

Word Problems

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

Simplifying Word Problems

Most of us are intimidated by word problems. But if we take away the extra words, a lot of the confusion goes with them. Use these four steps as an outline to guide you through the problem:

Step 1- Understand the Problem. Read through the problem to get a general idea of the situation. What is happening in the story? What question(s) do you need to answer? What information can be disregarded?

Step 2- Devise a Plan. Read through the problem again, looking for details. Decide what operations to use (addition, multiplication, etc.). Set up relationships, translate from English to math, make lists, draw and label pictures. Use any strategy you know to organize the information into a workable format.

Step 3- Work the Plan. Now that you have a plan, work it. Do the math, crunch the numbers. Some problems require several steps, so be sure to work them all.

Step 4- Look Back. Now that you are done, are you really done? Did you answer all the questions? Does your answer make sense? Did you work the problem correctly?

Some extra advice

- Many word problems have more than one part that needs to be worked out. Break down the problem to its individual parts and work one at a time. If something seems to be missing in order to work a sub-problem, set it aside and work another part. You may find the missing information as you work other sub-problems.
- Problems with lists of the same type of thing tend to be addition problems. "John worked 5 hours on Monday, 12 hours on Tuesday, 6 hours on Wednesday and 7 hours and 30 minutes on Thursday. How many hours has he worked this week?" Be sure that the units match before adding.
 - Units: hours, hours, hours, hours and minutes.

- Problems with mixed units tend to be multiplication or division problems. “An airplane travels at 350 miles per hour. How far does the airplane travel in 6 hours?”
 - Units: miles per hour, hours, miles.

Vocabulary

There are many keywords in English that can help us decide what mathematical operation or relationship to use. Here are some examples.

Words, Phrases	Symbol or operation
plus, sum of, added to, joined with, increased by, more, more than, and, total	+
minus, difference between, subtracted from, decreased by, reduced by, less, less than, exceeds, take away, remove, purchase	—
times, times more than, multiplied by, product, equal amounts of, of, at, each, every, total	*
divided by, divides, quotient, ratio, compared to, separated into equal parts, per, out of, goes into, over	÷
equals, is equal to, is, is the same as, was, were, will be, results in, makes, gives, leaves	=
two time, double, twice	2 *
half, half as much, halves, one half of	$\frac{1}{2}$ *
What (number, part, percent, amount, price, etc.), a number, the number, how (many, much, often, far, few, etc.) This is a symbol (place holder) for the number you are trying to find as you construct your formula.	$n, x, ?, \underline{\hspace{1cm}}$

Example

Best Bakery is having a sale on pumpkin pies. Each pie is cut into 8 equal slices. They have $2\frac{1}{4}$ pies left. Jim wants to purchase $1\frac{3}{8}$ pies for dinner.

How many pies will be left?

At \$0.75 per slice, how much will the pie Jim is buying cost?

Step 1- Understand the Problem. You can do this by crossing out unnecessary information, organizing the information into charts, and writing out relationships.

~~Best bakery is having a sale on pumpkin pies. Each pie is cut into 8 equal slices. They have $2\frac{1}{4}$ pies left. Jim wants to purchase $1\frac{3}{8}$ pies for dinner.~~

~~How many pies will be left?~~

~~At \$0.75 per slice, how much will the pie Jim is buying cost?~~

Step 2- Devise a Plan. Translate key words and phrases into their proper mathematical symbols, break difficult problems into sub problems, and write down any pertinent formulas or cautions.

Question 1- How many pies will be left?

The problem is asking us to compare the number at the beginning to the number after some pies are **taken away** (by Jim). This is a subtraction problem.

Number of pies in the store	take away	Number of pies bought	results in	Number of pies left.
$2\frac{1}{4}$	—	$1\frac{3}{8}$	=	??

Step 3- Work the Plan.

$$2\frac{1}{4} - 1\frac{3}{8} = \frac{7}{8}$$

Step 4- Look Back. Just because you have an answer, doesn't mean that it is the right answer. Sometimes story problems take several steps to complete, so be sure that you have answered all the questions that were asked. Work backwards or use estimation to check your answer, make sure that your answer is reasonable. Most importantly, answer the question that was asked.

$\frac{7}{8}$ of a pie is left.

Question 2- How much will the pie cost?

The problem is asking for a total cost, but we know the cost for **each** slice. This is a multiplication problem.

Cost of a slice	for each	number of slices	results in	Total Cost
\$. 75	*	??	=	??

