

**EVALUATING
ACADEMIC READINESS
FOR APPRENTICESHIP TRAINING**
Revised for
ACCESS TO APPRENTICESHIPS

**MATHEMATICS SKILLS
OPERATIONS WITH PERCENTAGES**

**AN ACADEMIC SKILLS MANUAL
for
The Metal Work Trades**

This trade group includes the following trades:
Heat & Frost Insulator, Iron Worker,
Precision Metal Fabricator, Sheet Metal Worker, and
Welder & Fitter

*Workplace Support Services Branch
Ontario Ministry of Training, Colleges and Universities*

Revised 2011

In preparing these Academic Skills Manuals we have used passages, diagrams and questions similar to those an apprentice might find in a text, guide or trade manual.

This trade related material is not intended to instruct you in your trade. It is used only to demonstrate how understanding an academic skill will help you find and use the information you need.

MATHEMATICS SKILLS

OPERATIONS WITH PERCENTAGES

*An academic skill required for the study of the
Metal Work Trades*

INTRODUCTION

In your training and on the job in construction you will come across statements such as:

The aluminum base, for beverage cans consists mostly of aluminum, but it contains small amounts of other metals as well. These are typically 1% magnesium, 1% manganese, 0.4% iron, 0.2% silicon, and 0.15% copper.

Alloy composition of this lead free solder is as follows: 2.5 % Ag, 0.8 % Cu, and 0.5 % Sb (percent by mass), with the leading element (in this case, Sn) making up the balance to 100 %. (Ag. – Silver
Cu – Copper Sb- antimony Sn – tin).

Die clearance is related to the type and thickness of the material being punched. For mild steel (AISI 1010 or equivalent) we recommend using 10% of material thickness (5% per side) added to the punch size, when punching up to .25" (6.35 mm) thick material. Clearance should be doubled when punching thicker materials, or when punching Stainless Steels. Use 8% (4% per side) when punching light gage softer materials, like aluminum or copper. calculate die clearances for various metal types

All these statements use a mathematical shorthand called percent. This skills sheet looks at different ways to use percent. It covers the following topics:

- ◆ The meaning of percent
- ◆ Writing a number as a percent
 - writing whole numbers, decimals and fractions as percent,
 - rounding off
- ◆ Changing a percent to a decimal
- ◆ Problems involving percent, including
 - finding a percent of a number
 - finding what percent one number is of another
 - finding a number when a percent of it is known

THE MEANING OF PERCENT

*A **percent** is an amount expressed out of a total of one hundred.*

Example: 25% means 25 parts out of a total of 100 parts.

Example: When your course states that you need to achieve 65% on your tests to pass, this means you need to get 65 marks out of every 100 possible marks.

Example: You put a 40% antifreeze solution in your truck.

- The % (percent sign) tells you that the solution has been divided into a total of 100 parts.
- 40 tells us that forty of those parts consist of antifreeze,
- It also means that the other 60 of the parts ($100 - 40 = 60$), or 60%, consists of other things, let's say water.

The relative amounts of antifreeze and water are easier to picture as percents than if you read that the solution is $\frac{2}{5}$ antifreeze and $\frac{3}{5}$ water.

Percent can be used to make comparisons.

Example: a metal shaft can be solid or hollow. A manual might report that a hollow shaft is 25 % lighter than a solid shaft but is only 6 % less strong. This information tells us in an easily visualized way that the reduction in weight (25%) is considerably more than the loss of strength (6%).

Percent is often used to calculate financial amounts.

Examples:

A 10% increase in heating costs this year means that for every dollar you spent on heating costs last year, you now need to spend \$.10 more.

You pay 13% HST on all parts and materials which you forward on to your customers when you calculate the bill.

Your clients also pay 13% HST which you add to labour as you calculate the bill.

If you want to start your own business and you need a loan, the amount of interest on the loan is given as a percent such as 6.5%. To find out how much interest you will pay on an \$85,000 loan at 6.5% interest per year, you need to know how to do calculations with percent.

A Percent is a Special Kind of Fraction

A percent expresses an amount out of a total of 100 hundred equal parts. Since the 100 parts represent one whole amount, any percent less than 100 is a partial amount. A partial amount can be written as a percent, a fraction or a decimal.

Fraction: A fraction tells how many equal parts a whole amount is divided into; it also tells you how many of those parts you have.

