

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

**MATHEMATICS SKILLS
OPERATIONS WITH PERCENTAGES**

**AN ACADEMIC SKILLS MANUAL
for**

The Motive Power Trades

This trade group includes the following trades:
Automotive Service Technician, Heavy Duty Equipment Mechanic,
Motive Power Parts Person, Transmission Mechanic,
Truck & Coach Technician, and Truck & Trailer Service Technician

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

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In preparing these Academic Skill 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
Motive Power Trades*

INTRODUCTION

When you read the information handed out in your course, you will come across statements such as:

“The electrolyte in the battery is 36% sulphuric acid and 64% water.”

“A 40% antifreeze-to-water mix offers freeze protection to about -23°C .”

“Operators of on-highway diesel equipment are required to use fuel that contains no more than 0.05% by weight sulfur fuel.”

All these statements use a mathematical shorthand called percent. This skills manual 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 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 $\frac{19}{100}$, 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 $\frac{19}{100}$, 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%.

Percent is usually used to express amounts that are less than one whole (100 parts being equal to 1 whole). Any percent less than 100% represents an amount smaller than one whole.

Example: Percent is used to make comparisons in manuals. A manual might compare the energy content (Btu's per liter) of different fuels compared to diesel using the following percents:

No. 2 diesel	100%
Gasoline	89%
Methanol	44%
Ethanol	58%

- You can see from this chart that diesel is the most efficient source of fuel in terms of the amount of Btu's per liter, while gasoline is next in thermal efficiency.
- Notice that since diesel is the standard used to compare the energy ratings, its rating is listed as 100%.

You also use percents when calculating financial amounts.

Example: The amount of income tax, and the HST you pay, are all calculated as percentages.

Example: A job estimate might state that 60% of the cost of a job is for labour charges and 40% is for parts; you need to know how to do these calculations.

WRITING A NUMBER AS A PERCENT

Your course manual might state that you have to attend 180 hours out of a total of 200 course hours in order to pass. Or it might state that you must attend 90% of the course. 180 hours out of 200 and 90% both indicate the same time spent in class, but they are expressed in different ways. The fraction $180/200$ is the same as 90%.

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.

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

To Change a Fraction to a Percent

There are two methods of 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.

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

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 to get a decimal number.
2. Multiply the decimal by 100 and add the percent sign.

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

$$\begin{array}{ll} \frac{3}{8} & \\ = 3 \div 8 & \text{change the fraction to a decimal} \\ = .375 & \\ \\ .375 \times 100 & \text{multiply by } 100 \\ = 37.5 & \\ = 37.5\% & \text{write the percent sign} \end{array}$$

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.

$$\begin{aligned}\frac{1}{3} &= 1 \div 3 \\ &= .33... \\ &= .33... \times 100 \\ &= 33.33... \%\end{aligned}$$

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.

$$\begin{array}{ll}\frac{1}{3} = 33.3333... \% & \text{expressed as a percent} \\ = 33.33 \% & \text{rounded to two places}\end{array}$$

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

$$\begin{array}{ll}\frac{2}{3} = 66.666.. \% & \text{expressed as percent} \\ = 66.67 \% & \text{rounded off}\end{array}$$

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 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:

- 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 by insulating 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 the number by 100 using one of the methods shown. 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. Write the % sign.

Express the following as a percent. **Answers are at the end of this skills manual.**

1. a) 10 out of 100 b) $1/5$ c) 100 out of 100
d) $2/1$ e) .85 f) 2.75
g) .05 h) $1/3$ i) 1

TO CHANGE A PERCENT TO A DECIMAL

1. Remove the percent sign.
2. Divide the 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.

Change the following percents to decimal numbers.

2. 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:

1. Finding the percent of a number.
2. Finding what percent one number is of another.
3. 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

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

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:

- The amount of additives in an oil is 10% by weight. What is the weight of the additives in 450 grams of oil?
- If a set of electrical meters costs \$499.99, and the sales tax is 13%, what is the total amount you will have to pay?
- Find the amount of interest you must pay in a year on a loan of \$3000 if the interest rate is 6% per annum.

In each case, you must first find a percentage of the given number:

- in the first problem find 10% of 450 g,
- in the second, 13% of \$499.99, and
- in the third, 6% of \$3000.

Example 1: The amount of additives in an oil is 10% by weight. What is the weight of the additives in 450 grams of oil?

Change 10% to the decimal .1 and multiply.

$$\begin{array}{r} 450 \\ \times .1 \\ \hline 45.0 \end{array}$$

The weight of the additives is 45 grams.

Example 2: If a set of electrical meters costs \$499.99 and the sales tax is 13%, what is the total amount you have to pay?

First find the amount of tax paid. Change 15% to the decimal .15 and multiply.

$$\begin{array}{r} .13 \times \$499.99 \\ = \$64.9987 \text{ rounded to } \$65.00 \end{array}$$

Add the amount of tax paid to the cost of the meters.

$$\begin{array}{r} \$499.99 + \$65.00 \\ = \$564.99 \end{array}$$

The total amount paid is \$564.99.

Example 3: Find the amount of interest you must pay in a year on a loan of \$3000 if the interest rate is 6% per annum.

Change 6% to the decimal .06 and multiply.

$$\begin{aligned} &.06 \times \$3000 \\ &= \$180 \end{aligned}$$

The yearly interest paid is \$180.

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.
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Solve the following questions. Round off money values to two decimal places. **Answers are on the last page.**

3. 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 a set of wrenches 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. Using radial ply tires to replace bias ply tires results in a 5% saving in the amount of fuel needed. If a car with bias tires uses an average of \$9,000 worth of fuel in a year, how much money would be saved if the tires were switched to radial tires?

