What is the rate of toasters per minute?

Answer: **Convert:**
change hours to minutes

larger to smaller – multiply
 $4 \text{ hr} \times 60 \text{ min} = 240 \text{ min}$

or

$$4 \cancel{\text{hr}} \times \frac{60 \text{ min}}{1 \cancel{\text{hr}}} = 240 \text{ min}$$

Ratio:

$$\frac{500}{240} = \frac{\text{toasters}}{\text{minutes}} = \frac{25}{12}$$

Rate:

$$25 \div 12 = \mathbf{2.1 \text{ toasters}} \text{ per min}$$

8. One of the vats at your plant has a leak. At 8:00 a.m. the vat was full, but by 10:00 a.m. it had lost 5 gallons. What is the rate of loss?

Answer: **Ratio:**

$$\frac{5 \text{ gallon}}{2 \text{ hr}}$$

Rate:

$$5 \div 2 = \mathbf{2.5 \text{ gallons}} \text{ per hour}$$



LESSON 5

WIN CAREER SOLUTIONS

9. A butcher sells 4 pounds of meat for \$14. Find the price per pound.

Answer: $\frac{\$14}{4} = \3.50 per pound

10. On a survey map, 5 inches represents 400 yards. Find the number of yards per inch.

Answer: $\frac{400 \text{ yd}}{5 \text{ in}} = 80 \text{ yd}$ per in

Proportions

11. A dietician tells her patients there are 640 calories in a 20 ounce serving of ice cream. How many calories would be in a 35 ounce serving of ice cream?

Answer: $\frac{640}{20} = \frac{x}{35}$

NOTE: $\frac{\text{calories on top}}{\text{ounces on bottom}}$

cross multiply

$$20x = 22,400$$

divide by 20

$$\frac{20x}{20} = \frac{22,400}{20}$$

$$x = 1,120$$

1,120 calories in 35 ounces



12. A model of a building has a scale of 15 feet to 2 inches. How many inches on the model are needed to represent 60 feet on the building?

Answer: $\frac{15}{2} = \frac{60}{x}$

NOTE: $\frac{\text{feet on top}}{\text{inches on bottom}}$

$$15x = 120$$

$$\frac{15x}{15} = \frac{120}{15}$$

$$x = 8$$

8 inches represent 60 ft

13. A machine can produce 576 units in 18 hours. How many units will it produce in 28 hours?

Answer: $\frac{576}{18} = \frac{x}{28}$

NOTE: $\frac{\text{units}}{\text{hours}}$

$$18x = 16,128$$

$$x = 896$$

896 units in 28 hr



LESSON 5

WIN CAREER SOLUTIONS

14. If 6 bags of fertilizer are needed for 9 baseball fields, how many bags of fertilizer are needed for 24 fields?

Answer: $\frac{6}{9} = \frac{x}{24}$

NOTE: $\frac{\text{bags}}{\text{fields}}$

$$9x = 144$$

$$x = 16$$

16 bags for 24 fields

15. How much would 75 pens cost if 30 pens cost \$12.80?

Answer: $\frac{75}{x} = \frac{30}{12.8}$

NOTE: $\frac{\text{pens}}{\text{cost}}$

$$30x = 960$$

$$x = 32$$

\$32.00 for 75 pens

PERCENTAGES

Lesson 6 is about percentages. It's a very practical lesson because people deal with percents almost daily.

If you'll look closely at your calculator, you may find a key that looks like this $\%$. This is your percent key. Try using the key by punching

3 0 $\%$ on your calculator.

Your answer will be 0.3, which means that your calculator changed the percent to a decimal. You may need to key in $=$ after $\%$ to get 0.3 on your screen. If you do not have that key, you will have to move your decimal two places left to get the same result.

It is important that you know how to correctly change a percent to a decimal because we cannot calculate or use basic math operations with %. We must first convert percents to decimals. Let's observe this principle in the next example.

Make sure you understand
"percents."






Employees in a particular department store get 30% off any purchases they make. If an employee buys an item costing \$25.00, how much does he or she save?

This problem is asking you to take 30% off of an item which costs \$25.00 (30% of \$25.00). The word “of” indicates multiply (remember your list of Key Words).

$$30\% \times \$25.00 = \$7.50$$

If you do not have the  key, you must change 30% to .3 or .30 before you multiply by \$25.

The employee will get \$7.50 off of the item’s original \$25.00 price.

In another example, you might be asked how much to charge someone when sales tax is involved. Let’s suppose you purchase an item which costs \$119.95 before an 8% sales tax.

$$8\% \text{ of } \$119.95 = 8\% \times \$119.95 = \$9.60 \text{ sales tax}$$

Without the percent key, you must change 8% to .08 and multiply $.08 \times 119.95$. You should get \$9.60 for the tax. (Rounding monetary units was explained in Level 3.) It wouldn’t make sense to say that you would pay \$9.60 for the item. The \$9.60 is the sales tax. You must add \$9.60 to \$119.95.

$$\begin{array}{r} \$119.95 \\ +\$9.60 \\ \hline \$129.55 \end{array} \quad \text{(what you actually will pay)}$$

Sometimes you may have to find two different percentages and add the results together:

Joe Black receives a salary of \$2,240 per month. If 18% is deducted for income tax and 6% is deducted for savings, what is the total deduction?

$$\$2,240 \times 18\% = \$403.20$$

$$\$2,240 \times 6\% = \$134.40$$

\$537.60 is the total deduction

or

$$18\% + 6\% = 24\%$$

$$24\% \times 2,240 = \$537.60 \text{ is the total deduction}$$

You should work some practice problems. You may need to refer to the examples. Good luck!



EXERCISE – PERCENTAGES

Instructions: *Solve the following word problems. Remember the 4 steps to problem solving. Make sure your answers make sense. Round any decimal answers to hundredths place.*

- 1. If you purchase an item worth \$269.95 at a 75% off sale, how much money will you save?**
- 2. Your income last year was \$27,000 from your main job, \$2,200 from a part-time job doing income-tax preparation, and \$600 from interest you earned on some investments. If your state income tax is 3% of your gross income, what was your state tax for last year?**
- 3. A quality control inspector finds that 3% of the 1,200 pieces he inspected were defective. How many pieces were defective?**

WIN CAREER SOLUTIONS

- 4. The manager of the furniture store where you work advertised a 50% off sale. Some of the discontinued merchandise was still not selling, so she told you to mark 30% off the sale price. What is the new price of a table that originally cost \$48.95?**
- 5. You are a real estate agent earning a commission rate of 6%. How much commission would you earn on the sale of a \$62,000 house?**

**ANSWERS TO EXERCISE**

1. If you purchase an item worth \$269.95 at a 75% off sale, how much money will you save?

Answer: $\$269.95 \times 75\% (.75) = \text{\textcolor{blue}{\$202.46}}$ saved

2. Your income last year was \$27,000 from your main job, \$2,200 from a part-time job doing income-tax preparation, and \$600 from interest you earned on some investments. If your state income tax is 3% of your gross income, what was your state tax for last year?

Answer: $\$27,000 + \$2,200 + \$600 = \$29,800$

$$\$29,800 \times 3\% (.03) = \text{\textcolor{blue}{\$894}}$$

3. A quality control inspector finds that 3% of the 1,200 pieces he inspected were defective. How many pieces were defective?

Answer: $1,200 \times 3\% = \text{\textcolor{blue}{36}}$ pieces were defective



4. The manager of the furniture store where you work advertised a 50% off sale. Some of the discontinued merchandise was still not selling, so she told you to mark 30% off the sale price. What is the new price of a table that originally cost \$48.95?

Answer: $\$48.95 \times 50\% = \24.48

$$\$24.48 \times 30\% = \$7.34$$

$$\$24.48 \text{ (price after 50\% off)} - \$7.34 \text{ (add'l 30\% off)} = \textbf{\$17.14}$$

At first, this answer may not appear reasonable...a table for \$17.14! But when you consider the size of the markdowns... it was about \$50 before it was 50% off. So, after the first markdown it sold for about \$25. Another 30% off this price makes \$17.14 a reasonable answer. If I find the address for this furniture store, I'll pass it along to you...what a sale!

5. You are a real estate agent earning a commission rate of 6%. How much commission would you earn on the sale of a \$62,000 house?

Answer: $\$62,000 \times 6\% = \textbf{\$3,720}$



ADDITION OF COMMON FRACTIONS, DECIMALS, AND PERCENTS

Lesson 7 deals with the addition of fractions, decimals, and percents. Let's begin by adding fractions with like denominators. (Denominators are the bottom numbers in a fraction.) When we add like fractions, we must add the top numbers, carry or keep the bottom numbers, and reduce the fraction.

