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ABSTRACT

This booklet is intended to help mainstreamed mentally retarded, emotionally disturbed, or learning disabled high school students acquire a basic understanding of the responsibilities and working conditions of plumbers and to practice basic math skills necessary in the occupation. The first section provides a brief introduction to the occupation by focusing upon those job tasks of a plumber with which the student is likely to be familiar. The next two sections deal with the work environment of the typical plumber and the training, education, and experience needed for the occupation. Exercises addressing basic math skills used by plumbers are provided. Various suggestions are listed for students interested in further exploring the occupation of plumber. A glossary and answer sheet conclude the booklet. (KC)

MATH on the job

Plumber

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MATH ON THE JOB:

PLUMBER

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MATH on the job

Plumber

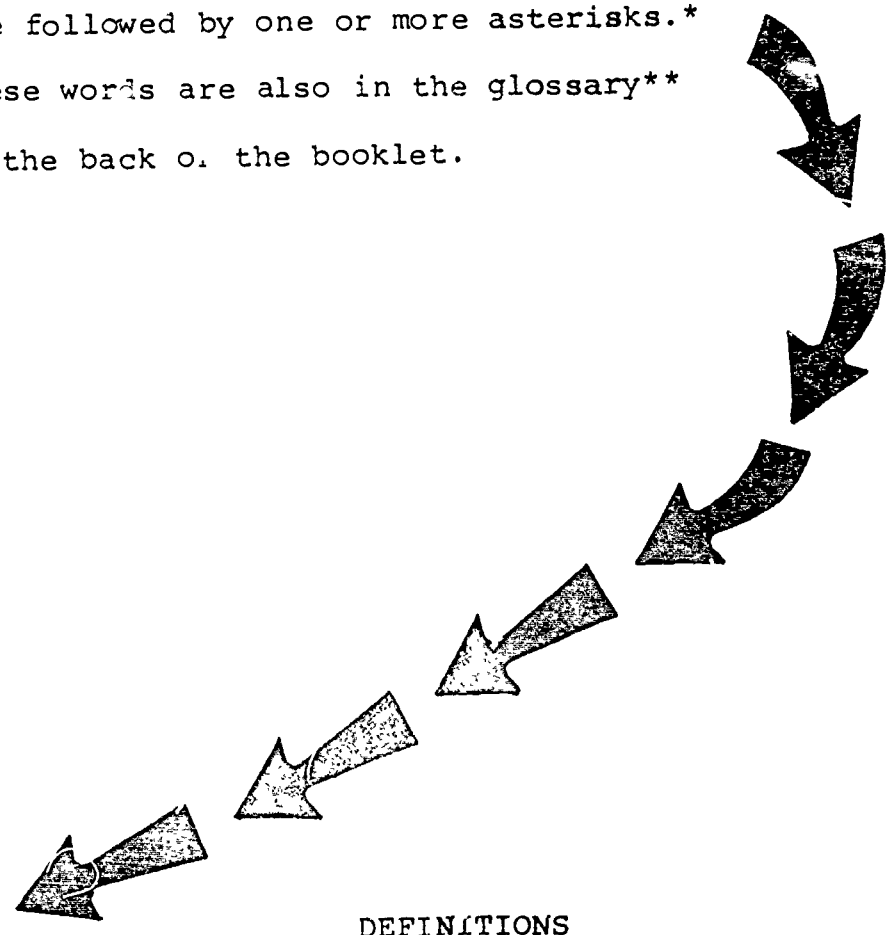
In this booklet, you can--

- find out what a plumber does
- see how a plumber uses math
- get a chance to use math as a plumber
- find out the types of things a plumber needs to know
- find out what courses, training, and experience you need to become a plumber

SPECIAL WORDS USED IN THIS BOOKLET

Workers in many jobs use special words or special meanings for words. Learning these words helps you to learn about a job.

You will find some of these special words in this booklet. When these words, and some hard words, are used for the first time, they are followed by one or more asterisks.* These words are also in the glossary** at the back of the booklet.