Example: In the fraction $19/100$, the bottom number tells you how many parts, in this case 100, that the total amount is divided into. The top number tells you how many of these parts, in this case 19, you have.

- The top part of the fraction, representing the partial amount 19, is called the *numerator*.
- The bottom part of the fraction, representing the total amount 100, is called the *denominator*.
- The numerator and denominator are divided by the *fraction line*.

Percentages are fractions too: A percent is a kind of fraction whose denominator, like the fraction $19/100$, is 100.

- When we write a percent, we only write the numerator.
- The numerator is written with the percent (%) symbol after it.
- The % symbol represents the fraction line and indicates that the unwritten denominator is 100.

Example: To express the fraction $19/100$ as a percent:

- The numerator 19 is written with the % sign after it.
- The denominator 100 is not shown.
- Nineteen percent is written as 19%.

WRITING A NUMBER AS A PERCENT

Your course description might state that you have to attend 90 hours out of a total of 100 course hours in order to pass. Or it might state that you must attend 90% of the course. 90 out of 100 is the fraction $90/100$. The fraction $90/100$ and 90% both indicate the same time spent in class, but they are expressed in different ways.

You can convert any fraction, whole number or decimal number to a percent using the following rule:

To write a number as a percent, multiply it by 100 and add the % sign.

Remember: A quick way to multiply a number by 100 is to move the **decimal point** two places to the **right**. If the decimal point isn't shown at the end of a whole number, it is assumed to be after the last digit in the number. (Digits are the symbols we use to write numbers. The digit for four is 4.)

We will look at changing a whole number, a decimal number and a fraction to a percent. There is one method each for converting whole numbers and decimals to percent and two methods for changing fractions to percent.

To Change a Whole Number to a Percent

1. Multiply the number by 100.
2. Add the percent sign.

Example: Express 3 as a percent.

$$\begin{array}{ll} 3 \times 100 & \\ = 300 & \text{write the \% sign} \\ = 300\% & \end{array}$$

To Change a Decimal Number to a Percent

1. Multiply the number by 100.
2. Move the decimal point two places to the right, using zero as a place holder if necessary.
3. Add the % sign.

Example: Express .725 as a percent.

$$\begin{array}{ll} .725 \times 100 & \text{move the decimal point two places to the right} \\ = 72.5 & \\ = 72.5\% & \text{write the \% sign} \end{array}$$

Example: Express .5 as a percent.

$$\begin{array}{ll} .5 \times 100 & \text{move the decimal point two places to the right, using one zero as a place holder} \\ = 50 & \\ = 50\% & \text{write the \% sign} \end{array}$$

Changing a Fraction to a Percent

There are two methods for changing fractions to percentages.

Method One: (This method is handy if the denominator of the fraction divides evenly into 100.)

1. Multiply the fraction by 100.
2. Reduce the answer to its lowest terms
3. Write the percent sign with the answer.

Example: Express $\frac{2}{5}$ as a percent.

$$\begin{array}{ll} \frac{2}{5} \times 100 & 5 \text{ divides evenly into } 100 \\ \frac{2}{\cancel{5}_1} \times \cancel{100}^{20} & \text{we can cross out before multiplying} \\ = 40 & \\ = 40\% & \text{write the \% sign} \end{array}$$

Method Two: (This is the most common way to convert a fraction to a percent. This method is handy if the denominator of the fraction does not divide evenly into 100.)

1. Change the fraction to a decimal.
 - a. Divide the denominator of the fraction into the numerator. The answer is a decimal number.
2. Multiply the decimal by 100 and write the percent sign.

Example: Express $\frac{3}{8}$ as a percent.

$$\begin{aligned} & \frac{3}{8} \\ & = 3 \div 8 \quad \text{change the fraction to a decimal} \\ & = .375 \end{aligned}$$

$$\begin{aligned} & .375 \times 100 \quad \text{multiply by 100} \\ & = 37.5 \\ & = 37.5\% \quad \text{write the percent sign} \end{aligned}$$

Methods One and Two result in the same answer. You can use either method with any fraction to convert it to a percent.