Examples:

1. $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$ add top numbers, keep bottom numbers

$$\frac{2}{2} = 1 \text{ reduced}$$

2. $\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$

$$\frac{2}{4} = \frac{1}{2}$$

3. $\frac{2}{3} + \frac{7}{3} = \frac{9}{3}$

$$\frac{9}{3} = 3$$

When you have mixed numbers, you can add the whole numbers and then add the fractions.

$$\begin{array}{r} 1\frac{1}{2} \\ 7 \\ + 3\frac{1}{2} \\ \hline 11\frac{2}{2} \end{array}$$

$$\frac{2}{2} = 1$$

$$\text{So, } 11\frac{2}{2} = 11 + 1 = 12$$

Any fraction with the same top and bottom numbers equals one whole or 1. Think about it. Two out of two parts is one whole. Five out of five parts is one whole.

$$\frac{3}{10} + \frac{4}{10} + \frac{5}{10} = \frac{12}{10} = \frac{6}{5} \text{ or } 1\frac{1}{5}$$

$\frac{12}{10}$ and $\frac{6}{5}$ are called improper fractions. The top number is larger than the bottom number. Improper fractions may be rewritten as mixed numbers by division.

$$\frac{12}{10}$$

$$\begin{array}{r} 1 \text{ whole} \\ 10 \overline{)12} \\ \underline{10} \\ 2 \text{ parts} \end{array}$$

$\frac{10}{10}$ is a whole 1. So, $\frac{12}{10}$ is the same as $\frac{10}{10} + \frac{2}{10}$ and may be written as $1 + \frac{2}{10}$ or $1\frac{2}{10}$.

If you don't have a calculator that does fractions, you might want to run out to the discount store and invest in one!



Fractions that can be written in lower terms (reduced) should be. For instance, $\frac{2}{10}$ has a factor of 2 in the top and bottom numbers (that means 2 divides into both numbers). So $\frac{2}{10} = \frac{2 \div 2}{10 \div 2} = \frac{1}{5}$. Calculators automatically reduce fractions and convert improper fractions to mixed numbers.



LESSON 7

There may be a key on your calculator that will calculate fractions for you. Your fraction key looks like this or something similar: $\text{a}^{\text{b}/\text{c}}$

When we add $\frac{1}{2} + \frac{1}{2}$, we key:

$1 \text{ a}^{\text{b}/\text{c}} 2 + 1 \text{ a}^{\text{b}/\text{c}} 2 =$

Your calculator automatically reduces the fraction and gives “1” as your answer. Go back and try the previous examples on your calculator and make sure you get the correct answers.

Do the following problems for practice. It is a good idea to do them by hand and on your calculator since you may not always have your calculator with you.

**EXERCISE – ADDING FRACTIONS WITH LIKE DENOMINATORS**

Instructions: *Add the fractions and reduce to the lowest terms.*

1. $\frac{1}{10} + \frac{9}{10} + \frac{7}{10} =$

2. $2\frac{3}{7} + \frac{3}{7} + \frac{1}{7} =$

3. $6\frac{7}{8} + 2\frac{3}{8} + 4\frac{1}{8} =$

4. $\frac{8}{15} + \frac{7}{15} + \frac{4}{15} =$

5. $\frac{1}{6} + \frac{5}{6} + 2\frac{1}{6} =$



LESSON 7

ANSWERS TO EXERCISE

1. $\frac{1}{10} + \frac{9}{10} + \frac{7}{10} =$

Answer: add the top numbers and keep the bottom numbers the same

$$\frac{17}{10} \text{ (improper fraction)}$$

divide 10 into 17 to see that there is 1 whole number and a remainder of 7

$$\frac{17}{10} = \frac{10}{10} + \frac{7}{10} = 1 + \frac{7}{10} \text{ or } 1\frac{7}{10} \text{ (mixed number)}$$

2. $2\frac{3}{7} + \frac{3}{7} + \frac{1}{7} =$

Answer: $2\frac{7}{7} = 2 + 1 = 3 \left(\frac{7}{7} = 1 \right)$

You may prefer to work this problem first converting the

mixed number ($2\frac{3}{7}$) to an improper fraction, if you already

know how to convert. If not, do not worry. We will discuss this process later.

$$\frac{17}{7} + \frac{3}{7} + \frac{1}{7} = \frac{21}{7}$$

$$\frac{21}{7} = 3$$



3. $6\frac{7}{8} + 2\frac{3}{8} + 4\frac{1}{8} =$

Answer: $\frac{107}{8}$ (improper fraction)

add the whole numbers and fractions separately

$$6\frac{7}{8} + 2\frac{3}{8} + 4\frac{1}{8} = 12\frac{11}{8}$$

$$12 + \frac{8}{8} + \frac{3}{8} = 12 + 1 + \frac{3}{8} = 13\frac{3}{8} \text{ (mixed number)}$$

Again, you may prefer to change all numbers to improper fractions before you add.

$$\frac{55}{8} + \frac{19}{8} + \frac{33}{8} = \frac{107}{8}$$

$$\frac{107}{8} = 13\frac{3}{8} \text{ (use division to convert to mixed number)}$$



LESSON 7

WIN CAREER SOLUTIONS

4. $\frac{8}{15} + \frac{7}{15} + \frac{4}{15} =$

Answer: $\frac{19}{15}$ (improper fraction)

$$\frac{15}{15} + \frac{4}{15} = 1 + \frac{4}{15} = 1\frac{4}{15} \text{ (mixed number)}$$

5. $\frac{1}{6} + \frac{5}{6} + 2\frac{1}{6} =$

Answer: $\frac{1}{6} + \frac{5}{6} + 2\frac{1}{6} = 2\frac{7}{6}$

$$2 + \frac{6}{6} + \frac{1}{6} = 2 + 1 + \frac{1}{6} = 3\frac{1}{6} \text{ (mixed number)}$$

or

$$\frac{1}{6} + \frac{5}{6} + \frac{13}{6} = \text{(convert to improper fraction)}$$

$$\frac{19}{6} \text{ (improper fraction)}$$

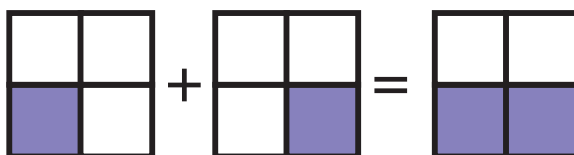
$$\begin{array}{r} 3 \text{ whole} \\ 6 \overline{)19} \\ \underline{18} \\ 1 \text{ part} \end{array}$$

$$= 3\frac{1}{6}$$

There are some very common fractions that may have the same or different denominators that you should be able to add by sight. By now you should know that:

$$\frac{1}{2} + \frac{1}{2} = 1$$

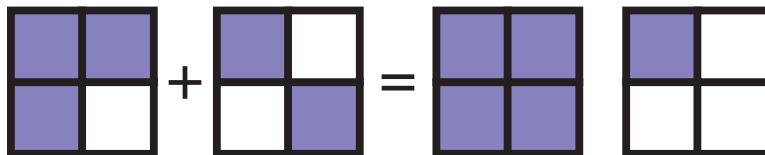
$$\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$$



$$\frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1$$



$$\frac{3}{4} + \frac{1}{2} = 1\frac{1}{4}$$



You can see by the last drawing that fractions can be added with unlike denominators. These are the more common addition problems that you should memorize. Do the three problems on the following page, adding the common fractions.



EXERCISE – **ADDING COMMON FRACTIONS**

Instructions: *Solve the following word problems. Remember to reduce your fractions and write final answers as mixed numbers.*

1. Jill worked $2\frac{1}{4}$ hours on Monday, 7 hours on Tuesday, $3\frac{1}{2}$ hours on Wednesday, 4 hours on Thursday and was off on Friday. Find the total number of hours Jill worked for the week.

2. Sam works in the table department of the Knockwood Furniture Company. In building a table, Sam needs pieces of wood that are $3\frac{1}{4}$ and $5\frac{1}{4}$ feet in length. If both pieces must be cut from the same board, what is the shortest board that Sam can use? (Assume no waste in cutting.)

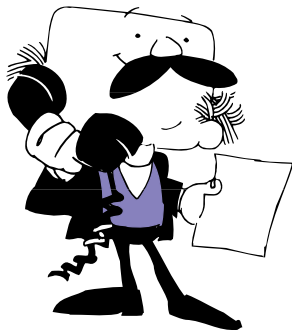


LESSON 7

WIN CAREER SOLUTIONS

3. Your stationery store has just received a rush order for five crates of envelopes. Your inventory shows only four crates in stock, but you remember seeing some partially filled crates that had been opened for in-house use. You find one crate that is three-quarters full and another one-half full. Do you have enough envelopes to fill the order?