DEFINITIONS

*An asterisk (*) is a symbol that tells you to look at the bottom of the page for the meaning, or definition, of the word.

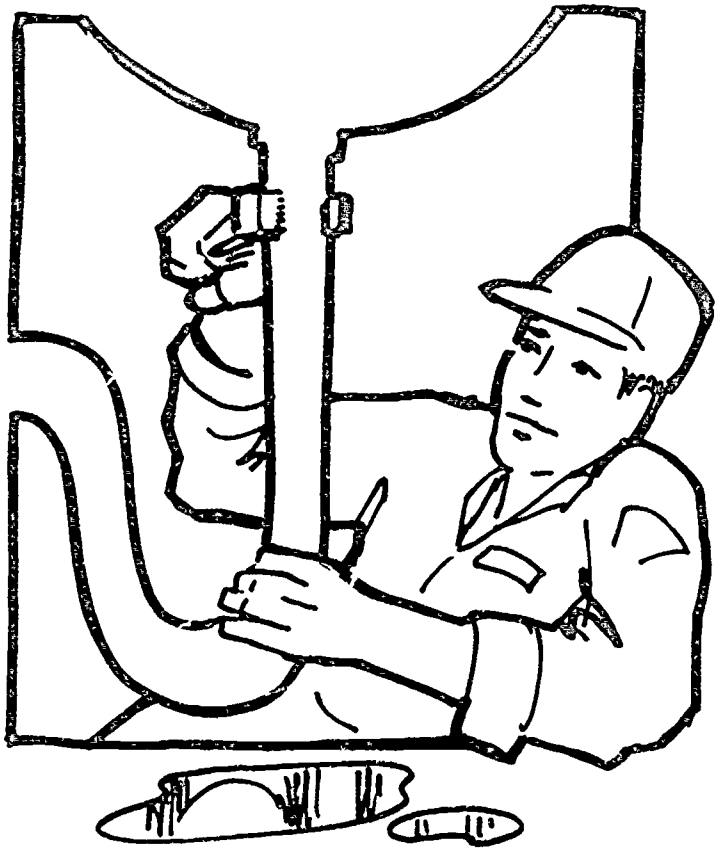
**A glossary is a list of words with their meanings.

CONTENTS

HAVE YOU EVER...

- watched someone repair a leaky faucet?
- watched someone install a sink, toilet, bathtub, or shower?
- watched a plumber install waterlines in a home or building under construction?
- helped someone fix a leaky pipe?
- cleaned out a stopped up or clogged drain pipe?

If you have, then you have some idea about the work that a plumber does. This booklet will help you learn about the work of a plumber and how math is important to do the job.



WHAT DOES A PLUMBER DO?

A plumber assembles, installs, repairs, and replaces pipes and pipe systems. How does a plumber do this? As a plumber, you--

- read blueprints* and scale drawings
- measure pipes and pipe fittings**
- cut the pipe to the correct size
- connect the pipes and pipe fittings by using such methods as welding or soldering***
- make measurements to find where the plumbing should be located
- mark where the plumbing should be located

Plumbers also install and repair--

- plumbing fixtures such as sinks, toilets, bathtubs, and showers
- appliances such as dishwashers and garbage disposal units
- heating and refrigeration units such as radiators and air conditioners

DEFINITIONS

*A blueprint is a picture that shows how something is to be built or put together.

**A pipe fitting is a connector used to join pipe.

***To solder means to join metals. During soldering, a heated rod is used to melt a soft metal. This melted metal flows between the pipe and pipe fitting and joins the two together.

Math is very important to the work of a plumber. As a plumber, you--

- count, add, subtract, multiply, and divide
- use whole numbers, fractions, and decimals
- measure pipe and pipe fittings
- read measuring instruments such as rulers, tape measures, and pressure gauges
- count materials needed to do the job
- figure out how much to charge for the work done
- read blueprints and scale drawings
- convert measurements on a blueprint or scale drawing to actual size

A plumber uses math to count and measure supplies.