Examples:

a) Express .25 as a percent.
 $.25 \times 100 = 25\%$

b) Express 1 as a percent.
 $1 \times 100 = 100\%$

c) Express $\frac{1}{4}$ as a percent.
 $\frac{1}{4} \times 100 = 25\%$

d) Express 65 out of 100 as a percent.
 $\frac{65}{100} \times 100 = 65\%$

e) Express $\frac{5}{8}$ as a percent.
 $5 \div 8 = .625$
 $.625 \times 100 = 62.5\%$

f) Express $\frac{1}{3}$ as a percent.
 $\frac{1}{3}$
 $= 1 \div 3$
 $= .33\ldots$
 $= .33\ldots \times 100$
 $= 33.33\ldots \%$

To round off an answer:

1. Look at the digit one place to the right of the place you are rounding off to.
2. If that digit is five or more, change the digit you are rounding off to one more than it is.
3. If the digit to the right is less than five, leave the digit you are rounding off the same.
4. Discard any digits after the one you have rounded off.
5. If the number you are rounding off to is 9 and the digit one past it is five or greater, the 9 becomes 10 and the place value where the 9 was becomes 0. The one from the 10 is added to the digit to the left of the 9, which becomes one larger in value.

Example: Round .6769 to two decimal places.

We look at the digit one past the 7, the second decimal place, which is a 6. Since it is five or larger, the 7 becomes 8 and the other digits are dropped.

6769 rounded to two decimal places is .68

Example: Express $\frac{1}{3}$ as a percent with the percent rounded to two decimal places.

$\frac{1}{3} = 33.3333\dots\%$ expressed as a percent
= 33.33 % rounded to two places

Example: Express $\frac{2}{3}$ as a percent.

$\frac{2}{3} = 66.666\dots\%$ expressed as percent
= 66.67% rounded off

Sometimes you are told how many places to round off to in the question and sometimes you are not. If you are not told, answers are generally rounded off to two places, although there are often exceptions. One eighth ($\frac{1}{8}$) is 12.5% as a percent and .125 as a decimal number. When a decimal number ends evenly in three or four places, we don't round it off.

CHANGING A PERCENT TO A DECIMAL

Imagine you have been told that insulating the walls of your shop will result in an energy savings of 10% on your heating bill. Before you decide whether to insulate the shop, you might want to calculate the actual monthly savings. You convert 10% to a decimal and then multiply the decimal number by your average monthly heating bill. To do this calculation, you first need to know how to change a percent to a decimal.

Decimals Are Also a Type of Fraction

Like percent, decimals are a kind of fraction. *A decimal is the numerator of a fraction which has a denominator that is a power of ten.* (A power of ten is a number that starts with 1 followed by any number of zeros such as 10, 100, 1000.) However, decimals show no denominator. A decimal point placed in front of the numerator replaces the denominator and the fraction line.

You have already learned how to convert a decimal number to a percent: multiply by 100 and add the % sign. To change a percent to a decimal, reverse the process.

To change a percent to a decimal:

1. Remove the percent sign and divide by 100.

Remember: *To divide by 100 quickly, move the decimal point two places to the left. When dividing by 100, the decimal point moves in the opposite direction than when multiplying by 100. If there are empty spaces between the decimal point and the digits of the number after you have moved the decimal point to the left, fill the spaces with zeros.*

Example: Divide 3.67 by 100 the quick way.

Move the decimal point two places to the left and fill the empty space with a zero. The answer is .0367

Example: Change 5% to a decimal.

5% = .05 move the decimal 2 places to the left, use zero as a place holder and remove the % sign

Example: Change 33.3% to a decimal.

33.3% = .333 move the decimal 2 places to the left and remove the % sign

Example: Express 10% as a decimal.

10% = .10 or .1 move the decimal point two places to the left and remove the % sign

Example: If you can save 10% in energy costs if you insulate your shop how much money you would save if you insulated the shop.

10% = .1

If the average monthly heating bill is \$250, 10% saving would be $.1 \times \$250 = \25 . The savings would be \$25 a month. You can now decide if it is worthwhile insulating.