May I take your order?





ANSWERS TO EXERCISE

1. Jill worked $2\frac{1}{4}$ hours on Monday, 7 hours on Tuesday, $3\frac{1}{2}$ hours on Wednesday, 4 hours on Thursday and was off on Friday. Find the total number of hours Jill worked for the week.

Answer: $2\frac{1}{4} + 7 + 3\frac{1}{2} + 4 = 16\frac{3}{4}$ hours

2. Sam works in the table department of the Knockwood Furniture Company. In building a table, Sam needs pieces of wood that are $3\frac{1}{4}$ and $5\frac{1}{4}$ feet in length. If both pieces must be cut from the same board, what is the shortest board that Sam can use? (Assume no waste in cutting.)

Answer: $3\frac{1}{4} + 5\frac{1}{4} = 8\frac{1}{2}$ feet

3. Your stationery store has just received a rush order for five crates of envelopes. Your inventory shows only four crates in stock, but you remember seeing some partially filled crates that had been opened for in-house use. You find one crate that is three-quarters full and another one-half full. Do you have enough envelopes to fill the order?

Answer: $\frac{3}{4} + \frac{1}{2} = 1\frac{1}{4}$ crates

$1\frac{1}{4} + 4 = 5\frac{1}{4}$ crates – **yes**, you have enough since you only need 5 crates



LESSON 7

WIN CAREER SOLUTIONS

Now, just a short note on adding and subtracting percents: percents add like anything else - they just need a percent sign.

$$40\% + 50\% = 90\%$$

Also, when you add parts of a whole, the parts should add up to 100%.

For example:

A school consists only of A and B students. If 43% are A students, what is the percentage of B students?

Since we are referring to a whole class, 100% represents all students.

$$43\% = \text{A students}$$

$$100\% - 43\% = \text{B students}$$

$$57\% \text{ are B students}$$

Percentages of one whole should not exceed 100%. Do the next four problems on your own. You may have to do a little thinking, especially on the last one.



Pop Quiz: Name the 4 steps that are suggested for problem solving. List at least one question you should ask yourself to complete each step.

Step 1 _____

Question to help complete Step 1

Step 2 _____

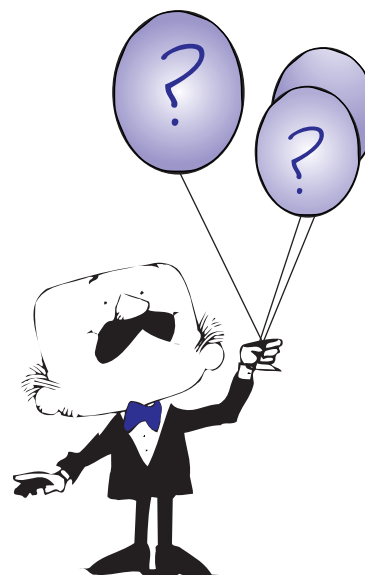
Question to help complete Step 2

Step 3 _____

Question to help complete Step 3

Step 4 _____

Question to help complete Step 4



**EXERCISE – PERCENTS**

Instructions: *Solve the following word problems. Remember the 4 steps to problem solving.*

1. While doing your federal income tax for last year, you noticed that 15% of your salary was deducted for federal income tax, 8% of your salary went for social security tax, and 5% of your salary was taken by state taxes. What percent of your salary was left?
2. In a recent election, 43% of the voters voted for the Democratic candidate and 52% of the voters voted for the Republican candidate. What percent of the voters voted for the third-party candidates?
3. 15% of your paycheck is deducted for taxes, 4% for health insurance and 8% for FICA. What percent of your gross pay goes for deductions?
4. A will stipulates that three children Alice, Bob, and Carl are to receive, respectively, 35%, 40%, and 45% of the estate. Is this possible?



LESSON 7

ANSWERS TO EXERCISE

1. While doing your federal income tax for last year, you noticed that 15% of your salary was deducted for federal income tax, 8% of your salary went for social security tax, and 5% of your salary was taken by state taxes. What percent of your salary was left?

Answer: $15\% + 8\% + 5\% = 28\%$
 100% (whole salary) - 28% (deductions) = **72%** left or take home pay

2. In a recent election, 43% of the voters voted for the Democratic candidate and 52% of the voters voted for the Republican candidate. What percent of the voters voted for the third-party candidates?

Answer: $52\% + 43\% = 95\%$
 100% (all voters) - $95\% =$ **5%** voted third party

3. 15% of your paycheck is deducted for taxes, 4% for health insurance and 8% for FICA. What percent of your gross pay goes for deductions?

Answer: $15\% + 4\% + 8\% =$ **27%**

4. A will stipulates that three children Alice, Bob, and Carl are to receive, respectively, 35%, 40%, and 45% of the estate. Is this possible?

Answer: $35\% + 40\% + 45\% = 120\%$
This is not possible because it totals over 100%.

Sometimes we have problems with both decimals and fractions in them. You must convert one or the other of them before you can add. (Remember, to convert a fraction to a decimal, divide the bottom number into the top number.) If, of course, you are using a calculator with a fraction key, you can enter the numbers without worrying about conversion.

If we need to add

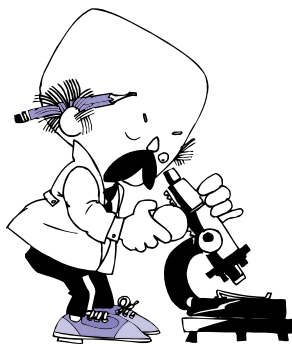
$$.25 + \frac{3}{4} + \frac{1}{4} + .36,$$

we would most likely convert the fractions to decimals since that's easier. Typically, individuals prefer to work with decimals rather than fractions. But, either way, your answers would represent the same number:

$$.25 + .75 + .25 + .36 = 1.61$$

The following word problems contain decimals, fractions, or percents which must be converted before the math is done. Try your hand at these conversions.

*Make your conversions
carefully!*





LESSON 7

WIN CAREER SOLUTIONS

3. You calculate that you spend $\frac{2}{5}$ of your income for housing expenses. You decide to budget 20% for food. What fraction of your income goes for food and housing?
4. You need a supply of bolts. One warehouse has $\frac{1}{4}$ the number you need, a second has 10% of the number you need, and a third has .20 of the number you need. Will this be enough?



LESSON 7

ANSWERS TO EXERCISE

1. In order to assemble a product, you stack .10 inch of foam, $\frac{1}{4}$ inch of metal, $\frac{1}{2}$ inch of wood, and .1 inch of fabric. How thick will this product be?

Answer: $.10 + .25 + .50 + .1 = .95$ in thick

2. Al worked $6\frac{3}{4}$ hours on Monday, 7.5 hours on Tuesday, $8\frac{1}{2}$ hour on Wednesday, 7.75 hours on Thursday, and $7\frac{1}{4}$ hours on Friday. How many hours did Al work for the week?

Answer: $6.75 + 7.5 + 8.5 + 7.75 + 7.25 = 37.75$ hours



3. You calculate that you spend $\frac{2}{5}$ of your income for housing expenses. You decide to budget 20% for food. What fraction of your income goes for food and housing?

Answer: $\frac{2}{5} + 20\%$

Since the problem asks for a fraction, we need to change 20% to a fraction (Level 3 skill)

$$20\% = \frac{20}{100} = \frac{1}{5}$$

$$\frac{2}{5} + \frac{1}{5} = \frac{3}{5} \text{ for housing and food}$$

4. You need a supply of bolts. One warehouse has $\frac{1}{4}$ the number you need, a second has 10% of the number you need, and a third has .20 of the number you need. Will this be enough?

Answer: $\frac{1}{4} = .25 = 25\%$

$$\begin{array}{r} +10\% \\ +20\% \\ \hline 55\% \end{array}$$

No, this is only 55% of the 100% that you need.



MULTIPLICATION OF FRACTIONS

Let's begin Lesson 8 by multiplying some simple fractions. You need to first realize every whole number has an implied one below it.

$$5 = \frac{5}{1}$$

$$10 = \frac{10}{1}$$

$$121 = \frac{121}{1}$$

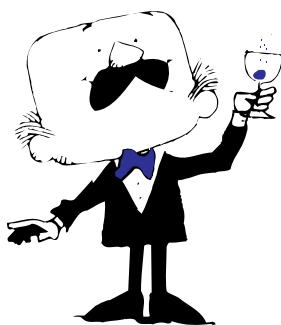
When you multiply a whole number, you may need to put a one underneath it.

$$\frac{2}{3} \times 5 = \frac{2}{3} \times \frac{5}{1}$$

When you multiply, do so straight across, top number by top number and bottom number by bottom number. You may be able to reduce your answer, so always try.

$$\frac{2}{3} \times \frac{5}{1} = \frac{10}{3} \text{ or } 3\frac{1}{3}$$

Here's to fractions!
Life is full of them.