EXAMPLE

A plumber must be able to work with measurements. From a 72" long pipe, a plumber cuts 42". How many inches of pipe remain? To find this amount, subtract 42" from 72".

$$72 - 42 = 30$$

The plumber has 30" of pipe left over.

NOW YOU TRY IT

Practice Exercise A

1. A plumber has a pipe 26" long. The plumber cuts a piece 10-1/2" long. How long is the pipe that is left over?

2. From a pipe 6' long, a plumber cuts 30". How much pipe is left over?

3. To a measurement reading 5/8" on a ruler, a plumber had to add 3/32" before cutting a length of copper tubing. How long a piece of copper tubing should the plumber cut?

A plumber uses math to figure out how much to charge for services.

EXAMPLE

Ted is a plumber. He charges $9.75 an hour for his services. Ted spent 3 hours doing a job. To figure out the total cost of his labor, Ted multiplied his hourly rate by the number of hours he worked:

$9.75 x 3 = $29.25

The total cost of Ted's labor was $29.25.

NOW YOU TRY IT

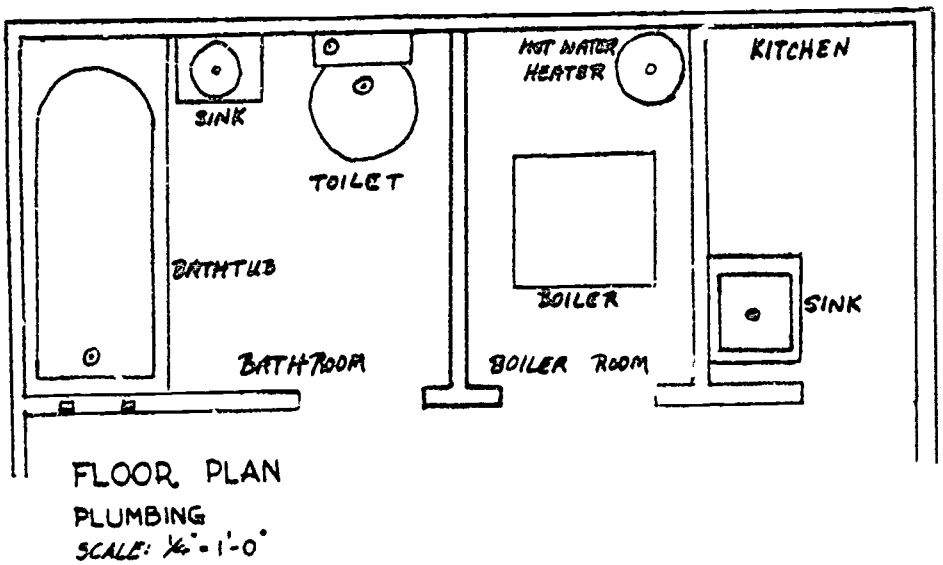
Practice Exercise B

In the chart below, you are given the charge per hour for several different plumbers. You are also given the number of hours each plumber worked. Find the total cost of labor for each plumber. Write your answers on a separate sheet of paper.

	Charge per Hour	Number of Hours Worked	Total Cost of Labor
4.	$ 7.79	8	?
5.	$11.50	5	?
6.	$ 6.89	7	?
7.	$10.00	6.5	?
8.	$ 8.75	4	?
9.	$12.62	2	?

A plumber uses math to convert scale measurements to actual measurements.

EXAMPLE



The scale of the drawing above is 1/4" = 1'. On the scale drawing, the distance from the bathroom sink to the hot water heater is 3". What is the actual distance? To find the actual length, multiply the scale measurement by the number of scale units in the unit of actual measure.

$$3 \times 4 = 12$$

The actual distance from the bathroom sink to the hot water heater is 12 feet.

NOW YOU TRY IT

Practice Exercise C

The chart below is a conversion chart. In the SCALE column, you are given the scale of a drawing or blueprint. In the SCALE MEASUREMENT column, you are given the distance measured on a blueprint. Convert the scale measurement to actual size. Convert each scale measurement listed below. Write your answers on a separate sheet of paper.