TO WRITE A NUMBER AS A PERCENT:

1. Multiply by 100 by moving the decimal point **two** places to the **right**. Use zeros as place holders when needed. If the decimal point is not shown in a whole number, it is assumed to be after the last digit.
 2. Add the % sign.
-

1. Express the following as a percent. **Answers are on the last page of the skills manual.**
Check your answers often.

- | | | |
|------------------|------------------|-------------------|
| a) 10 out of 100 | b) $\frac{1}{5}$ | c) 100 out of 100 |
| d) $\frac{2}{1}$ | e) .85 | f) 2.75 |
| g) .05 | h) $\frac{1}{3}$ | i) 1 |

TO CHANGE A PERCENT TO A DECIMAL:

1. Remove the percent sign.
 2. Divide the given number by 100 by moving the decimal point **two** places to the **left**. Use zeros as place holders when needed.
 3. If the decimal point is not shown, it is assumed to be after the last digit in the number.
-

2. Change the following percents to decimal numbers. Answers are on the last page

- | | | |
|---------|----------|-----------|
| a) 28% | b) 56.7% | c) 7% |
| d) 100% | e) 8.5% | f) 250% |
| g) 15% | h) .2% | i) 62.5 % |

PROBLEMS INVOLVING PERCENT

Sometimes you have to solve problems which involve percent. You may be given information expressed as a percent and asked to find an unknown amount by using the given information. For example, you use percent to find the amount of sales tax owed or to find the interest on a loan.

***Note:** When doing percent problems, a calculator can do the calculations accurately, but you first have to decide what steps to use and in what order. Once you have figured out what you are asked to find and what method to use, you can use your calculator.*

We will look at three main types of percent problems so you will know what method to choose for different situations. The three types of problems are:

- Finding the percent of a number.
- Finding what percent one number is of another.
- Finding a number when you know a percent of it.

Problem Type #1: To Find a Percent of a Number

The most common kind of percent problem involves finding a percentage of a number.

Example: In Ontario, you pay 13% HST for many goods and services you buy. If you want to know the total price of an object or service before buying it, you need to calculate the amount of tax (13%) and add that to the cost. If the price of a truck is \$22 000, you have to add 13% harmonized sales tax to find the total cost.

To find the percent of a number:

1. Change the percent to a decimal.
2. Then multiply the number by the decimal.

We looked at how to change a percent to a decimal in the last section. Drop the percent sign and move the decimal point two places to the left.

Example: Find 5% of 20. .

$$5\% = .05$$

1. Change 5% to a decimal.

When you move the decimal point two places to the left, you will need to use a zero as a place holder

$$\begin{array}{r} 20 \\ \times .05 \\ \hline 100 \\ \hline 00 \\ \hline 1.00 \end{array}$$

Now multiply $.05 \times 20$.

$$5\% \text{ of } 20 = 1$$

Example: Find 25% of \$150.

$$\begin{array}{r} \$150 \\ \times .25 \\ \hline 7500 \\ 3000 \\ \hline \$37.50 \end{array}$$

Change 25% to the decimal .25 and multiply.

$$25\% \text{ of } \$150 = \$37.50$$

Most problems that ask you to find a percentage of a number are worded something like this:

- What is the total cost of a power saw that sells for \$257.99 if the tax is 13%?
- If a hollow shank weighs 75 % of the weight of a similar solid shaft and the solid shaft weighs 8.54 kg, what is the weight of the hollow shaft?
- Find the amount of interest you must pay in a year on a loan of \$3000 if the interest rate is 5% per annum.

In each case, you need to find a percentage of the given number:

- in the first problem, 15% of \$257.99
- in the second problem 75% of 8.54 kg
- in the third problem 12% of \$3000.

Example 1: What is the cost of a power saw that sells for \$257.99 if the tax is 13%?

1. Find the amount of tax first.

$$\begin{array}{r} \$257.99 \\ \times .13 \\ \hline 77397 \\ 25799 \\ \hline \$335387 \end{array}$$

change 13 % to .13.
and multiply

Money is always rounded off to two decimal places. \$33.5387 is rounded off to \$33.54

2. Add the tax to the price of the saw to get the amount you pay

$$\begin{array}{r} \$ 257.99 \\ + \$33.54 \\ \hline \$ 291.53 \end{array}$$

The total cost is \$291.53

Example 2: Find 75% of 8.54 kg

Change 75% to the decimal .75 and multiply.
 $.75 \times 8.54 = 6.405 \text{ kg}$

The hollow shaft weighs 6.405 kg.

Example 3: Find 12% of \$3000.

Change 5% to the decimal .05 and multiply.

$$.05 \times \$3000 = \$150$$

The yearly interest paid is \$150.