LESSON 8

WIN CAREER SOLUTIONS

You may be able to “cancel.” You can cancel when one number on top is the same as another on the bottom.

$$\frac{3}{4} \times \frac{4}{1}$$

Since 4 will go into 4, this problem can be reduced. We often call this cancelling.

$$\frac{3}{\cancel{4}} \times \frac{\overset{1}{\cancel{4}}}{1}$$

4 goes into 4, 1 time

$$\frac{3}{1} \times \frac{1}{1} = \frac{3}{1} = 3$$

Let's try another problem.

$$\frac{3}{\underset{2}{8}} \times \frac{\overset{1}{\cancel{4}}}{1} =$$

4 goes into itself once and 8 twice.

$$\frac{3}{2} \times \frac{1}{1} = \frac{3}{2}$$

If you need to multiply a mixed number by a whole number, you must change the mixed number to a “top heavy” fraction. We discussed improper fractions in Lesson 7. To convert a mixed number to an improper fraction, multiply the whole number by the bottom of the fraction, then add the top number of the fraction to your answer.

Examples:

$$5\frac{3}{4} \rightarrow 5 \times 4 = 20 \rightarrow 20 + 3 = 23 \rightarrow \frac{23}{4}$$

$$\begin{array}{c} \text{add} \nearrow 3 \xrightarrow{\text{result}} 23 \\ 5 \overline{) 4} \\ \text{multiply} \nwarrow 4 \text{ (carry over)} \\ \uparrow \\ \text{start} \end{array}$$

$$12\frac{1}{8} \rightarrow 12 \times 8 = 96 \rightarrow 96 + 1 = 97 \rightarrow \frac{97}{8}$$

$$\text{So, } 12\frac{1}{8} \times 4 = 12\frac{1}{8} \times \frac{4}{1} = \frac{97}{8} \times \frac{4}{1} = \frac{97}{2} \times \frac{1}{1} = \frac{97}{2} \text{ (steps are below)}$$

$$12\frac{1}{8} \times 4 = 12\frac{1}{8} \times \frac{4}{1} \text{ write whole numbers over 1}$$

$$12\frac{1}{8} \times \frac{4}{1} = \frac{97}{8} \times \frac{4}{1} \text{ change mixed numbers to improper fraction}$$

$$\frac{97}{8^2} \times \frac{4^1}{1} = \frac{97}{2} \times \frac{1}{1} = \frac{97}{2} \text{ reduce fractions by four}$$

$$\frac{97}{2} = 48\frac{1}{2} \text{ change to mixed number}$$



Of course, you may use your calculator if you have a fraction

key $\left(\frac{a}{b/c}\right)$.

$12\frac{1}{8} \times 4$ would be keyed in as follows:

$\left(\frac{1}{2}\right) \left(\frac{a}{b/c}\right) \left(\frac{1}{2}\right) \left(\frac{a}{b/c}\right) 8 \times 4 = 48\frac{1}{2}$

$48\frac{1}{2}$ is the same as $\frac{97}{2}$ ($48 \times 2 + 1 = 97$)

Here is an example of a word problem that requires you to multiply by a fraction:

You work at a store where you are marking tags for $\frac{1}{2}$ off.

An item costs \$76. What is the new price?

$$\frac{38}{1} \times \frac{1}{2} = \frac{38}{1} = \$38$$

This figure is the amount off of the original price. So, typically you need to subtract this amount from the original price. Since

this discount is exactly $\frac{1}{2}$, we can see the price will still be \$38.

Now, try the following problems on your own.

**EXERCISE – MULTIPLICATION OF FRACTIONS**

Instructions: *Solve the following word problems using the 4 steps to problem solving. Reduce fractions and write answers as mixed numbers.*

1. Your department uses $5\frac{3}{8}$ boxes of envelopes each month. Each box contains a gross (144) of envelopes. How many envelopes does your department use each month?

2. You are constructing deck chairs that require $12\frac{2}{3}$ feet of lumber each. How many feet of lumber will you use to make 15 chairs?

3. You work at an appliance store which offers an extended warranty on each product sold. Two-fifths of the customers purchase the extended warranty. One year the store sold 12,930 appliances. How many extended warranties were purchased?



LESSON 8

WIN CAREER SOLUTIONS

4. You work at a pharmacy where you must file insurance claims. Three-fourths of the prescriptions filled are paid by insurance companies. One week 1,968 prescriptions were filled. How many claims did you file for that week?

5. Sam is paid \$8.00 per hour for 40 hours per week and $1\frac{1}{2}$ times his normal salary for overtime. How much will he make for working a 46-hour week?

6. It takes $\frac{3}{4}$ yard of material to make a place mat and matching napkin. How many yards of material will it take to make 8 sets?

7. You earn extra money on Saturday cleaning and polishing cars. It takes you $1\frac{2}{3}$ hours to wash and polish one car. How many hours will it take to wash and polish 5 cars?



LESSON 8

ANSWERS TO EXERCISE

1. Your department uses $5\frac{3}{8}$ boxes of envelopes each month. Each box contains a gross (144) of envelopes. How many envelopes does your department use each month?

Answer: $5\frac{3}{8} \times 144 =$

$$\frac{43}{8} \times \frac{144}{1} =$$

$$\frac{43}{1} \times \frac{18}{1} = \frac{774}{1} = \mathbf{774} \text{ envelopes}$$

2. You are constructing deck chairs that require $12\frac{2}{3}$ feet of lumber each. How many feet of lumber will you use to make 15 chairs?

Answer: $12\frac{2}{3} \times 15 =$

$$\frac{38}{3} \times \frac{15}{1} =$$

$$\frac{38}{1} \times \frac{5}{1} = \frac{190}{1} = \mathbf{190} \text{ ft}$$



LESSON 8

WIN CAREER SOLUTIONS

3. You work at an appliance store which offers an extended warranty on each product sold. Two-fifths of the customers purchase the extended warranty. One year the store sold 12,930 appliances. How many extended warranties were purchased?

$$\text{Answer: } \frac{2}{5} \times \frac{12,930}{1} =$$

$$\frac{2}{1} \times \frac{2,586}{1} = \mathbf{5,172} \text{ extended warranties}$$

4. You work at a pharmacy where you must file insurance claims. Three-fourths of the prescriptions filled are paid by insurance companies. One week 1,968 prescriptions were filled. How many claims did you file for that week?

$$\text{Answer: } \frac{3}{4} \times \frac{1,968}{1} =$$

$$\frac{3}{1} \times \frac{492}{1} = \mathbf{1,476} \text{ claims filed}$$

5. Sam is paid \$8.00 per hour for 40 hours per week and $1\frac{1}{2}$ times his normal salary for overtime. How much will he make for working a 46-hour week?

$$\text{Answer: } 1\frac{1}{2} \times 8 = \$12 \text{ per hour for overtime}$$

$$\begin{array}{rcl} 8 \times 40 = & \$320 & \text{regular salary} \\ + 72 & & (\$12 \times 6 \text{ hours} = \$72 \text{ overtime}) \\ \hline \mathbf{\$392} & & \text{total} \end{array}$$



6. It takes $\frac{3}{4}$ yard of material to make a place mat and matching napkin. How many yards of material will it take to make 8 sets?

Answer: $\frac{3}{4} \times 8 =$

$$\frac{3}{4} \times \frac{8}{1} =$$

$$\frac{3}{1} \times \frac{2}{1} = 6 \text{ yd}$$

7. You earn extra money on Saturday cleaning and polishing cars. It takes you $1\frac{2}{3}$ hours to wash and polish one car. How many hours will it take to wash and polish 5 cars?