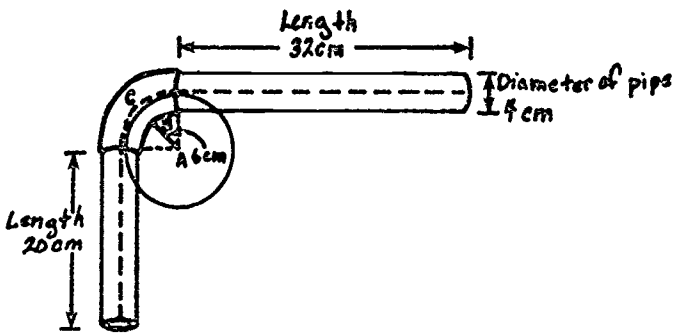
CONVERSION CHART

	Scale	Scale Measurement	Actual Size
10.	1/16" = 1'	2-3/16"	?
11.	1/8" = 1'	3-1/8"	?
12.	1/8" = 1'	2-3/4"	?
13.	1/4" = 1'	6-1/4"	?
14.	1/4" = 1'	2-1/2"	?

A plumber uses math to find the lengths of different pipes.

EXAMPLE

A plumber is replacing water pipes in a building. To order materials, the plumber must find the total length of this pipe.



To find the length of the curved section of pipe, the plumber follows these steps:

Step 1. Find one-half of the diameter of the pipe to get CB:

$$1/2 \times 4 \text{ cm} = 2 \text{ cm}$$

Step 2. Add this to AB to find the radius AC:

$$6 \text{ cm} + 2 \text{ cm} = 8 \text{ cm}$$

Step 3. Find the circumference of the circle shown using radius AC (Remember: $C = 2 \quad r$):

$$2 \times 3.14 \times 8 \text{ cm} = 50.24 \text{ cm}$$

Step 4. Find one-fourth of the circumference because the bend is 90° (one-fourth of a circle). Round the answer to the nearest centimeter.

$$1/4 \times 50.24 \text{ cm} = 12.56 \text{ cm} \quad 13 \text{ cm}$$

The length of the curved section is about 13 centimeters. Then find the total length of the pipe by adding the lengths of the three sections:

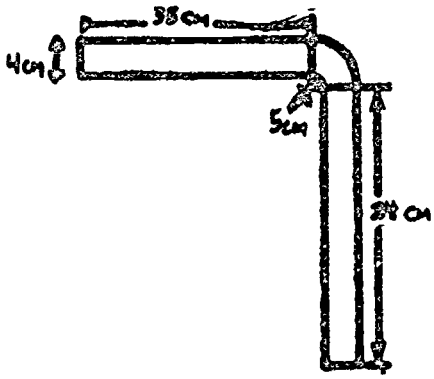
$$32 \text{ cm} + 13 \text{ cm} + 20 \text{ cm} = 65 \text{ cm}$$

The total length of the pipe is about 65 centimeters.

Practice Exercise D

Find the total length of the pipe.

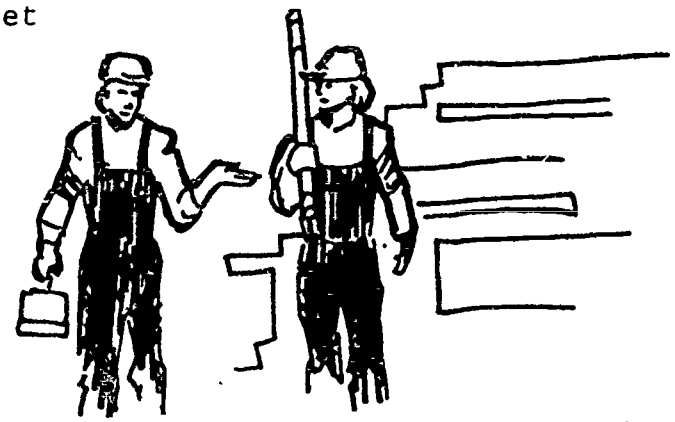
15.



WHERE DOES A PLUMBER WORK?