TO FIND A PERCENT OF A NUMBER:

1. Change the number with the percent to a decimal by dropping the percent sign and moving the decimal **two** places to the **left**.
 2. Multiply the two numbers together.
-

3. Solve the following questions. Answers are on the last page.

a) Find 50% of 200

b) Find 33.3% of 150

c) Find 4.25% of 30

d) Find 12% of \$48.50

e) Find 15% of \$1.99

f) Find .25% of 12

g) What is 100% of 75

h) What is 150% of 68

i) What is 9% of \$10.75

4. What is the tax on an item that costs \$45.98 if the sales tax is 13%? What is the total cost?

5. 80% of the students in a course passed their test. If there are 40 students in the class, how many failed the test? (Hint: If 80% passed, what % failed?)

6. If 160 trucks were tested and 25% were found to need new emissions controls, how many trucks needed their emission system upgraded? How many still had reliable systems?

7. If you have finished 50% of a job and you are scheduled to work 20 days, how long have you worked already?

Problem Type #2: Find What Percent One Number Is of Another

This type of problem allows us to use percent to compare things in a way we can easily understand.

Example: If a survey found that 620 people of 1000 feel air bags are essential, they would probably convert this finding to a percent and report it by saying 62 % of the people surveyed think air bags are essential.

These questions can be worded in two ways:

“620 is what percent of 1000?” or “What percent of 1000 is 620?”

To find what percentage one number is of another, follow these three steps:

First step: Make a fraction. When one number is expressed out of another, it can be written as a fraction.

Example: 150 out of 500 is the fraction $150/500$.

You have to know which number is the numerator and which number is the denominator to make the fraction.:

- ◆ The number representing the total, or *the number following “of”*, is the **denominator**. It forms the bottom part of the fraction.
- ◆ The other number is the **numerator**. It forms the top part of the fraction.

Remember: To make a fraction, write “is” over “of”, or is/of.

Second step: Make the fraction into a decimal number. *The numerator is divided by the denominator.*

Note: You make the fraction in order to see what part is the numerator and what part is the denominator. This lets you correctly divide the numerator by the denominator. You can divide without making a fraction if you know to divide the number associated with “is”, the numerator, by the number following “of”, the denominator.

Third step: Change the decimal answer to a percent:

- ◆ Multiply it by 100.
- ◆ Add the percent sign.

Remember: To multiply by 100 move the decimal point two places to the right.

Example: 150 is what percent of 500?

$\frac{150}{500}$ Write the fraction. Remember *is* over *of*

$150 \div 500 = .3$ Change the fraction to a decimal.
 $.3 \times 100 = 30\%$ Change the decimal to a percent.

In Brief

To find what percent one number is of another number:

1. Make a fraction by writing the number with the word *is* over the number with the word *of*.
2. Convert the fraction to a decimal by dividing the numerator by the denominator.
3. Change the decimal to a percent by multiplying by 100 and adding the % sign.

If you are dividing with a calculator, always key in the numbers so that the dividend (the number being divided into) is keyed in first, then the division sign and then the divisor (the number you divide by). To divide 75 by 25 using a calculator, key in the dividend 75 first and then the divisor 25.

Example: 620 is what percent of 1000?

$\frac{620}{1000}$ Write the fraction. (*is* over *of*)

$620 \div 1000 = .62$ Change the fraction to a decimal by dividing.

$.62 \times 100 = 62\%$ Change the decimal to a percent by multiplying and adding the % sign.

620 is 62% of 1000

Example: What percent of 50 is 25?

$\frac{25}{50}$
 $= 25 \div 50$
 $= .5$
 $.5 \times 100 = 50\%$

Rounding off: If the division answer doesn't come out evenly or is a repeating decimal, round off the answer. If the answer will be in percent, round off to four places so you have two decimal places in your percent.

Example: 1 is what percent of 3?

$1 \div 3 = .3333\dots$ round off to four places

$.3333 \times 100 = 33.33\%$

Example: 200 is what percent of 300?

$$\begin{aligned} 200 \div 300 \\ = .6666\dots \end{aligned} \quad \text{rounded to four places is } .6667$$

$$.6667 \times 100 = 66.67\%$$

TO FIND WHAT PERCENT ONE NUMBER IS OF ANOTHER:

1. Make a fraction, using the number representing the total or the number following “of” as the denominator and the other number, following “is”, as the numerator.
2. Change the fraction to a decimal number by dividing the numerator by the denominator.
3. Multiply this division answer by 100 and add the percent sign.