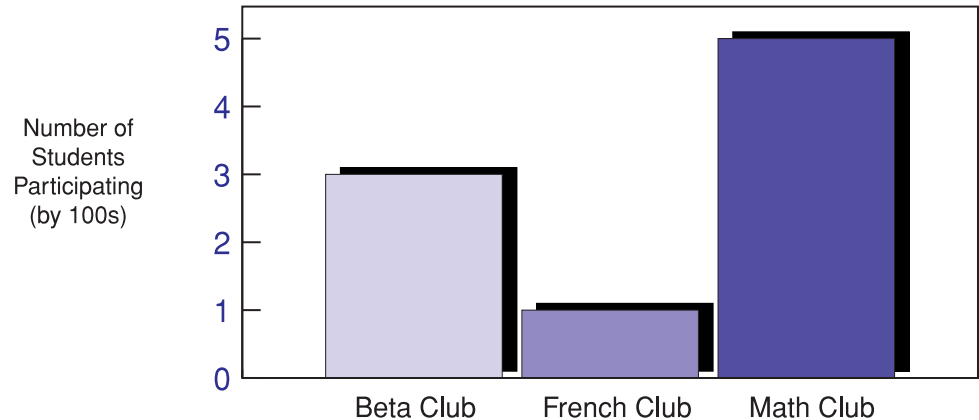
Answer: $1\frac{2}{3} \times 5 =$

$$\frac{5}{3} \times \frac{5}{1} = \frac{25}{3} \text{ or } 8\frac{1}{3} \text{ hr}$$



CHARTS AND GRAPHS

Lesson 9 involves reading simple charts and graphs. We will look at three different graphics: bar graphs, circle graphs, and line graphs.

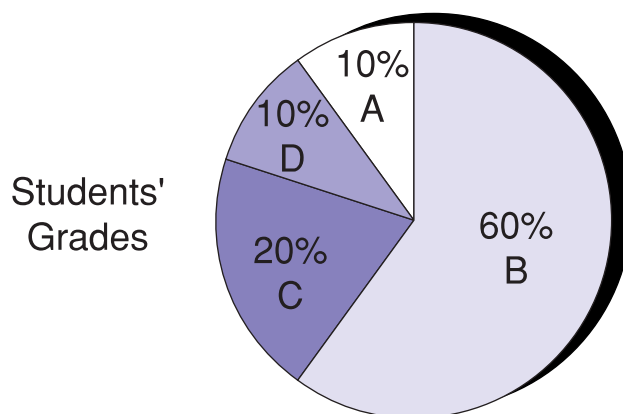


Bar graphs give information on the left and at the bottom. In this particular graph, the number of students are listed by 100s on the left. Various clubs are listed at the bottom of the graph. There are 300 students in the Beta Club. I might ask you: how many more students are in the Math Club than in the Beta Club?

- 500 in Math Club, 300 in Beta Club
- $500 - 300 = 200$
- There are 200 more students in the Math Club.

Late for my club meeting!





Circle or pie graphs are also easy to read. A circle graph is divided into parts (often percentages). The percents must add up to 100%.

You can look at the pie graph and see that 10% of the students made Ds. I might tell you that there are 2,400 students in the school. How many students made Bs?

Well, 60% of the total 2,400 = 1,440 students made Bs.

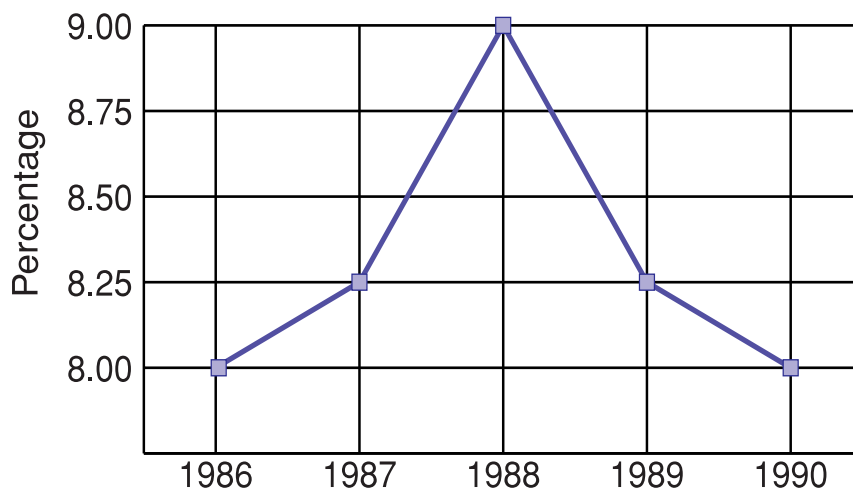
$$60\% \times 2,400$$

or

$$.60 \times 2,400 = 1,440$$

1,440 students made Bs

Interest Rates



Line graphs are similar to bar graphs. You read the data at the point where the bottom information intersects with the side information.

If you look at this graph you can see that the interest rate was highest when the date or bottom figure reads 1988. The information on the left indicates 9% at this point. You can also see that the line goes down from there which indicates that the rate decreased.



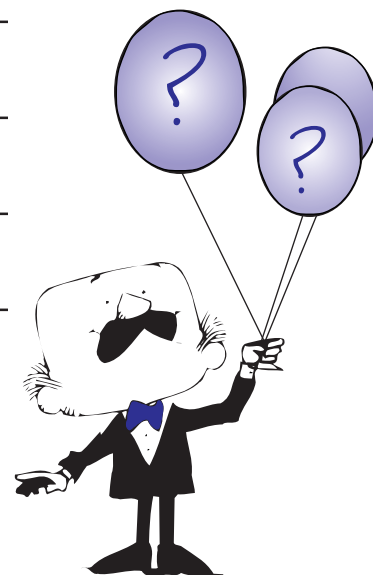
Pop Quiz: List as many "key words" for mathematical operations as you can remember without referring to your list.