This problem has a sub problem, because we don't actually know how many slices of pie Jim bought. Jim bought $1\frac{3}{8}$ of a pie, and **each** pie was cut into 8 slices. This is also a multiplication problem.

Number of slices	for each	pie	results in	total slices
8	*	$1\frac{3}{8}$	=	??

Step 3- Work the Plan.

$$8 * 1\frac{3}{8} = 11$$

Jim bought 11 slices, so use this answer in the original question.

Cost of a slice	for each	number of slices	results in	Total Cost
\$. 75	*	11	=	??

$$$.75 * 11 = \$8.25$$

Step 4- Look Back. Did you answer the original question? Did you include the appropriate units? Does your answer seem logical?

How much will the pie cost? The pie will cost \$8.25.

The pie costs \$.75 for one slice of pie. We can estimate that each slice costs a little less than \$1. Using this estimate, we know that if he bought 11 slices for \$1 each, he would pay \$11. Because our actual price for each slice is less than our estimate, our total is less than the estimated total. \$8.25 is less than \$11, so the answer makes sense.

Practice

1. A plane takes off from a point on the floor of Death Valley which is 200 feet below sea level. The plane must clear an 800ft mountain by 300 ft. How many feet must the plane climb after takeoff to safely clear the mountain?
 - a. 900 ft
 - b. 1300 ft
 - c. 1100 ft
 - d. 500 ft
2. John paid \$45.00 for a shirt. This represents a discount of 25%. What was the original price of the shirt?
 - a. \$60.00
 - b. \$180.00
 - c. \$11.25
 - d. \$33.75
3. If 37% of a number is 36, what is the number?
 - a. 64
 - b. 32
 - c. 15
 - d. 97
4. What percent of an hour is 36 minutes?
 - a. 60%
 - b. 40%
 - c. 24%
 - d. 4%
5. $\frac{5}{8}$ expressed as a percent is?
 - a. 56%
 - b. 62.5%
 - c. 87.5
 - d. 114.3%
6. A plane travels at an average speed of 600 miles per hour for 4 hours. How far did the plane travel, in miles?
 - a. 150 miles
 - b. 240 miles
 - c. 2400 miles
 - d. 1500 miles

7. Maria is making a scale drawing of her basement, which is 20 ft long. If her scale is $\frac{1}{2}$ in = 1 ft, how many inches long should she make her drawing?
- 20 inches
 - 6 inches
 - 10 inches
 - 15 inches
8. The weights of 4 children are 80, 85, 90, and 75 lbs. What is the average weight, in pounds, of the four children?
- 90 lbs
 - 75 lbs
 - 80.4 lbs
 - 82.5 lbs
9. All of the following are ways to write 20 percent of n **EXCEPT**
- $.2n$
 - $\frac{20}{100}n$
 - $\frac{1}{5}n$
 - $20n$
10. Which of the following is closest to $\sqrt{10.5}$?
- 3
 - 4
 - 5
 - 8
11. Three people who work part-time are to work together on a project, but their total time on the project is to be equivalent to only one person working full time. If one of the people budgeted $\frac{1}{2}$ of his time for the project and the second person budgeted $\frac{1}{3}$ of her time, what fraction of his time should the third person put into the project?
- $\frac{1}{3}$
 - $\frac{1}{4}$
 - $\frac{1}{6}$
 - $\frac{1}{8}$

Key

- | | | | | | |
|------|------|------|------|-------|-------|
| 1. B | 3. D | 5. B | 7. C | 9. D | 11. C |
| 2. A | 4. A | 6. C | 8. D | 10. A | |

Integers

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

Integers are positive and negative whole numbers. Applications with integers involve Order of Operations. Operations are ways to combine two numbers. The operations we use most often are addition, subtraction, multiplication and division.