A plumber works mainly in residential and commercial buildings such as a person's home or a restaurant. As a plumber, you may work alone or with others. Your supervisor will tell you what to do, but you may have to do the job without supervision. You must--

- listen carefully to what your supervisor tells you
- ask your supervisor questions if you do not understand
- write down any important information you might forget



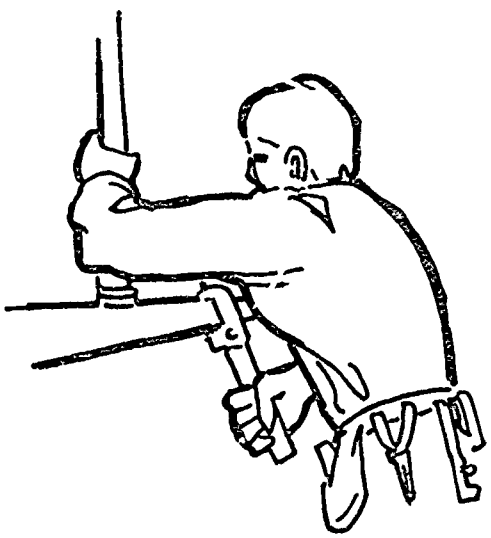
You may also have to work with others. If you work at a construction site, you will work with construction workers and other plumbers. You may work in homes, offices, or factories. You may have to work while the people who live or work at these places are present. To work well with others you must be--

- friendly and cooperative
- patient. Other people at the job site often ask plumbers about the work they are doing. You must be patient so that you can answer questions while doing your work.

A plumber uses special types of equipment to do work.

As a plumber, you use--

- hand tools such as hammers, saws, pliers, drills, and tape measures
- large and small adjustable wrenches to hold and turn pipe and pipe fittings
- torches to heat pipes and fittings so that they can be soldered together
- hand or powered pipe benders to bend pipes



- pipe and tube cutters to cut pipes
- reamers to clean burrs and rough surfaces from the inside edges of a pipe or tube after it has been cut
- chisels to cut cast iron pipe
- pipe threaders to cut threads* on the ends of pipe
- pressure gauges to measure or test pressure such as water or air pressure

DEFINITION

*Threads are the ridges on the ends of pipes. Pipe fittings may also have threads. The ridges of the pipe and the ridges of the pipe fitting may be used to screw the two together.

IF YOU ARE INTERESTED IN

THE WORK OF A PLUMBER

AND WOULD LIKE TO KNOW MORE,

READ ON

WHAT TRAINING, EDUCATION, AND EXPERIENCE DO YOU NEED TO BECOME A PLUMBER?

What do you think? Would you like to be a plumber? If you would like to be a plumber, there are some things you should know.

A plumber needs to know about plumbing and plumbing fixtures. As a plumber, you need to know about pipes and pipe systems which carry water, steam, air, or other liquids and gases. You need to know how to--

- do arithmetic
- use many kinds of equipment such as hand tools and power machines
- read blueprints and scale drawings
- work well with others
- work well without close supervision

To get a job as a plumber, you must enter either an apprenticeship program or an on-the-job training program. In an apprenticeship program, you will work on a job while being taught about being a plumber. You will go to school and be taught by master, or trained, plumbers. Apprenticeship programs may take up to five years and you are paid for the work you do.

In an on-the-job training program, you will help a plumber do the work. Your boss will show you what to do and train you on the job. Some plumbers want their helpers to get additional training at a trade or technical school.

Taking every chance to learn new skills and tasks will help you do a better job. Good math skills will also help you perform your work as a plumber.

DO YOU WANT TO DO MORE PLUMBER'S MATH?

Practice Exercise E

16. A plumber has a pipe 42" long. From it, the plumber cuts a pipe 28" long. How long is the pipe that is left over?

17. From a pipe 5' long, a plumber cuts 24". How much pipe is left over?

18. From a pipe 5'10" long, a plumber cuts 1'11". How much pipe is left over?

Practice Exercise F

In the chart below, you are given the charges per hour of several different plumbers. You are also given the number of hours each plumber worked. Find the total cost of labor for each plumber. Write your answers on a separate sheet of paper.

