DOCUMENT RESUME

ED 263 428   CE 042 976

TITLE   Math on the Job. Sheet-Metal Worker.
INSTITUTION   Ohio State Univ., Columbus. National Center for
                 Research in Vocational Education.
SPONS AGENCY   Office of Special Education and Rehabilitative
                 Services (ED), Washington, DC.
PUB DATE   85
GRANT   G008300003
NOTE   26p.; For the other booklets in this series, see CE
                 042 963-994.
PUB TYPE   Guides - Classroom Use - Materials (For Learner)
                 (051)

EDRS PRICE   MF01/PC02 Plus Postage.
DESCRIPTORS   Blueprints; *Career Awareness; Career Education;
                 *Disabilities; Emotional Disturbances; Enrichment
                 Activities; Equipment Utilization; Learning
                 Disabilities; *Mathematics Skills; Mental
                 Retardation; *Metal Working; Occupational
                 Information; Secondary Education; *Sheet Metal Work;
                 Skill Development; Special Education; *Work
                 Environment

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 sheet metal workers 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 sheet metal worker with which the student is likely to be
familiar. The next two sections deal with the work environment of the
typical sheet metal worker and the training, education, and
experience needed for the occupation. Exercises addressing basic math
skills used by sheet metal workers are provided. Various suggestions
are listed for students interested in further exploring the
occupation of sheet metal worker. A glossary and answer sheet
conclude the booklet. (MN)

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MATH
on the job

Sheet-Metal Worker

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  programs

MATH ON THE JOB:

SHEET METAL WORKER

MATH
# on the job

Sheet-Metal Worker

In this booklet, you can--

- ☉ find out what a sheet metal worker does

- ☉ see how a sheet metal worker uses math

- ☉ get a chance to use math as a sheet metal worker

- ☉ find out the types of things a sheet metal worker needs to know

- ☉ find out what courses, training, and experience you need to become a sheet metal worker

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.
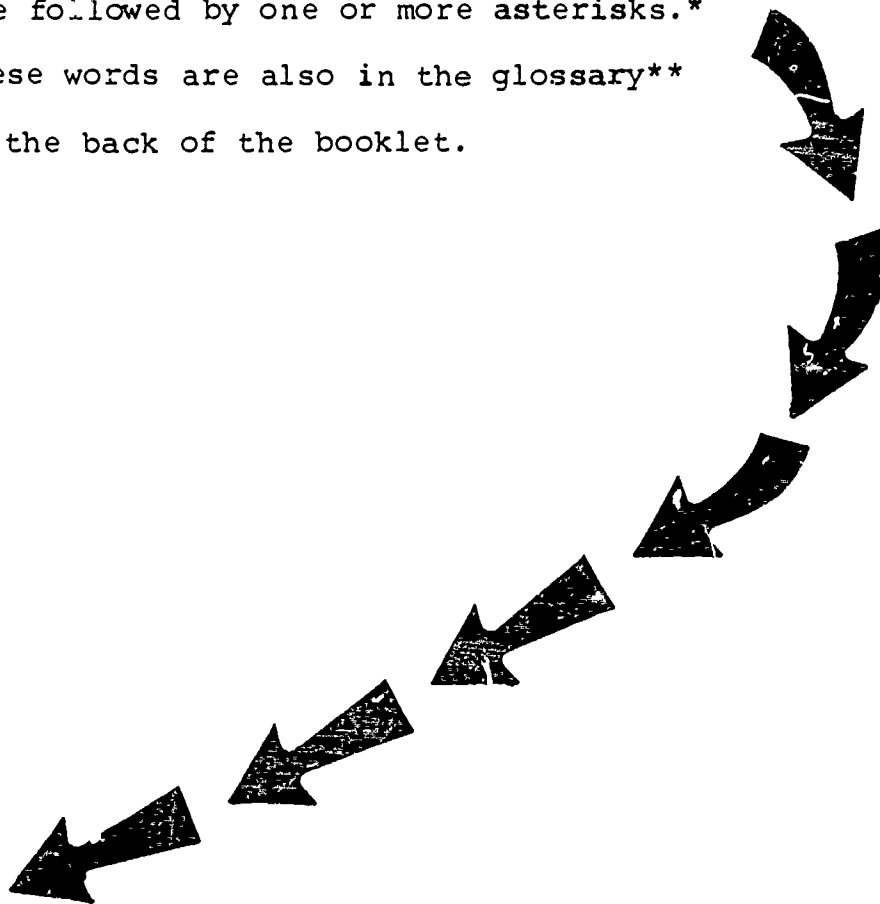
—————————— DEFINITIONS ——————————