Order of Operations

1. Do operations inside grouping symbols before the operations outside of the grouping symbols.

- a. Work grouping symbols from the inside to the outside.

$$\begin{aligned} &3(12 - 5) \\ &= 3(7) \\ &= 21 \end{aligned}$$

- b. Grouping symbols include (parentheses), [brackets], {braces}, as well as operations such as $\frac{\text{fractions}}{1}$, |absolute values|, and $\sqrt{\text{roots}}$.

$$\begin{aligned} &5 + \sqrt{(7 - 3)} \\ &= 5 + \sqrt{4} \\ &= 5 + 2 \\ &= 7 \end{aligned}$$

- c. Once an operation such as a root or an absolute value has been performed, it may help to replace it with parentheses to avoid mistakes.

$$\begin{aligned} &3|-6| \\ &= 3(6) \\ &= 18 \end{aligned}$$

2. Evaluate exponents and roots before other operations. Follow the appropriate rules of exponents.

$$\begin{aligned} &12 - 3^2 \\ &= 12 - 9 \\ &= 3 \end{aligned}$$

3. Perform multiplication and division before addition and subtraction. Work left to right, and work multiplication and division together. DO NOT perform all the multiplication and then all the division.

$$\begin{aligned}4 + 20 \div 2 * 5 \\&= 4 + 10 * 5 \\&= 4 + 50 \\&= 54\end{aligned}$$

4. Addition and subtraction is the last step in the order of operations. Remember that numbers can be added in any order.
- a. It is often helpful to change the order to make sums that are easy to work with, such as multiples of 10.

$$\begin{aligned}53 + 14 + 7 \\&= 53 + 7 + 4 \\&= 60 + 14 \\&= 74\end{aligned}$$

- b. To change the order for subtraction, keep the negative or the subtraction sign with the number that follows it.

$$\begin{aligned}10 - 15 + 12 \\&= 10 + 12 - 15 \\&= 22 - 15 \\&= 7\end{aligned}$$

5. Remember special properties, such as the Distributive Property. These allow you to work in a slightly different order without changing the answer.

$$\begin{aligned}4(25 - 3) + 12 \\&= 4(25) - 4(3) + 12 \\&= 100 - 12 + 12 \\&= 100\end{aligned}$$

Rules of Integers

1. When adding two integers, the larger sign wins:

- a. If the signs are the same, add and keep the sign.

$$+3 + +5 = +8$$

$$-3 + -5 = -8$$

- b. If the signs are different, subtract and keep the sign of the larger number.

$$+7 + -4 = +3$$

$$-7 + +4 = -3$$

2. When subtracting two integers, change subtraction to addition of the opposite.

$$13 - (-4)$$

$$= 13 + (+4)$$

$$= 17$$

3. When multiplying integers, two negatives make a positive:

- a. When multiplying two positives, the answer is positive.

$$(+3)(+8) = +24$$

- b. When multiplying two negatives, the answer is positive.

$$(-3)(-8) = +24$$

- c. When multiplying a positive and a negative, the answer is negative.

$$(-3)(+8) = -24$$

$$(+3)(-8) = -24$$

4. For more than two integers being multiplied together, count the signs:

- a. An even number of negative signs will multiply to a positive number.

$$(-2)(-5)(-4)(-1) = +40$$

- b. An odd number of negative signs will multiply to a negative number.

$$(-2)(-5)(-4) = -40$$

5. To divide two integers, the rules are the same as multiplication.

6. An absolute value is the distance a number is from zero. Distance is never negative, so absolute values will never be negative.

- a. $|5| = 5$

- b. $|-3| = 3$

- c. $|0| = 0$

Practice

1. $27 \div 3 * 2$

2. $17 - 15 + 13$

3. $3(10 - 2) + 7$

4. $-4(5 - 3)^2 - 12$

5. $5 + 4 * 3$

6. $(5 + 4) * 3$

7. $2|5 - 9|$

8. $\sqrt{9 + 16}$

9. $3 - 4 + (-5) + 6 - (-1)$

10. $10 - 15 + 6 + 7 - 8$

11. $4(-2)$

12. $(-15) \div (-5) * (3)$

Key

1. 18

2. 15

3. 31

4. -28

5. 17

6. 27

7. 8

8. 5

9. 1

10. 0

11. -8

12. 9

Adding and Subtracting Decimals

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

Adding and Subtracting Decimals

1. Write the problem in column form.
2. Line up the decimals.
3. Add zeros to the right to fill in missing place values.
4. Add or subtract just like a whole number. Carry the decimal straight down into the answer.