Addition

Multiplication

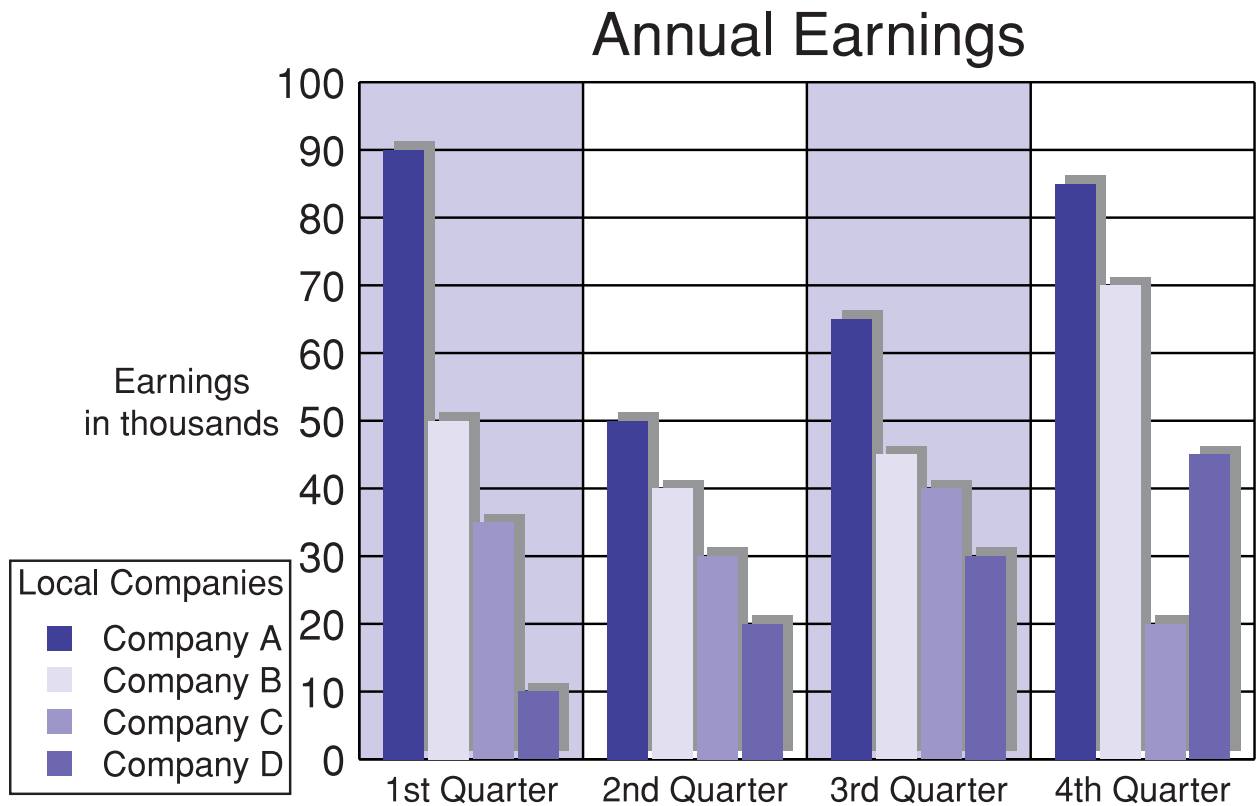
Subtraction

Division

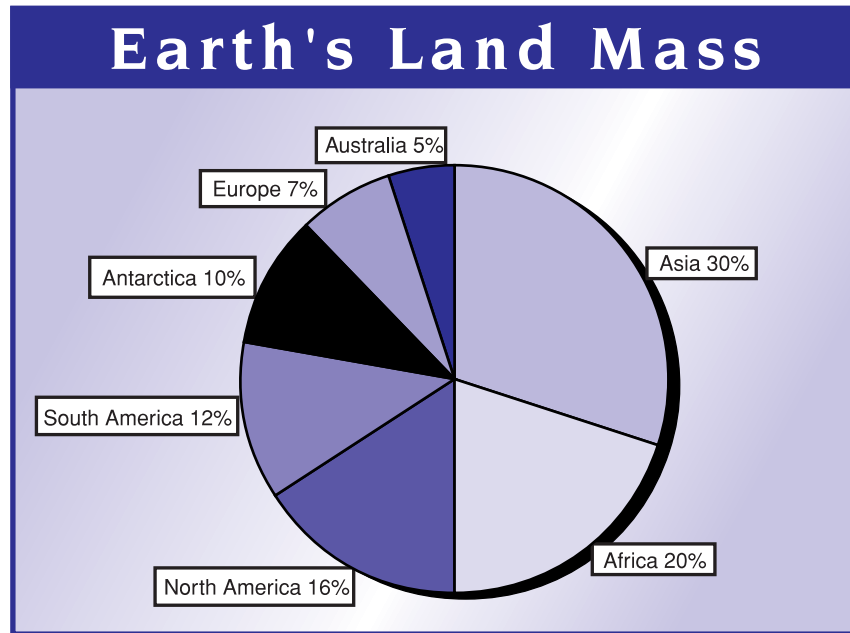


EXERCISE – READING GRAPHS

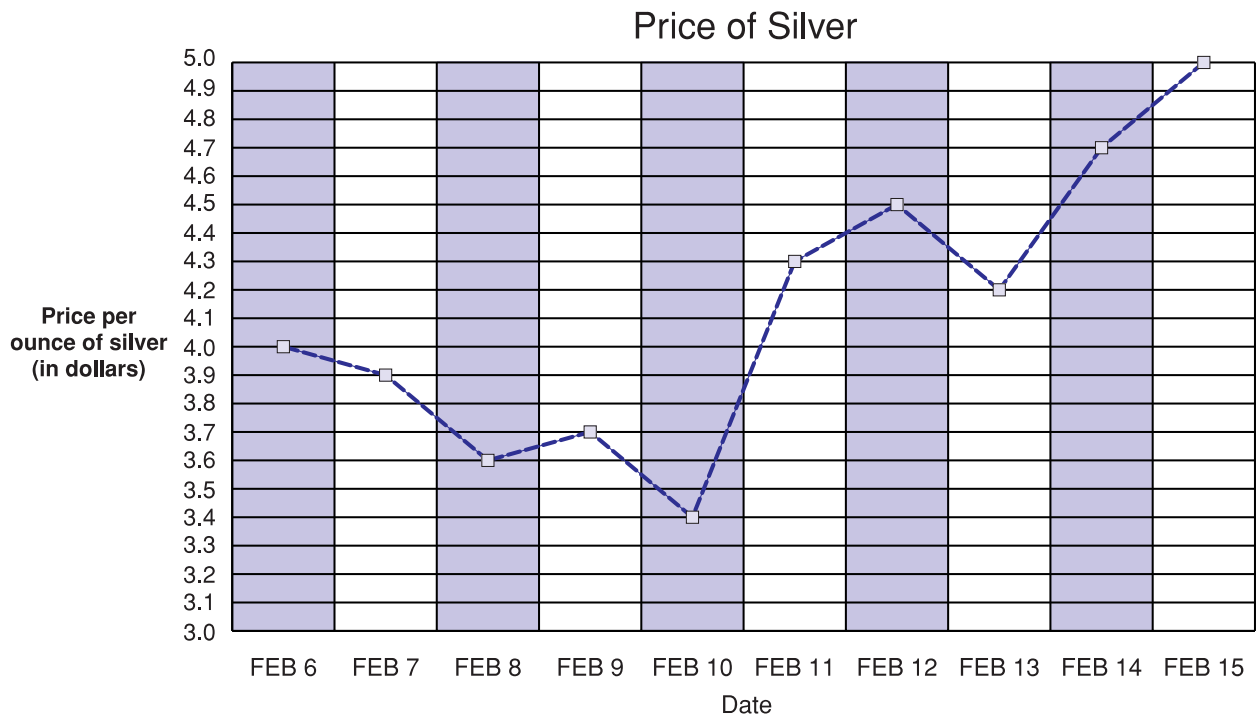
Instructions: *Read the following graphs and answer the questions about each one.*



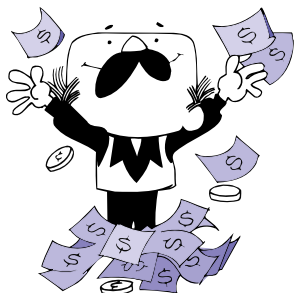
1. **How much less money did Company A earn in the 2nd quarter than in the 1st quarter?**
2. **How much more did Company B earn in the 4th quarter than in the 2nd quarter?**
3. **Find the average quarterly earnings for Company D.**



4. What is the ratio of the land mass of the largest continent to the land mass of the smallest continent?



5. You purchased 30 ounces of silver on Feb. 10 and sold it on Feb. 14. How much money did you make?





ANSWERS TO EXERCISE

- How much less money did Company A earn in the 2nd quarter than in the 1st quarter?

Answer: $90 - 50 = 40$

\$40,000 less

- How much more did Company B earn in the 4th quarter than in the 2nd quarter?

Answer: $70 - 40 = 30$

\$30,000 more

- Find the average quarterly earnings for Company D.

Answer: $10,000 + 20,000 + 30,000 + 45,000 = \$105,000$

$\$105,000 \div 4 = \textbf{\$26,250}$ average

- What is the ratio of the land mass of the largest continent to the land mass of the smallest continent?

Answer: Asia - largest 30%

Australia - smallest 5%

$\frac{30}{5} = \frac{6}{1}$ or **6:1** or **6 to 1**

- You purchased 30 ounces of silver on Feb. 10 and sold it on Feb. 14. How much money did you make?

Answer: $\$3.40 \times 30 = \102 buying price

$\$4.70 \times 30 = \141 selling price

$\$141 - \$102 = \$39$ – you made **\$39**



LESSON 10

WIN CAREER SOLUTIONS

I trust that you did well throughout Level 4. Let's see how much you remember by taking the Posttest on the following pages. Good luck and don't peek at the answers!

No peeking!





POSTTEST

EXERCISE – POSTTEST

Instructions: *Solve the following word problems utilizing your new skills. Remember to examine your answers to make sure they make sense. Round decimals to the nearest hundredth.*

1. You work on a farm where you gather eggs each morning. One morning you gather 60 eggs from 15 chickens. What is the rate of eggs per chicken?
2. You pay a total of \$440 for 8 visits to your doctor. What is the cost per visit?
3. A retailer purchased 117 units for a total of \$1,250 and sold them for \$1,601. What was his profit per unit?
4. A truck driver can travel 560 miles on 28 gallons of gas. How far can he travel on 35 gallons of gas?



POSTTEST

WIN CAREER SOLUTIONS

5. Your plant runs 2 assembly lines. Line A produces 45 units in the same time that it takes line B to produce 37 units. On one run line B produced 555 units. How many units did line A produce during the same time?
6. Your company purchased 23 computers for \$29,803.86. How much will it cost to buy 15 more of the same computer?
7. The machine you operate produces 584 units during your 8-hour shift. How many units would it produce in 2 hours?
8. On a blueprint, a square with 20 meters per side was shown as a square with 12 centimeters per side. How long would a girder appear on the blueprint if the girder was actually 15 meters long?



9. A real estate agent makes commissions of \$6,500 in January, \$4,500 in February, and \$4,000 in March. Find her average monthly commission for this period.
10. It has been decided that 2,700 diskettes will meet your company's need for the next year. The diskettes are sold in packages of 50 for \$17.95. How much do you need to put into your budget for diskettes?
11. Carpeting for one office cost \$210. You remember the cost of the carpet was \$8.75 per sq yd. How many sq yd of carpeting were purchased?



POSTTEST

WIN CAREER SOLUTIONS

12. Five employees in the shipping department each earn \$9.75 per hour. They decide each of them will put their pay from one eight-hour day toward the cost of a gift for a friend who is retiring. How much money will they have for the present?
13. A part that you are making requires three pieces of wire. The lengths are $\frac{2}{17}$ cm, $\frac{5}{17}$ cm, and $\frac{8}{17}$ cm. What is the total amount of wire used for the part?
14. You have purchased 9 yards of material. It takes $3\frac{7}{8}$ yards to make a jacket, $2\frac{3}{8}$ yards to make a skirt and $2\frac{1}{8}$ yards to make a pair of pants. Can you make all three without purchasing additional material? (Assume no waste in cutting.)