*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 put metal siding or roofing on a house?

- watched someone install a furnace or air-conditioning system?

- helped someone put up metal kitchen cabinets?

- helped someone repair a leaky rainspout*?

If you have, then you have some idea about the work of a sheet metal worker. This booklet will help you learn about the work of a sheet metal worker and how math is important to do the job.
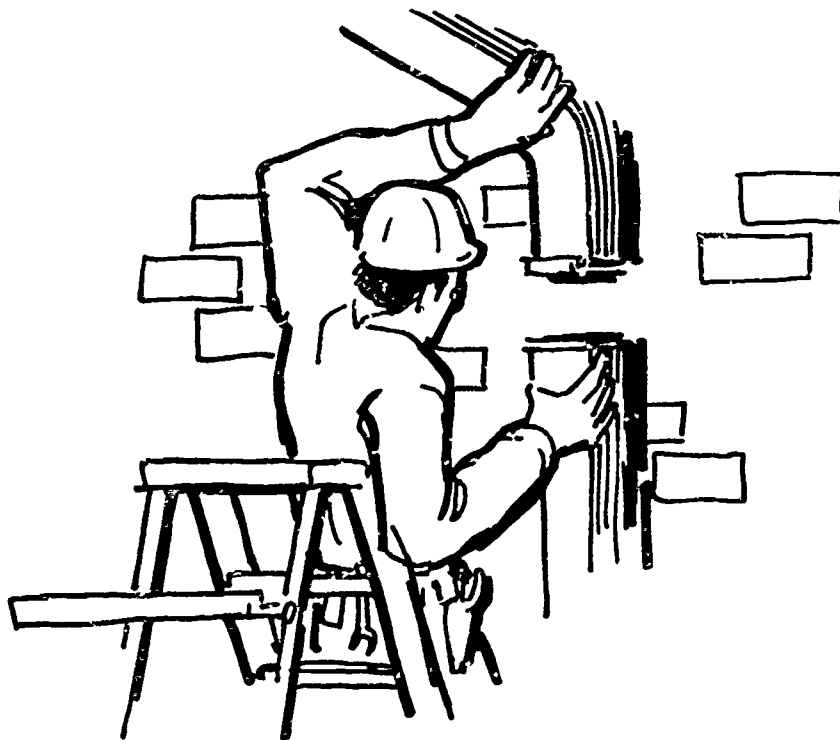
_____DEFINITION_____

*A rainspout is a pipe that carries rainwater from the gutter of a building to the ground.

WHAT DOES A SHEET METAL WORKER DO?

Most sheet metal workers make, install, repair, and
alter* ducts** used for heating, ventilating, and
air-conditioning systems. How does a sheet metal worker
make and install ductwork? As a sheet metal worker, you--

- read a blueprint*** or drawing of the sheet
  metal product to be made

- pick out the size and type of sheet metal to be
  used

- use a blueprint or drawing to make measurements
  and determine angles

- mark measurements and angles on a sheet of metal.
  This is the pattern of the product to be made.

- cut out the pattern with hand or power shears

- drill or punch holes where needed

- assemble the parts by welding, soldering, bolting,
  or riveting them together

- install the completed unit by welding, bolting,
  screwing, or nailing it into place

_____DEFINITIONS_____

*To alter something means to make it different;
to change something.