Problem: $24.62 - 3.4$

Solution:

$$\begin{array}{r} 24.62 \\ - 3.40 \\ \hline 21.22 \end{array}$$

Line up the decimal

Fill in zeros to the right

Bring the decimal straight down

Practice

1. $24.62 - 3.4$
2. $61.4 + 0.34 + 1.2$
3. $.4 + .023 + .06$
4. $1.6 + 0.7$

5.
$$\begin{array}{r} 2.42 \\ - .3 \\ \hline \end{array}$$

6.
$$\begin{array}{r} 5.1 \\ .32 \\ + 1.456 \\ \hline \end{array}$$

7.
$$\begin{array}{r} 2.12 \\ - .32 \\ \hline \end{array}$$

8.
$$\begin{array}{r} .41 \\ .023 \\ + .68 \\ \hline \end{array}$$

Key

- | | | | |
|----------|---------|----------|----------|
| 1. 21.22 | 3. .483 | 5. 2.12 | 7. 1.8 |
| 2. 62.94 | 4. 2.3 | 6. 6.876 | 8. 1.113 |

Multiplying and Dividing Decimals

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

Multiplying Decimals

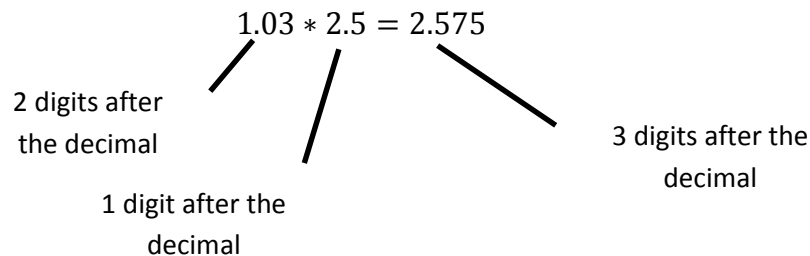
Multiplying decimals is very similar to multiplying whole numbers, except that you need to determine where to put the decimal in the answer. Follow these steps to multiply decimal numbers:

1. Multiply the number as though you were working with whole numbers.
2. Count the total number of digits after (to the right of) the decimal.
3. Beginning at the far right, count the same number of digits to the left, so that the answer has the same number of digits after the decimal as the total of the number of digits in the problem.

Example

Problem: $1.03 * 2.5$

Solution: $103 * 25 = 2575$



Practice

1. $1.03 * .25 =$

2. $2.4 * 1.2 =$

3. $.06 * .63 =$

4. $0.4 * 1.5 =$

5. $3 * 1.42 =$

6. $12.3 * .005 =$

7. $300 * .04 =$

8. $0.0007 * .002 =$

Key

- | | |
|-----------|--------------|
| 1. 0.2575 | 5. 4.26 |
| 2. 2.88 | 6. 0.0615 |
| 3. .0378 | 7. 12 |
| 4. 0.6 | 8. 0.0000014 |

Dividing Decimals

Dividing decimals similar to dividing whole numbers. Again the concern is where to place the decimal. Follow these steps to divide decimals.

1. Write the problem in long division format. Be sure to identify the placement of the decimal in both the divisor (outside) and the dividend (inside).
2. In the divisor, move the decimal to the right until all non-zero digits are in front of the decimal. Move the decimal in the dividend the same number of places to the right. The decimals should be moved the same distance and the same direction.
3. Add zeros to the end (after the decimal) if needed.
4. Divide. Bring the decimal in the dividend straight up into the quotient (answer).
5. Remember that division does not always come out even. As a rule of thumb, you should round your answer to four decimal places. You may need to add zeros to the end of the dividend so that you have enough digits.

Example

$38.8 \div 1.2$ is the same as $1.2 \overline{) 38.8}$

Move the decimal so that the divisor is a whole number

$12. \overline{) 388.0000}$

32.333333...

Add zeros if needed

Move this decimal the same distance and direction, and then carry it straight up.

$38.8 \div 1.2 = 32.3333$

Round your answer to 4 decimal places.

Practice

1. $37.5 \div 4$

2. $2.123 \div 0.2$

3. $471.012 \div 2.3$

4. $1.159 \div 4.8$

5. $0.055 \div 11$

6. $725 \div 0.005$

7. $1.25 \div 50$

8. $453 \div 0.7$

Key

1. 9.375

2. 10.615

3. 204.7878

4. 0.2415

5. 0.005

6. 145000

7. 0.025

8. 647.1429

Adding and Subtracting Fractions

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

The Lowest Common Denominator (LCD)

When adding and subtracting fractions, the denominators of the fractions must be equal, or *like*. Follow these steps to find a common denominator:

1. Identify the largest denominator. The LCD cannot be smaller than this number, and must be a multiple of this number.
2. There are possibilities when looking for an LCD:
 - a. The smaller number divides evenly into the larger number. In this case, the larger number is the LCD.