15. For problem 15, use the following chart:

**Cougar Drive-In
Week of May 29**

WORKER	SUN	MON	TUE	WED	THU	FRI	SAT
BARRY	4.5	off	6.5	8.25	4	8	7.5
LORA	7.0	7.5	7.5	off	6.75	8.5	3.25
MARTY	6.5	8.25	off	7.5	off	3.5	8
PAUL	off	6.5	4.0	5.25	4.5	5.75	8.5
MEG	off	off	off	off	6	9.5	8.75
NICK	6.5	off	off	off	off	off	off

- A. How many hours did Lora work during the week?
- B. If Paul earns \$6.75 per hour, how much did he earn during the week of May 29?
- C. How many hours did employees work at Cougar Drive-In on Saturday?

**ANSWERS TO EXERCISE**

1. You work on a farm where you gather eggs each morning. One morning you gather 60 eggs from 15 chickens. What is the rate of eggs per chicken?

Answer: $\frac{60 \text{ eggs}}{15 \text{ chickens}} = 4 \text{ eggs per chicken}$

2. You pay a total of \$440 for 8 visits to your doctor. What is the cost per visit?

Answer: $\frac{\$440}{8} = \55 per visit

3. A retailer purchased 117 units for a total of \$1,250 and sold them for \$1,601. What was his profit per unit?

Answer: $\$1,601 - \$1,250 = \$351 \text{ total profit}$
 $\$351 \div 117 \text{ units} = \$3 \text{ profit per unit}$

4. A truck driver can travel 560 miles on 28 gallons of gas. How far can he travel on 35 gallons of gas?

Answer: $\frac{560}{28} = \frac{x}{35}$

$$28x = 19,600$$

$$x = 700$$

700 miles traveled on 35 gallons of gas



5. Your plant runs 2 assembly lines. Line A produces 45 units in the same time that it takes line B to produce 37 units. On one run line B produced 555 units. How many units did line A produce during the same time?

Answer: $\frac{A}{B} = \frac{45}{37} = \frac{x}{555}$

$$37x = 24,975$$

$$x = 675$$

675 units

6. Your company purchased 23 computers for \$29,803.86. How much will it cost to buy 15 more of the same computer?

Answer: $\$29,803.86 \div 23 = \$1,295.82 \text{ each}$

$$\$1,295.82 \times 15 = \$19,437.30 \text{ for 15 more}$$

or

$$\frac{23}{\$29,803.86} = \frac{15}{x}$$

$$23x = 447,057.9$$

$$x = 19,437.30$$

\$19,437.30 for 15 more



7. The machine you operate produces 584 units during your 8-hour shift. How many units would it produce in 2 hours?

Answer: $\frac{584}{8} = \frac{x}{2}$

$$8x = 1,168$$

$$x = 146$$

146 units produced in 2 hours

8. On a blueprint, a square with 20 meters per side was shown as a square with 12 centimeters per side. How long would a girder appear on the blueprint if the girder was actually 15 meters long?

Answer: $\frac{20m}{12cm} = \frac{15m}{x}$

$$20x = 180$$

$$x = \mathbf{9\ cm}$$

9. A real estate agent makes commissions of \$6,500 in January, \$4,500 in February, and \$4,000 in March. Find her average monthly commission for this period.

Answer: $\$6,500 + \$4,500 + \$4,000 = 15,000$

$$\$15,000 \div 3 = \mathbf{\$5,000\ average}$$



POSTTEST

10. It has been decided that 2,700 diskettes will meet your company's need for the next year. The diskettes are sold in packages of 50 for \$17.95. How much do you need to put into your budget for diskettes?

Answer: $2,700 \div 50 = 54$ packages

$$54 \text{ packages} \times \$17.95 = \text{\textcolor{blue}{\$969.30}}$$

11. Carpeting for one office cost \$210. You remember the cost of the carpet was \$8.75 per sq yd. How many sq yd of carpeting were purchased?

Answer: $\$210 \div \$8.75 = \text{\textcolor{blue}{24 square yards}}$

12. Five employees in the shipping department each earn \$9.75 per hour. They decide each of them will put their pay from one eight-hour day toward the cost of a gift for a friend who is retiring. How much money will they have for the present?

Answer: $\$9.75 \times 8 = \78 from one employee
 $\$78 \times 5 = \text{\textcolor{blue}{\$390}}$ for the gift

13. A part that you are making requires three pieces of wire. The lengths are $\frac{2}{17}$ cm, $\frac{5}{17}$ cm, and $\frac{8}{17}$ cm. What is the total amount of wire used for the part?

Answer: $\frac{2}{17} + \frac{5}{17} + \frac{8}{17} = \frac{15}{17} \text{ cm}$



14. You have purchased 9 yards of material. It takes $3\frac{7}{8}$ yards to make a jacket, $2\frac{3}{8}$ yards to make a skirt and $2\frac{1}{8}$ yards to make a pair of pants. Can you make all three without purchasing additional material? (Assume no waste in cutting.)

Answer: $3\frac{7}{8} + 2\frac{3}{8} + 2\frac{1}{8} = 8\frac{3}{8}$ yards

Yes, you have enough to make the three garments since you have 9 yards and only need $8\frac{3}{8}$ yards.



15. For problem 15, use the following chart.

Cougar Drive-In
Week of May 29

WORKER	SUN	MON	TUE	WED	THU	FRI	SAT
BARRY	4.5	off	6.5	8.25	4	8	7.5
LORA	7.0	7.5	7.5	off	6.75	8.5	3.25
MARTY	6.5	8.25	off	7.5	off	3.5	8
PAUL	off	6.5	4.0	5.25	4.5	5.75	8.5
MEG	off	off	off	off	6	9.5	8.75
NICK	6.5	off	off	off	off	off	off

A. How many hours did Lora work during the week?

Answer: $7.0 + 7.5 + 7.5 + 6.75 + 8.5 + 3.25 = 40.5$ hours

B. If Paul earns \$6.75 per hour, how much did he earn during the week of May 29?

Answer: $6.5 + 4.0 + 5.25 + 4.5 + 5.75 + 8.5 = 34.5$ hours
 $34.5 \text{ hours} \times \$6.75 = \$232.88$
(round 232.875 to 232.88)

C. How many hours did employees work at Cougar Drive-In on Saturday?

Answer: $7.5 + 3.25 + 8 + 8.5 + 8.75 = 36$ hours



CALCULATING YOUR SCORE

WIN CAREER SOLUTIONS

Calculate your score counting the number of questions you answered correctly. Divide the number of your correct answers by 15. Change the decimal answer to a percentage by moving the decimal two places to the right.

Example: If you got 12 out of the 15 questions correct

$$\begin{array}{r} .80 \\ 15 \overline{) 12.00} \\ \underline{12.0} \\ 000 \end{array}$$

Number of correct answers

$$.80 = 80\%$$

Not bad, but I bet you can do better



SUMMARY

Well, how did you do on the Posttest? If you scored 93% or higher, you have a reasonable chance to pass Level 4 of the ACT WorkKeys® *Applied Mathematics* assessment. Remember the basic steps for solving mathematics problems. Take your time and think about each question, and you will do fine. But, you may want to complete Level 5 with me before you take the assessment. Hope to see you there.

Now don't be discouraged if you scored below 93%. There is a lot of information to remember. You can do it! And, your enhanced work skills will pay off in the long run.

Take time to review the *Workplace Problem Solving Glossary* and *Test-Taking Tips* provided at the end of this workbook. Good luck improving your work skills and attaining your goals!

You should be proud of
your progress!





WORKPLACE PROBLEM SOLVING GLOSSARY

The following is a partial list of words that has been compiled for you to review before taking the ACT WorkKeys® *Applied Mathematics* assessment. The assessment consists of approximately 33 application (word) problems that focus on realistic workplace situations. It is important that you are familiar with common workplace vocabulary so that you may interpret and determine how to solve the problems.