**A <u>duct</u> is a pipe, tube, or channel that carries or
conveys something such as heated air or wiring. In a
house, a duct may carry heated air from the furnace to
different rooms of the house. A duct may also carry
wiring from the basement power supply room to each
room of the house.

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

Sheet metal workers use math in their work every day. As a sheet metal worker, you--

- count, add, subtract, multiply, and divide

- use whole numbers, decimals, and fractions

- read measuring instruments such as rulers, tape measures, and micrometers

- read blueprints and scale drawings

- convert measurements on a blueprint or scale drawing to actual size
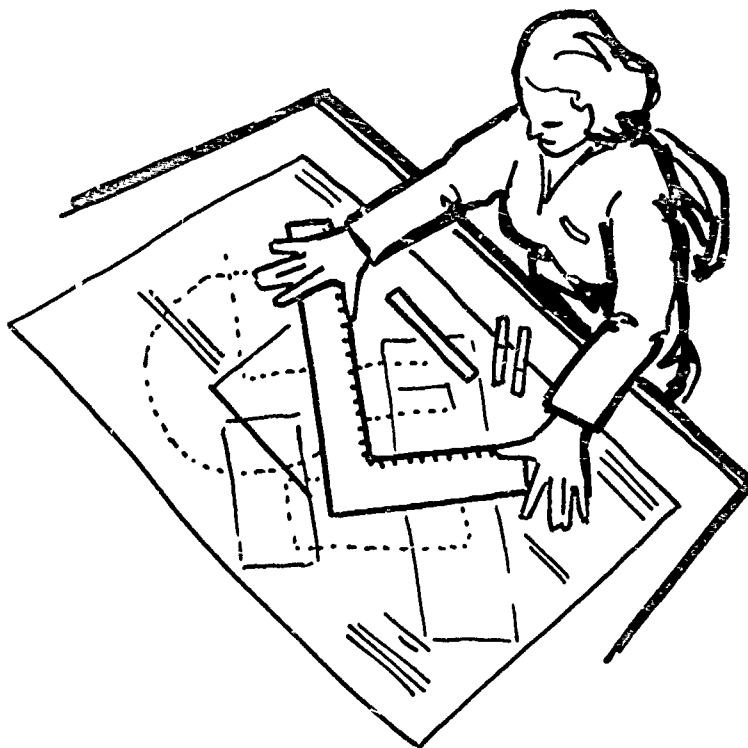
A sheet metal worker uses math to measure length.

EXAMPLE

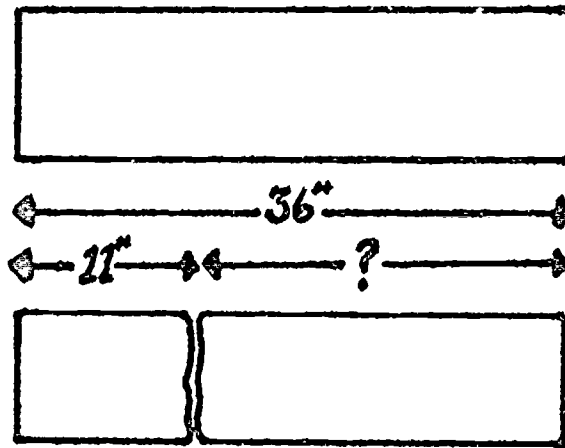A sheet metal worker must be able to work with measurement. From a sheet of metal 36" long, a sheet metal worker cut 13". How many inches of sheet metal remained? To find this amount, you must subtract 13" from 36".

The sheet metal worker had 23" of sheet metal left over.

NOW YOU TRY IT

Practice Exercise A

1. A sheet metal worker has a 43" long sheet of metal. The assignment was to cut a piece 14" long. How long was the sheet of metal that was left over?