8. Answer the following questions. Answers are on the last page.

- a) 3 is what percent of 12? b) 28 is what % of 32? c) What percent of 36 is 9?
- d) What % of 40 is 15? e) What % of 1 is 1? f) 250 is what % of 200?
- g) 25 is what % of 75? h) What % of \$3.99 is \$1.10?
9. If there are .5 kilograms of copper, .3 kilograms of zinc and .2 kilograms of nickel in a kilogram of German silver, what percentage of copper, zinc and nickel is there in the silver?
10. A set of metal molding tools normally sells for \$150 and you get it for only \$90, what % saving do you get? (Your savings are the amount you don't pay. The discount is \$60. What % is 60 out of 150?)
11. The gas mixture for oxy-acetylene welding contains 3 parts oxygen for 1 part acetylene. What is the % of acetylene in the mix? (First find the total number of parts of the mix, then find the % of acetylene to the total amount.)

Problem Type #3: Find a Number When a Percent of It Is Known

To find a number when a percent of it is known follow these steps:

1. Change the percent to a decimal number by dropping the percent sign and moving the decimal point two places to the left.
2. Divide the given number by the decimal number. The division answer is the unknown number.

Example: In a typical bill for a machining job, 60% of the cost is for labour. If the labour charge comes to \$900, how much is the total bill?

Change 60% to a decimal.

$$60\% = .6$$

Divide the cost for labour by the decimal number. The division answer is the cost of the total bill.

$$\$900 \div .6 = \$1500$$

The total bill is \$1500.

This type of question can be worded in two different ways, but each is solved in the same way.

Example: 45% of what number is 90?

Change 45% to .45

$$90 \div .45 = 200$$

The unknown number is 200.

Example: 12 is 24% of what number?

Change 24% to .24

$$12 \div .24 = 50$$

The unknown number is 50.

TO FIND AN UNKNOWN NUMBER WHEN A PERCENT OF IT IS KNOWN:

1. Change the percent to a decimal number by removing the % sign and moving the decimal point two places to the left.
 2. Divide the given number by the decimal number to get the number you are looking for.
-

12. Answer the following questions. The answers are on the last page.

- | | |
|-------------------------------|--------------------------------|
| a) 2% of what number is 10? | b) 18 is 36% of what number? |
| c) 44 is 55% of what number? | d) 25% of what number is 6? |
| e) 100% of what number is 70? | f) 40% of what number is 12.6? |
| g) 12 is 6% of what number? | h) 8% of what amount is \$180? |

13. You are doing a reinforcing job. 75% of the bill is for labour and the rest is for materials. What will the total bill be if labour costs are \$1250?

14. If 25% of a bill is for labour, what is the total bill if labour costs are \$50?

SOLVING WORD PROBLEMS

We have looked at the three types of percent problems individually. When you are answering problems that deal with percent, you have to decide which of the three kinds of questions you are being asked to solve.

The three types of problems are worded so you can recognize what you are being asked to find. You can then pick the right method:

1. **Find a percent of a number.** These questions are worded: "Find 20% of 66" or "What is 45% of 50?"
2. **Find what percent one number is of another.** These questions are worded: "15 is what percent of 25?" or "What percent of 40 is 10?"
3. **Find an unknown number when a percent of it is known.** These questions are worded: "20% of what number is 80?" or "24 is 35% of what number?"

When you know what kind of question you have to solve, you follow the steps listed for that type of question to get your answer. Ask what the problem requires you to find and decide what method to use to find it. Often there are further calculations to do once you have solved the percent problem.

Example: you are given the percent of one part and required to find the other part. If you saved 25% on a pair of \$90 pants, what did you pay? (What is the sale price?) In this case, you have to calculate the 25 % that you saved and then subtract that from the regular price.

First you are asked to find 25% of \$90.

$$.25 \times \$90 = \$22.50$$

Now you have to subtract the \$22.50 from \$90 to find the sale price.

$$\$90 - \$22.50 = \$67.50$$

The pants cost \$67.50

You could also subtract 25% (the part you saved) from 100% to get 75% and then find 75% of the original price.

$$.75 \times \$90 = \$67.50$$

Example: The estimated amount of waste on a job is 10%. If the cost of wasted material is \$449, what is the total cost of the materials for the job?