Example: $\frac{1}{8}$ and $\frac{1}{4}$.

$$8 \div 4 = 2. \text{ 8 divides evenly by 4}$$

8 is the LCD

- b. The numbers may not divide evenly, but they have a common factor. Divide the smaller number by the common factor and multiply the result to the larger number. This is the LCD.

Example: $\frac{1}{6}$ and $\frac{1}{9}$

$$9 \div 6 = ? \text{ , but both 6 and 9 divide evenly by 3}$$

$$6 \div 3 = 2, 2 * 9 = 18.$$

18 is the LCD

- c. The numbers do not divide evenly and have no factor in common (other than 1). To find the LCD, multiply the two numbers.

Example: $\frac{1}{4}$ and $\frac{1}{3}$

$$4 \div 3 = ? \text{ and they have no factors in common}$$

$$4 * 3 = 12$$

12 is the LCD

Adding and Subtracting Fractions

1. First identify the LCD. Multiply each fraction by 1 ($1=2/2$ or $3/3$ or $4/4$ etc.) to build a common denominator.
2. Add (or subtract) the numerators (tops) and keep the denominator (bottom).
3. Simplify. The fraction must be reduced to lowest terms.

Example

$$\frac{1}{3} + \frac{2}{5}$$

- The LCD of 3 and 5 is 15. Multiply each fraction by the appropriate version of 1.

$$\frac{1}{3} * \frac{5}{5} + \frac{2}{5} * \frac{3}{3}$$

$$\frac{5}{15} + \frac{6}{15}$$

- Now that we have common denominators, add the tops and keep the bottom.

$$\frac{5 + 6}{15}$$

$$\frac{11}{15}$$

- Reduce if possible. In this case, the fraction does not reduce.

Adding and Subtracting Mixed Numbers

1. Write the addition or subtraction problem in column form. Make sure the fraction parts have a common denominator.
2. Add and subtract the fraction parts first.
 - a. For addition, if the fractions add up to a number 1 or larger, you will need to change the answer to a mixed number and carry the whole number part to the whole number column.
 - b. For subtraction, if the first fraction is smaller than the second fraction, you will need to borrow 1 from the whole number column. Remember that $1=1/1$ or $2/2$ or $3/3$, etc.
3. Add or subtract the whole number column.
4. Be sure that your answer is in lowest terms. All fraction answers must be reduced to lowest terms.

Example

$$3\frac{1}{3} - 1\frac{1}{2}$$

- Write the problem in column format. Find a common denominator for the fraction parts.

$$3\frac{1}{3} * \frac{2}{2} \rightarrow 3\frac{2}{6}$$

$$-1\frac{1}{2} * \frac{3}{3} \rightarrow -1\frac{3}{6}$$

- Because $2/6$ is smaller than $3/6$ we will need to regroup or borrow from the whole number.

$$2 \quad 1\frac{2}{6} \rightarrow 2\frac{8}{6}$$

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

- Perform the subtraction.

$$1\frac{5}{6}$$

- Reduce the fraction part, if possible. In this case, the fraction is already in lowest terms.

Practice

1. $\frac{2}{5} + \frac{5}{8}$

2. $\frac{1}{6} + \frac{1}{3}$

3. $\frac{5}{9} - \frac{1}{3}$

4. $\frac{4}{5} - \frac{1}{10}$

5. $1\frac{3}{4} + 2\frac{1}{3}$

6. $5\frac{2}{5} - 3\frac{9}{10}$

Key

1. $\frac{41}{40}$ or $1\frac{1}{40}$

2. $\frac{1}{2}$

3. $\frac{2}{9}$

4. $\frac{7}{10}$

5. $4\frac{1}{12}$

6. $1\frac{1}{2}$

Multiplying and Dividing Fractions

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

When multiplying and dividing fractions, it is not necessary to get a common denominator. However, multiplying works much better if you work with either proper or improper fractions. Do not attempt to multiply mixed numbers without first changing them to improper fractions!

Multiplying Fractions

- 1- Change any mixed numbers to improper fractions
- 2- Multiply straight across, numerator to numerator and denominator to denominator.
- 3- Reduce the fraction.

Example

$$\frac{4}{5} * 1\frac{2}{3}$$

First change any mixed numbers to improper fractions

$$\frac{4}{5} * \frac{5}{3}$$

Multiply straight across. Because we will be reducing the fraction, don't actually carry out the multiplication. Instead, look for common factors.

$$\frac{4 * 5}{5 * 3}$$

$$\frac{4 * 5 \div 5}{5 \div 5 * 3} = \frac{4}{3}$$

Divide the numerator (top) and denominator (bottom) by the same number.