2. From a piece of sheet metal 57" long, a sheet metal worker cut 28". How long was the sheet of metal that was left over?

3. A sheet metal worker has two pieces of sheet metal. One is 6'5" long and the other is 5'8". How much sheet metal is there altogether?

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A sheet metal worker uses math to figure out the cost of materials.

EXAMPLE

The cost of one box of machine screws is $0.97. If a sheet metal worker orders 32 boxes, what is the cost? To find the cost, multiply the cost per box by the number of boxes:

$$\$0.97 \times 32 = \$31.04$$

The cost for machine screws is $31.04.

NOW YOU TRY IT

Practice Exercise B

4. A sheet metal worker orders 75 boxes of machine screws at $0.97 a box. What is the cost?

5. If the cost of one box of rivets is $1.12, what is the cost of 22 boxes?

6. A sheet metal worker orders 15 square feet of sheet metal at $0.37 per square foot. What is the cost?

A sheet metal worker uses math to calculate thickness.

EXAMPLE

If one sheet of metal is 0.4 centimeter (cm) thick,
how thick is a stack of sheet metal with 10 sheets?
To find this amount, multiply the thickness of one
sheet by the number of sheets in the stack:

$$0.4 \text{ cm} \times 10 = 4.0 \text{ cm}$$

The stack of sheet metal is 4.0 centimeters (cm) thick.

NOW YOU TRY IT

Practice Exercise C

7. If one sheet of metal is 0.3 cm thick, how thick
   is a stack of sheet metal with 12 sheets?

8. One sheet of metal is 0.7 cm thick. How thick is
   a stack with 436 sheets?

9. A stack of sheet metal contains 899 sheets. Each
   sheet is 0.4 cm thick. How thick is the stack?

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A sheet metal worker uses math to keep track of production.

EXAMPLE

Some sheet metal workers are paid by the number of pieces of metal parts on which they worked. This is called piece work. To find their gross income, these employees multiply the rate per piece by the total number of pieces on which they worked.

Pieces worked on x Rate per piece = Gross income

John Beagle worked on a total of 488 pieces in one week. If the rate per piece is $0.34, what was John's gross income for that week?

To find the amount, multiply the number of pieces worked on by the rate per piece:

488 x .34 = $165.92

John's gross income for that week was $165.92.

↓ NOW YOU TRY IT

Practice Exercise D

Find the gross income for each employee listed below.

Employee Name	Pieces Worked on	Rate per Piece	Gross Income
10. Julie Washington	50ɔ	.34	?
11. George Simms	467	.34	?
12. Ann Peters	282	.65	?
13. David Cobb	411	.36	?
14. Harry Draper	157	.98	?

WHERE DOES A SHEET METAL WORKER WORK?

As a sheet metal worker, you may work in a sheet metal shop or on a construction site. In a sheet metal shop, you will work with other sheet metal workers. You will have a shop supervisor who shows you what to do. On a construction site, you will work with construction workers as well as other sheet metal workers. You will have a site supervisor who shows you what to do. At both the sheet metal shop and construction site, your supervisor will check your work.

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To be a sheet metal worker, you should be able to work well under different conditions.

As a sheet metal worker, you may work for one of several firms. All of these firms are involved in the making and installing of heating, ventilating, and air-conditioning systems. You may work for a--

- general contractor who builds residential, commercial, or industrial buildings

- roofing, sheet metal, or air-conditioning and heating contractor

- government agency or business that does its own construction and alteration work

Sheet metal workers use special types of equipment to perform their work. As a sheet metal worker, you use--

- tape measures, rulers, and micrometers* for measuring sheet metal and laying out the work

- sheet and plate gauges** for measuring the thickness and weight of sheet metal

- hand shears, hack saws, and power saws for cutting

- specially designed, heavy steel presses and shears for cutting, bending, and shaping

- bolts, cement, rivets, and solder*** for fastening seams and joints together

- hammers, shears, and drills for making parts by hand at the worksite and for altering parts made in the shop