7. Aluminum has a tensile strength that is 10% higher than steel. If a steel automobile frame rail has a tensile strength of 70,000 psi, what is the tensile strength of a similar frame rail made of aluminum?

8. The amount of sulfur allowed in fuels is .05%. What is the weight of sulfur in a tank of fuel that weighs 50 kilograms?

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: You are asked to keep track of the causes of battery failure in a fleet of taxis your shop is maintaining. You find that of 50 cars with battery problems, 24 failures are caused by vibration, 20 are caused by recharge-discharge cycling, 14 are caused by overcharging, 9 are caused by broken posts, and 9 are caused by undercharging. To clearly indicate the causes of failure, your report might state these statistics as the following percentages:

Causes of battery failure:
vibration: 48%
recharge-discharge cycling: 40%
overcharging: 28%
broken posts or terminals: 18%
undercharging: - 18%

To write this chart, you have to know how to express numbers such as 24 out of 50 as percentages. Questions that require you to do this can be worded in two ways:

“24 is what percent of 50?” or “What percent of 50 is 24?”

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?

$$\frac{620}{1000}$$
$$620 \div 1000$$
$$= .62$$
$$.62 \times 100$$
$$= 62\%$$

Write the fraction. (is over of)

Change the fraction to a decimal by dividing.

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?

$$1 \div 3$$
$$= .3333\dots \quad \text{round off to four places}$$
$$.3333 \times 100$$
$$= 33.33\%$$

Example: 200 is what percent of 300?

$$200 \div 300$$
$$= .6666\dots \quad \text{rounded to four places is .6667}$$
$$.6667 \times 100 = 66.67\%$$

TO FIND WHAT PERCENT ONE NUMBER IS OF ANOTHER

1. Make a fraction. Use the number representing the total or the number following “of” as the denominator. Make the other number 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.
-
-

Answer the following questions. **Answers are at the end of this skills manual.**

9. 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?
10. If the normal price of a coil of brake cable is \$150 and you only pay \$90, what % savings do you get? (Your savings are the amount you don't pay. The discount is \$60. What % is 60 of 150?)
11. An electrolyte solution consists of 1.28 kilograms of water and 7.2 kilograms of acid. What is the percent of water and acid in the solution. (First you need to add the two weights to get the total weight of the solution.)

Problem Type #3: To 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: A routine check of cars revealed that the brake failure rate was 15%. If 45 vehicles had faulty brakes, how many cars in total were checked?

$$15\% = .15 \quad \text{Change 15\% to a decimal.}$$

Divide the number of vehicles checked by the decimal number. The division answer is the total number of cars checked.

$$45 \div .15 = 300 \text{ vehicles}$$

The total number of vehicles checked was 300 cars.

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?

$$90 \div .45 = 200 \quad \text{Change 45\% to .45}$$

The unknown number is 200.

Example: 12 is 24% of what number?

$$12 \div .24 = 50 \quad \text{Change 24\% to .24}$$

The unknown number is 50.

TO FIND A 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.
-

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

12. 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?

13. 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 in two ways:

- “Find 20% of 66.” or
- “What is 45% of 50?”

2. Find what percent one number is of another.

These questions are worded in two ways:

- “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 in two ways:

- “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 \$90 tool, what did you pay? (What is the sale price?) In this case, 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 subtract the \$22.50 from \$90.

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

The tool 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?

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 breakdowns due to misalignment this year. How many repairs 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.

Answer the following problems. Answers are on the last page.

14. An apprentice 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.)

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

16. An ignition switch costs \$10.85. The discount on buying 200 at a time is 25%. What would be the cost of buying 200 ignition switches?

17. A new 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?

18. 55 % of an order has been filled. You have received 220 items. How many items are you still waiting for?

ANSWER PAGE

WRITING PERCENT

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

CHANGING PERCENT TO A DECIMAL

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

FINDING A PERCENT OF A NUMBER

3. a) 100 b) 49.95 c) 1.275 d) \$5.82 e) \$.30 (rounded up)
f) .03 g) 75 h) 102 i) \$.97(rounded up)
4. \$6.90 The total cost is $\$45.98 + 6.90 = \52.88 (rounded up).
5. 20% of the students didn't pass the test, so 8 students failed.
6. \$450 savings ($\$9000 \times .05$)
7. $70,000 \times .1 = 7,000$ psi increase. Total tensile strength of aluminum rail is
 $70,000 + 7,000 = 77,000$ psi
8. $50 \text{ kg} \times .0005 = .025$ kg sulfur

FINDING WHAT PERCENT ONE NUMBER IS OF ANOTHER

9. a) 25% b) 87.5% c) 25% d) 37.5% e) 100% f) 125%
g) 33.33% h) 27.57
10. $60 \div 150 = .4$
 $.4 \times 100 = 40\%$
The saving is 40%.
11. Total weight = 8.48 kg
 $1.28 \div 8.48 = .15$
 $.15 \times 100 = 15\%$ water
 $7.2 \div 8.48 = .849$
 $.849 \times 100 = 84.9\%$ acid

FINDING A NUMBER WHEN A PERCENT OF IT IS KNOWN

12. a) .2 b) 50 c) 80 d) 24 e) 70 31.5

13. This question asks 25% of what amount is \$50.00

$$\$50 \div .25 = \$200$$

The total bill is \$200.00

WORD PROBLEMS

14. \$38.48 (his increase is \$1.48 an hour)

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

16. \$1627.50 (find the cost of 200, then find 75% of that cost)

17. 6% interest on \$19,000 is \$1140, total cost is \$24,140

18. $220 \div .55 = 400$, $400 - 220 = 180$, 180 items are still on order