You can also reduce before you multiply and many people prefer this method. Be cautious to only reduce this way for multiplication. This does not work with any other operation.

$$1\frac{5}{7} * 1\frac{5}{9}$$

Change mixed numbers to improper fractions

$$\frac{12}{7} * \frac{14}{9}$$

Reduce before multiplying. Be sure to divide a numerator and a denominator by the same number.

$$\frac{12 \div 3}{7 \div 7} * \frac{14 \div 7}{9 \div 3}$$

Multiply straight across. Check to see if your answer reduces- there may have been a common factor that was missed.

$$\frac{4}{1} * \frac{2}{3} = \frac{8}{3}$$

Dividing Fractions

- 1- Change any mixed numbers to improper fractions.
- 2- Change division to multiplication by multiplying by the reciprocal
- 3- Follow the rules for multiplying fractions.

Example

$$\frac{5}{6} \div 2\frac{2}{3}$$

First, change mixed numbers to improper fractions.

$$\frac{5}{6} \div \frac{8}{3}$$

Second, change division by a fraction to multiplication by the reciprocal.

$$\frac{5}{6} * \frac{3}{8}$$

DO NOT REDUCE FRACTIONS THAT ARE BEING DIVIDED.

$$\frac{5}{6 \div 3} * \frac{3 \div 3}{8}$$

Now that we have two fractions being multiplied, we can reduce and multiply.

$$\frac{5}{2} * \frac{1}{8} = \frac{5}{16}$$

Practice

1. $\frac{5}{12} * \frac{3}{4}$

2. $1\frac{3}{4} * 2$

3. $2\frac{1}{3} * 3\frac{2}{3}$

4. $\frac{1}{3} * 1\frac{4}{5}$

5. $2\frac{1}{4} * 3\frac{2}{3}$

6. $\frac{1}{2} \div 2$

7. $2\frac{1}{4} \div \frac{2}{3}$

8. $3\frac{2}{5} \div 6$

9. $\frac{3}{4} \div \frac{15}{16}$

10. $\frac{3}{4} \div \frac{9}{16}$

11. $1\frac{5}{8} \div 8\frac{1}{5}$

12. $2\frac{1}{3} \div 1\frac{3}{7}$

Key

1. $\frac{5}{16}$

2. $3\frac{1}{2}$

3. $8\frac{5}{9}$

4. $\frac{3}{5}$

5. $8\frac{1}{4}$

6. $\frac{1}{4}$

7. $3\frac{3}{8}$

8. $\frac{17}{30}$

9. $\frac{4}{5}$

10. $1\frac{1}{3}$

11. $\frac{65}{328}$

12. $1\frac{19}{30}$

Conversions

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

Converting Fractions to Decimals

Every fraction is really a division problem. To change a fraction to a decimal, do the division.

$\frac{4}{5}$ is the same as $4 \div 5$	$\begin{array}{r} 0.8 \\ 5 \overline{)4.0} \end{array}$	$\frac{4}{5} = 0.8$
---	---	---------------------

Converting Decimals to Fractions

There are two types of decimals that can be converted into fractions, the decimals that terminate (stop), and the decimals that repeat.

Terminating decimals- to change a terminating decimal to a fraction say its name. Be sure to reduce the fraction to lowest terms.

$$.25 = \text{twenty} - \text{five hundredths} = \frac{25}{100} = \frac{1}{4}$$

Notice that the decimal form of the number has two digits after the decimal, and the denominator of the original fraction has two zeros after the one.

Two decimal digits = two zeros.

Repeating decimals- to change a repeating decimal to a fraction, first determine what is repeating. This is the numerator of the fraction.

$$.27272727 \dots = \frac{27}{?}$$

Because there are two digits that repeat, the denominator will be 99. Be sure to reduce your fraction to lowest terms.

Two digits repeating = two nines.

$$.27272727 \dots = \frac{27}{99} = \frac{3}{11}$$

This rule applies regardless of how many digits are repeating.

$$.222222 \dots = \frac{2}{9}$$

One digit repeating = one nine in the denominator.

$$.358358358 \dots = \frac{358}{999}$$

Three digits repeating = three nines in the denominator.