Micrometer

Solder
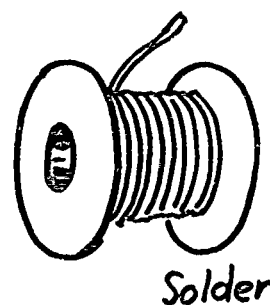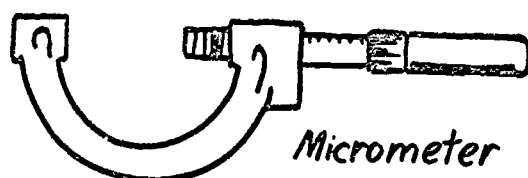
_____DEFINITIONS_____

*A <u>micrometer</u> is a measuring instrument used to make small, precise measurements.

**A <u>gauge</u> is a measuring instrument used to measure thickness and weight. Thickness is measured in units called gauges. For example, a piece of sheet metal measuring 1/32" in thickness is called 22 gauge sheet metal.

***<u>Solder</u> is a soft metal. A torch is used to melt the solder. This melted solder flows between the joints and fastens them together.

IF YOU ARE INTERESTED IN

THE WORK OF A SHEET METAL WORKER

AND WOULD LIKE TO KNOW MORE,

READ ON

WHAT TRAINING, EDUCATION, AND
EXPERIENCE DO YOU NEED
TO BECOME A SHEET METAL WORKER?

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

To get a job as a sheet metal worker, 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

The best way to learn these things is to take courses
in metal shop, mechanical drawing, and mathematics at your
high school.

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To be a sheet metal worker, you should be a high
school graduate. After high school, you must enter either
an apprenticeship program or an on-the-job training
program. In an apprenticeship program, you will work on
different sheet metal jobs totalling 8,000 hours of work
experience. At the same time, you will attend classes.
In these classes, you will learn about sheet metal workers
and the work they do. Apprenticeship programs may take up
to four years and you are paid for the work you do.
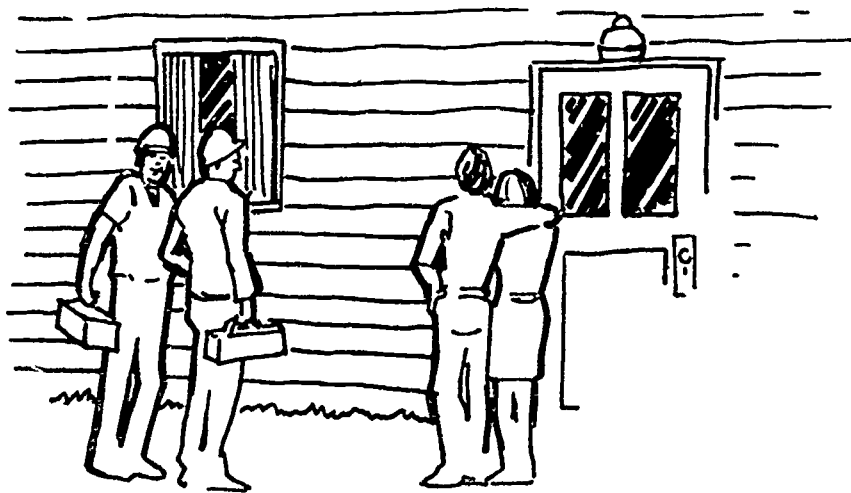
In an on-the-job training program, you will help
experienced sheet metal workers do their work. They will
show you what to do and train you on the job. You may
have to get additional training at a trade or technical
school. On-the-job training programs may take up to five
years, and you are paid for the work you do.

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 sheet metal worker.

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Practice Exercise E

13. A sheet metal worker has a sheet of metal 81"
    long. The assignment is to cut a piece 39" long.
    How long is the sheet of metal that is left over?