	Charge per Hour	Number of Hours Worked	Total Cost of Labor
19.	$ 9.75	7	?
20.	$ 8.22	5.5	?
21.	$11.17	6	?

Practice Exercise G

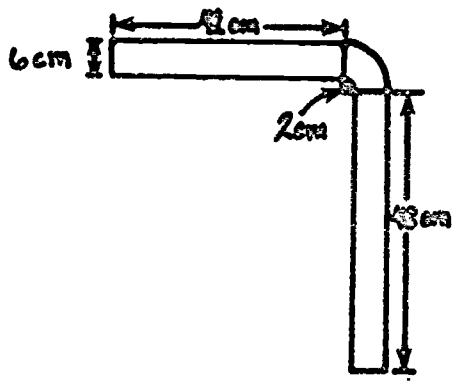
Use the scale on the left to convert each scale measurement to actual size. Write your answers on a separate sheet of paper.

	Scale	Scale Measurement	Actual Size
22.	1/16" = 1'	7/16"	?
23.	1/8" = 1'	8-3/4"	?
24.	1/4" = 1'	3-1/4"	?
25.	1/4" = 1'	5-1/2"	?

Practice Exercise H

Find the total length of the pipe.

26.



DO YOU WANT TO EXPLORE SOME MORE?

1. Go to your school library. Ask the librarian to help you find books and magazines about plumbers and what plumbers do.

2. Talk with two or three plumbers. Ask them what tasks they perform on the job. Ask them about their training and experience. Ask them what things they like and dislike about their job.

3. Call, visit, or write the plumber's union in your community. Ask them how you can get into an apprenticeship program. Ask them what courses you should take in high school to help you become a plumber.

4. Visit a job site where a plumber is working. Watch the plumber do the job. Write down the tasks you see the plumber perform. Would you like to do these tasks?

5. Talk to your high school guidance counselor. Ask your counselor if your school offers a vocational program in plumbing. If it does, talk to the instructor of the class. Ask if you may visit the class. Talk to the other students in the class and ask them why they want to be plumbers. Ask them how they use math in their plumbing classes.

6. Are you interested in other jobs which are similar to that of a plumber?

   - Pipefitters install, repair, and maintain very large pipe such as those found in large industries.
   - Steamfitters assemble and install steam or hot water systems.
   - Gas fitters install and maintain gas fittings on natural gas lines.
   - Ammonia pipefitters work on ammonia pipes in refrigeration plants.
   - Plumbing inspectors inspect plumbing to make sure that the work is done correctly. They inspect the work while it is being installed as well as when the work is completed.

   You must have good math skills to do these jobs well. Most of these workers add, subtract, multiply, and divide every day on the job.

GLOSSARY

Asterisk (*):	a symbol that tells you to look at the bottom of the page for the meaning, or definition, of the word.
Blueprint:	a picture that shows how something is to be built or put together.
Glossary:	a list of words with their meanings.
Pipe fitting:	a connector used to join pipe.
Solder:	to join metals. A plumber solders by using a heated rod to melt a soft metal. This melted metal flows between the pipe and pipe fitting and joins the two together.
Threads:	the ridges on the ends of pipes. The ridges of the pipe and the ridges of the pipe fitting may be used to screw the two together.

ANSWER SHEET

Practice Exercise A

1. 15-1/2"
2. 42"
3. 23/32"

Practice Exercise B

4. $62.32
5. $57.50
6. $48.23
7. $65.00
8. $35.00
9. $25.24

Practice Exercise C

10. 35'
11. 25'
12. 22'
13. 25'
14. 10'

Practice Exercise D

15. 70 cm

Practice Exercise E

16. 14"
17. 3'
18. 3'11"

Practice Exercise F

19. $68.25
20. $45.21
21. $67.02

Practice Exercise G

22. 7'
23. 70'
24. 13'
25. 22'

Practice Exercise H

26. 98 cm