Converting Percentages to Decimals

A percent is a special fraction in which the denominator is always 100. *Per cent* literally means *divide by 100*. To change a percent to decimal, just divide by 100. The easiest way to do this is to move the decimal two places to the **left** and drop the percent sign.

$$325\% = 325 \div 100 = 3.25$$

Remember that we are **dividing** by 100, so the decimal should appear **smaller** than the percent. /

Converting a Decimal to a Percent

To change a decimal into a percent, reverse the process of changing a percent into a decimal. This means that instead of dividing by 100 and removing the percent sign, you will need to multiply by 100 and add the percent sign. To do this, move the decimal two places to the **right** and put a percent sign on the end of the number.

$$0.357 = .357 * 100\% = 35.7\%$$

Here we are **multiplying** by 100, so the percent should appear **larger** than the decimal. /

Converting a Percent to a Fraction

Remember that *percent* means *divide by 100*. When working with fractions, we change division into multiplication by the reciprocal, so multiply by $1/100$.

$$35\% = 35 \div 100 = \frac{35}{1} * \frac{1}{100} = \frac{35}{100} = \frac{7}{20}$$

Simplify your answer. If there is a decimal in the numerator, you will need to move both decimals the same distance and the same direction until there are no digits after the decimal. (same rule as decimal division).

$$2.4\% = \frac{2.4}{100} = \frac{24}{1000} = \frac{3}{125}$$

Converting a Fraction to a Percent

If you can make the denominator equal to 100, the numerator is the percent

$$\frac{3}{10} = \frac{30}{100} = 30\%$$

If you cannot, first change the fraction into a decimal, then convert the decimal into a percent.

$$\frac{1}{7} \approx .1429 = 14.29\%$$

Practice

Complete the chart by converting each number to the other two forms.

	Fraction	Decimal	Percent
Ex	$1\frac{3}{4}$	1.75	175%
1.	$\frac{1}{7}$		
2.		0.125	
3.			12%
4.	$\frac{5}{8}$		
5.		0.33333 ...	
6.			3.5%
7.	$5\frac{2}{5}$		
8.		2.6	
9.			485%

Key

	Fraction	Decimal	Percent
Ex	$1\frac{3}{4}$	1.75	175%
1.	$\frac{1}{7}$.142857 ...	14.29%
2.	$\frac{1}{8}$	0.125	12.5%
3.	$\frac{3}{25}$	0.12	12%
4.	$\frac{5}{8}$	0.625	62.5%
5.	$\frac{1}{3}$	0.33333 ...	33.33%
6.	$\frac{7}{200}$.035	3.5%
7.	$5\frac{2}{5}$	5.4	540%
8.	$2\frac{3}{5}$	2.6	260%
9.	$4\frac{17}{20}$	4.85	485%

Percentages

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

To calculate the percentage of a number:

In math, when we take a percent of a number, the word 'of' can be translated as multiplication, and the word 'is' translates as an equals sign.

30 percent of 120 is 40

$$30\% * 120 = 40$$

To solve a problem involving percent, first translate the sentence from English into mathematical symbols, then work the problem. Sometimes you will be able to multiply to find the answer, and other times you will need to divide.

Example

32% of 55 is what number?

First translate the sentence into a math equation $32\% * 55 = \underline{\hspace{2cm}}?$

Convert the percentage into either a fraction or a decimal $.32 * 55 = \underline{\hspace{2cm}}?$

Work the problem. In this example, perform the multiplication to find the answer. $.32 * 55 = 17.6$

Example

If you do not know what to multiply by, you should divide instead. Take a look at the next problem:

5% of what number is 24?

$$5\% * \underline{\hspace{2cm}} = 24$$

$$.05 * \underline{\hspace{2cm}} = 24$$

In this example, one of the factors is unknown, so we cannot multiply. However, we do know the answer to multiplication, so we can make this a division problem instead.

$$24 \div .05 = \underline{\hspace{2cm}}$$

$$24 \div .05 = 480$$

Example

In the third example, the unknown number is the percentage. Be sure to put your answer in the right form! Change the answer to percentage form.

What percent of 40 is 15?

$$\underline{\hspace{2cm}} \% * 40 = 15$$

$$15 \div 40 = \underline{\hspace{2cm}} ?$$

$$15 \div 40 = 0.375$$

$$.375 = 37.5\%$$

A common mistake that students make when performing a division problem is dividing in the wrong order. Here are a few pointers to help you get the order right-

- Divide **by** the same number that you multiply **by**.
- When dividing by a number **larger** than 1 (or 100%), your answer will get **smaller**.
- When dividing by a number **smaller** than 1 (or 100%), your answer will get **larger**.
- Check your work by rewriting the sentence- 37.5% of 40 is 15 (third example).
Does this seem reasonable?