14. From a piece of metal 3'10" long, a sheet metal
    worker cut 2'8". How long was the sheet of metal
    that was left over?

15. From a piece of sheet metal 2'8" long, a sheet
    metal worker cut 1'9". How long was the sheet of
    metal that was left over?

Practice Exercise F

16. A sheet metal worker orders 89 boxes of machine
    screws at $0.76 a box. What is the cost?

17. If the cost of one box of rivets is $1.26, what is
    the cost of 19 boxes?

18. A sheet metal worker orders 34 square feet of
    sheet metal at $0.55 per square foot. What is the
    cost?

Practice Exercise G

19. If one sheet of metal is 0.4 cm thick, how thick is a stack of sheet metal with 13 sheets?

20. One sheet of metal is 0.9 cm thick. How thick is a stack with 576 sheets?

21. A stack of sheet metal contains 82 sheets. Each sheet is 0.3 cm thick. How thick is the stack?

Practice Exercise H

Find the gross income for each employee listed below. Use the formula given.

Pieces worked on x Rate per piece = Gross income

Employee Name	Pieces Worked on	Rate per Piece	Gross Income
22. Rita Rivers	250	.57	?
23. Chris Turner	478	.32	?
24. Carlos Sinclair	422	.43	?
25. Robert Rydell	297	.75	?

DO YOU WANT TO EXPLORE SOME MORE?

1. Visit a sheet metal shop. Watch the sheet metal
   workers do their jobs. Write down the tasks you see
   them perform. Would you like to do these tasks?

2. Visit a construction site. Watch the sheet metal
   workers do their jobs. Write down the tasks you see
   them perform. Would you like to do these tasks?

3. Talk with two or three sheet metal workers. 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.

4. Call, write, or visit the union for sheet metal
   workers in your community. Ask how you can get into
   an apprenticeship program. Ask what courses you
   should take in high school to help you become a sheet
   metal worker.

5. Talk to your high school counselor. Ask if your
   school offers a vocational program in sheet metal
   work. 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. Ask them why they want
   to be sheet metal workers. Ask them how they use math
   in their sheet metal classes.

5. Are you interested in other jobs which are like sheet
   metal work?

   ● Coppersmiths make, install, and repair equipment
     and materials made of copper

   ● Sheet metal lay out workers find and mark
     dimensions and reference lines on sheet metal

   ● Metal roofers install and repair metal roofs

   ● Metal products fabricators make and assemble metal
     products such as windows, doors, and awnings

   ● Metal patternmakers lay out, drill, grind, fit,
     and assemble castings and parts to make patterns
     for metal products

   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

Alter: to make something different; to change something.

Asterisk (*): a mark 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.

Duct: a pipe, tube, or channel that carries or conveys something such as heated air or wiring.

Gauge: a measuring instrument used to measure thickness and weight. Thickness is measured in units called gauges. For example, a piece of sheet metal measuring 1/32" in thickness is called 22 gauge sheet metal.

Glossary: a list of words with their meanings.

Micrometer: a measuring instrument used to make small, precise measurements.

Rainspout: a pipe that carries rainwater from the gutter of a building to the ground.

Solder: a soft metal. A torch is used to melt the solder. This melted solder flows between the joints and fastens them together.

ANSWER SHEET

Practice Exercise A

1. 29"

2. 29"

3. 12'1"

Practice Exercise B

4. $72.75

5. $24.64

6. $5.55

Practice Exercise C

7. 3.6 cm

8. 305.2 cm

9. 359.6 cm

Practice Exercise D

10. $171.02

11. $158.78

12. $183.30

13. $147.96

14. $153.86

Practice Exercise E

13. 42"

14. 1'2"

15. 11"

Practice Exercise F

16. $67.64

17. $23.94

18. $18.70

Practice Exercise G

19. 5.2 cm

20. 518.4 cm

21. 24.6 cm

Practice Exercise H

22. $142.50

23. $152.96

24. $181.46

25. $222.75