Annual - per year

Asset - anything of value

Budget - estimate of income and expenses

Capital - money, equipment, or property used in a business by a person or corporation

Capital gain (loss) - difference between what a capital asset costs and what it sells for

Commission - an agent's fee; payment based on a percentage of sales

Contract - a binding agreement

Convert - to change to another form

Deductions - subtractions

Denominate number - numbers with units i.e., 5 feet, 10 seconds, 2 pounds

Depreciation - lessening in value

Difference - answer to a subtraction

Discount - reduction from a regular price

Dividend - money a corporation pays to its stockholders

Expense - cost



Fare - price of transportation

Fee - a fixed payment based on a particular job

Fiscal year - 12-month period a corporation uses for bookkeeping purposes

Gross pay - amount of money earned

Gross profit - gross pay less immediate cost of production; difference in sales price of item or service and expenses attributed directly to it

Interest - payment for use of money; fee charged for lending money

Interest rate - rate percent per unit of time i.e., 7% per year

Liquid Asset - current cash or items easily converted to cash

Markup - price increase

Measure - a unit specified by a scale, such as an inch

Net pay - take-home pay; amount of money received after deductions

Net profit (income) - actual profit made on a sale, transaction, etc., after deducting all costs from gross receipts

Overtime - payment for work done in addition to regular hours

Per - for each

Percent off - fraction of the original price that is saved when an item is bought on sale

Product - answer to a multiplication problem

Profit - income after all expenses are paid

Proportion - an equation of 2 ratios that are equal



Quotient - answer to a division problem

Rate - a ratio or comparison of 2 different kinds of measures

Ratio - a comparison of 2 numbers expressed as a fraction, in colon form, or with the word “to”

Regular price - price of an item not on sale or not discounted

Return rate - percentage of interest or dividends earned on money that is invested

Revenue - amount of money a company took in (interest, sales, services, rents, etc.)

Salary - a fixed rate of payment for services on a regular basis

Sale price - price of an item that has been discounted or marked down

Sum - answer to an addition problem

Yield - amount of interest or dividends an investment earns



EDWIN'S TEST-TAKING TIPS

Preparing for the test . . .

Complete appropriate levels of the *WIN Instruction Solution for WorkKeys* self-study courses. Practice problems until you begin to feel comfortable working the word problems.

Get a good night's rest the night before the test and eat a good breakfast on test day. Your body (specifically your mind) works better when you take good care of it.

You should take the following items with you when you take the ACT WorkKeys® *Applied Mathematics* assessment: (1) pencils; pens are not allowed to be used on the test; it is a good idea to have more than one pencil since the test is timed and you do not want to waste time sharpening a broken pencil lead; and (2) your calculator; be sure your batteries are strong if you do not have a solar-powered calculator and that your calculator is working properly.

Allow adequate time to arrive at the test site. Being in a rush or arriving late will likely upset your concentration when you actually take the test.

About the test . . .

The test is comprised of approximately 33 multiple-choice questions. All test questions are in the form of word problems which are applicable to the workplace. You will not be penalized for wrong answers, so it is better to guess than leave blanks. You will have 45 minutes to complete the test.

The test administrator will provide a *Formula Sheet* exactly like the one provided in this workbook. You will not be allowed to use scratch paper, but there is room in your assessment booklet to work the problems.

During the test . . .

Listen to instructions carefully and read the test booklet directions. Do not hesitate to ask the administrator questions if you do not understand what to do.



Pace yourself since this is a timed test. The administrator will let you know when you have 5 minutes left and again when you have 1 minute remaining. Work as quickly as possible, but be especially careful as you enter numbers into your calculator.

If a problem seems too difficult when you read it, skip over it (temporarily) and move on to an easier problem. Be sure to put your answers in the right place. Sometimes skipping problems can cause you to get on the wrong line, so be careful. You might want to make a mark in the margin of the test, so that you will remember to go back to any skipped problems.

Since this is a multiple-choice test, you have an advantage answering problems that are giving you trouble. Try to eliminate any unreasonable answers and make an educated guess from the answers you have left.

If the administrator indicates you have one minute remaining and you have some unanswered questions, be sure to fill in an answer for every problem. Your guess is better than no answer at all!

If you answer all of the test questions before time is called, use the extra time to check your answers. It is easy to hit the wrong key on a calculator or place an answer on the wrong line when you are nervous. Look to see that you have not accidentally omitted any answers.

Dealing with math anxiety . . .

Being prepared is one of the best ways to reduce math or test anxiety. Study the list of key words for solving word problems. If your problem does not include any key words, see if you can restate the problem using your key words. Feeling like you know several ways to try to solve problems increases your confidence and reduces anxiety.

Do not think negatively about the test. The story about the “little engine that could” is true. You must, “think you can, think you can, think you can”. If you prepare yourself properly, there is no reason why you cannot be successful.



Do not expect yourself to know how to solve every problem. Do not expect to know immediately how to work word problems when you read them. Everyone has to read and reread problems when they are solving word problems. So, don't get discouraged; be persistent.

Prior to the test, close your eyes, take several deep breaths, and think of a relaxing place or a favorite activity. Visualize this setting for a minute or two before the test is administered.

During the test if you find yourself tense and unable to think, try the following relaxation technique:

1. Put feet on floor.
2. Grab under your chair with your hands. (hope there are no surprises!)
3. Push down with your feet and up on your chair at the same time - hold for 5 seconds.
4. Relax 5 seconds (especially try to relax your neck and shoulders).
5. Repeat a couple of times as needed, but do not spend the entire 45 minutes of the test trying to relax!

Studying with a partner is another way to overcome math anxiety. Encouragement from each other helps to increase your confidence.

**FORMULA SHEET***(\approx indicates estimate, not equal)***UNITS OF MEASUREMENT****Distance**

1 foot = 12 inches
1 yard = 3 feet
1 mile = 5,280 feet
1 mile \approx 1.61 kilometers
1 inch \approx 2.540 centimeters
1 foot \approx 0.3048 meters
1 meter = 1,000 millimeters
1 meter = 100 centimeters
1 kilometer = 1,000 meters
1 kilometer \approx 0.62 miles

Area

1 square foot = 144 square inches
1 square yard = 9 square feet
1 acre = 208.71 feet square
1 acre = 43,560 square feet

Volume

1 cup = 8 fluid ounces
1 quart = 4 cups
1 gallon = 4 quarts
1 gallon = 231 cubic inches
1 liter \approx 0.264 gallons
1 cubic foot = 1,728 cubic inches
1 cubic yard = 27 cubic feet
1 board foot = 1 inch by 12 inches by 12 inches

Weight

1 ounce \approx 28.350 grams
1 pound = 16 ounces
1 pound \approx 453.593 grams
1 milligram = 0.001 grams
1 kilogram = 1,000 grams
1 kilogram \approx 2.2 pounds
1 ton = 2,000 pounds

Temperature

$$^{\circ}\text{C} = .56(^{\circ}\text{F} - 32) \text{ or } \frac{5}{9}(^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = 1.8(^{\circ}\text{C}) + 32 \text{ or } (\frac{9}{5} \times ^{\circ}\text{C}) + 32$$

Electricity

1 kilowatt-hour = 1,000 watt-hours

FORMULAS**Rectangle**

Perimeter = $2(\text{length} + \text{width})$
area = $\text{length} \times \text{width}$

Cube

volume = $(\text{length of side})^3$

Triangle

sum of angles = 180°

$$\text{area} = \frac{1}{2}(\text{base} \times \text{height})$$

Circle

number of degrees in a circle = 360°
circumference $\approx 3.14 \times \text{diameter}$
area $\approx 3.14 \times (\text{radius})^2$

Cylinder

volume $\approx 3.14 \times (\text{radius})^2 \times \text{height}$

Cone

$$\text{volume} \approx \frac{3.14(\text{radius})^2 \times \text{height}}{3}$$

Ball

$$\text{volume} \approx \frac{4}{3} \times 3.14 \times (\text{radius})^3$$

Amperage

amps = watts \div volts



POP QUIZ QUESTION ANSWER KEY

1. Page 22
addition or multiplication
2. Page 84
 79°
 $75^\circ + 82^\circ + 80^\circ = 237^\circ$
$$\frac{237^\circ}{3} = 79^\circ$$
3. page 112 – any of the following questions would be correct
(answers do not need to be word for word as long as the meaning is similar)

Step 1 – Define the Problem

- What am I being asked to do or find?
- What information have I been given?
- Is there other information that I need to know or need to find?
- Will a sketch help?
- Can I restate the problem in my own words?
- Are there any key words?

Step 2 – Decide on a Plan

- What operations do I need to perform and in what order?
- On which numbers do I perform these operations?

Step 3 – Carry Out the Plan

Step 4 – Examine the Outcome

- Is this a reasonable outcome?
- Does the outcome make sense in the original problem?
- If I estimated the answer would it be close to the result?
- Does the outcome fall outside any limits in the problem? Is it too large or too small?

4. page 132
refer to page 16 to check your answers

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