10% is .1 as a decimal

$$\$449 \div .1 = \$4490$$

Materials for the job cost \$4490.

Example: Studies have found that 60% of the causes of mechanical breakdowns are related to misalignment. You have repaired 30 breakdown due to misalignment this year. How many repairs have you done are due to other causes?

First, find the number of repairs using the steps for finding an unknown number when a percent of it is known.

60% is .6 as a decimal

$$30 \div .6 = 50$$

The total number of repairs is 50.

Now subtract the number of repairs due to misalignment from the total to get the number of repairs due to other causes.

$$50 - 30 = 20$$

20 repairs are due to other causes.

To answer the following problems, you will have to decide what method to use.

15. An iron worker earning \$37.00 an hour receives a 4% increase in pay. What is his new hourly rate? (Find his increase and add it to what he is making now.)

16. A steel alloy contains 25 % chromium. A second steel alloy has 15 kilograms of chromium for every 90 kilograms of steel. Which steel alloy has the higher % of chromium?

17. A permanent metal mold becomes .01% larger each time it is used. When the mold becomes 1% larger, it must be replaced. How many castings can be made with the mold?

18. A precision metal fabricator's punching tool costs \$108.50. The industrial discount on buying 20 at a time is 25%. What would be the cost of buying 20 punching tools?

19. Stretch in a chain is determined by the increase in length (S) expressed as a percentage of the original chain length (L), as in the formula:
$$\text{stretch} = S/L \times 100\%$$
Chain manufacturers recommend that chain should be replaced when the extension is 1%. If a 20 meter chain has stretched .25 meters, should the chain be replaced?

20. A new-to-you truck costs \$23,000. You put \$4000 down and borrow the rest at 6% interest to pay for the truck. What is the total amount that you pay for the truck?

21. 55 % of a precision metal fabricating company's work involves reading CAD drawings. So far this year the company processed 220 orders using CAD. How many orders did **not** involve CAD drawings?

22. A rigging cable has a safe working load of 2000 kg. You need to lift a load of 1200 kg. However, the cable has a flaw in it and you know that this reduces the safe working load by 35 %. Can you use this rope to safely lift the load?

ANSWER PAGE

1. WRITING PERCENT

- a) 10% b) 20% c) 100% d) 200% e) 85%
f) 275% .g) 5 % h) 33.33% i) 100%

2. CHANGING PERCENT TO DECIMALS

- a) .28 b) .567 c) .07 d) 1 e) .085 f) 2.5
g) .15 h) .002 i) .625

3. FINDING A PERCENT OF A NUMBER

- a) 100 b) 49.95 c) 1.275 d) \$5.82 e) \$.30 f) .03
g) 75 h) 102 i) \$.97

4. \$5.98 - The total cost is $\$45.98 + 5.98 = \51.96

5. 20% of the students didn't pass the test, so 8 students failed.

6. 40 trucks need new emission systems, 120 were alright

7. $.5 \times 20 = 10$ days

8. FINDING WHAT PERCENT ONE NUMBER IS OF ANOTHER

- a) 25% b) 87.5% c) 25% d) 37.5% e) 100% f) 125%
g) 33.33% h) 27.57%

9. 50% copper, 30% zinc, 20% nickel (Note 1 kg = 100%)

10. Saving is 40%

11. 4 parts in mix, 25% is acetylene

12. FINDING A NUMBER WHEN A PERCENT OF IT IS KNOWN

- a) 500 b) 50 c) 80 d) 24 e) 70 f) 31.5
g) 200 h) \$2250

13. $\$1250 \div 75 = \1666.67

The total bill will be \$1666.67.

14. \$200

WORD PROBLEMS

15. \$38.48 (his increase is \$1.48 an hour)

16. The second alloy has 16.67 % chromium, so the first alloy has the higher % of chromium

17. 100 times ($1\% \div .01\%$)

18. \$1627.50 (find the cost of 20, then find 75% of that cost)

19. $.25 \div 20 \times 100\% = 1.25\%$, the chain should be replaced

20. 6% interest on \$19,000 is \$1140, total cost is \$24,140

21. $220 \div .55 = 400$, $400 - 220 = 180$, 180 orders did not involve CAD drawings

22. $100\% - 35\% = 65\%$, $.65 \times 2000 \text{ kg} = 1300 \text{ kg}$ safe working load; the cable can safely lift a 1200 kg load