Practice

1. 32% of 46 is what number?
2. 125% of 250 is what?
3. What number is 45% of 12?
4. 15% of what number is 45?
5. 150% of what number is 270?
6. 540 is 90% of what number?
7. What percent of 25 is 30?
8. What percent of 155 is 12?
9. 4.2 is what percent of 200?

Key

- | | | | | |
|----------|----------|----------|---------|--------|
| 1) 14.72 | 2) 312.5 | 3) 5.4 | 4) 300 | 5) 180 |
| 6) 600 | 7) 120% | 8) 7.74% | 9) 2.1% | |

Average or Mean Average

This sheet is designed as a review aid. If you have not previously studied this concept, or if after reviewing the contents you still don't pass, you should enroll in the appropriate math class.

The average, the mean average, or the mean all refer to the same concept. A mean average is a way to take a list of possibly very different numbers and treat them as though they were all the same. If you are given a list of numbers, the average is the number that all the values would be if they were all the same.

Consider the list of numbers: 5,5,5

In this case all three numbers are the same number, so the average is 5. Three 5's have a total of 15.

Now look at this list of numbers: 3,6,6

These three numbers also have a total of 15, and the average is 5.

To calculate a mean, add all the values and divide by the total number of values.

Example

Find the average of the following numbers:

1, 2, 5, 6, 3, 7

Add the values: $1 + 2 + 5 + 6 + 3 + 7 = 24$

Divide by the number of values: $24 \div 6 = 4$

The average is 4

Example

Suppose that several employees in a shop were making parts. One employee can make 5 parts in an hour while another employee makes 4 parts in an hour and the third employee makes 9 parts in an hour. The employer wants to be able to predict how many parts will be made each hour. What is the average number of parts that each employee produces each hour?

The list is: 5, 4, 9

Add to find the total: $5 + 4 + 9 = 18$

Divide to find the average: $18 \div 3 = 6$

The employees average 6 parts per hour.

Working Backwards

You can use an average to find a missing value by working backwards. Instead of adding then dividing to find the average, multiply and subtract to find the missing value.

Example

The average of 4 numbers is 12. The first three numbers are 10, 15, and 6. What is the missing value?

The list is: 10, 15, 6, ??

The average is: 12

Multiply to find the total: $4 * 12 = 48$

Subtract to find the missing value:

$$10 + 15 + 6 + \underline{\hspace{1cm}} = 48$$

$$31 + \underline{\hspace{1cm}} = 48$$

$$48 - 31 = \underline{\hspace{1cm}}?$$

$$48 - 31 = 17$$

17 is the missing value.

Practice

Find the average of the following lists of numbers:

1. 13, 15, 17, 18, 12
2. 8.2, 1.6, 3.5, 2.8, 7.4, 2.0
3. $\frac{1}{2}, \frac{2}{5}, 1\frac{1}{4}, 2\frac{7}{10}$
4. 9.5, $11\frac{1}{5}$, 16.12, $3\frac{2}{7}$

Find the missing value from the list to obtain the given average:

5. 3, 5, 4, 7, ____? Average=5
6. $3\frac{1}{2}, 2\frac{3}{8}, 4\frac{1}{4}, 6\frac{5}{8}, ___?$ Average = $4\frac{3}{4}$
7. 93.7, 94.1, 96.5, ____? Average =95.5
8. 12.12, $3\frac{1}{5}$, 6.34, $7\frac{1}{3}$, $5\frac{1}{6}$, ____? Average = 8

Solve the following word problems involving averages:

9. Maryann has taken three tests for her math class, and earned scores of 85%, 91% and 94%. What is her average in the class?
10. Michael needs a 70% average to pass his history class. If his test scores so far are 82%, 65%, and 74%, what score does he need to get on the fourth test to pass the class?

Key

- | | | | |
|------------------------------------|---|-------------------------------|--------------------|
| 1. 15 | 2. 4.25 | 3. $1\frac{17}{80}$ or 1.2125 | 4. ≈ 10.03 |
| 5. 6 | 6. 7 | 7. 97.7 | 8. 13.84 |
| 9. Maryann has a 90% in the class. | 10. Michael needs a 59% on his last test. | | |