

## LAYOUT TASKS



Carpenters Training Committee  
for Northern California

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Carpenters Training Committee for Northern California (CTCNC)

# MILLWRIGHT APPRENTICESHIP PROGRAM

## Course of Instruction

Year	Class#	Class Title (All classes - 36 hours in length)
<b>1</b>	856	*Millwright 16 Hour Safety & Millwright Tool Skills
	857	The Millwright Apprentice & The Trade
	858	Math Applications - *Fall Protection
	859	*Rigging
<b>2</b>	860	Materials of Construction
	861	Layout Procedures - *Fork Lift (Industrial & Rough Terrain)
	862	Precision Optical Instrument - *GE Turbine Familiarization/ Hytorc Bolting - *Human Performance
	863	Blueprint Reading - *Aerial Lift
<b>3</b>	864	Cutting & Welding 1
	865	Welding 2 – SMAW
	866	Monorails
	867	Conveyors
<b>4</b>	868	Installation of Machinery
	869	Maintenance of Machinery
	870	Precision Tools & Shaft Alignment
	871	Turbines
	872	Welding 3 - Certification

\* Qualification or Certification requirement

All Millwright classes taught in Pleasanton only

### Form 8-M Course of Instruction

JMc/lr: 08/02/99/Opeiu3/af-cio/211/MSW rev: 11.10.09 sls

## CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

## Manipulative Lesson Plan

TOPIC: Circle Layout

EXERCISE:

- 1 ERECT A PERPENDICULAR FROM A LINE
- 2 CONSTRUCT A HEXAGON
- 3 CONSTRUCT AN OCTOGON
- 4 BISECT A  $90^\circ$  ANGLE THEN  
BISECT A  $45^\circ$  ANGLE
- 5 CONSTRUCT A  $30^\circ$  ANGLE WITHOUT USING A PROTRACTOR
- 6 MAP OUT 3, EQUAL DISTANT POINTS ON THE CIRCUMFERENCES  
OF 1 SEPARATE CIRCLE

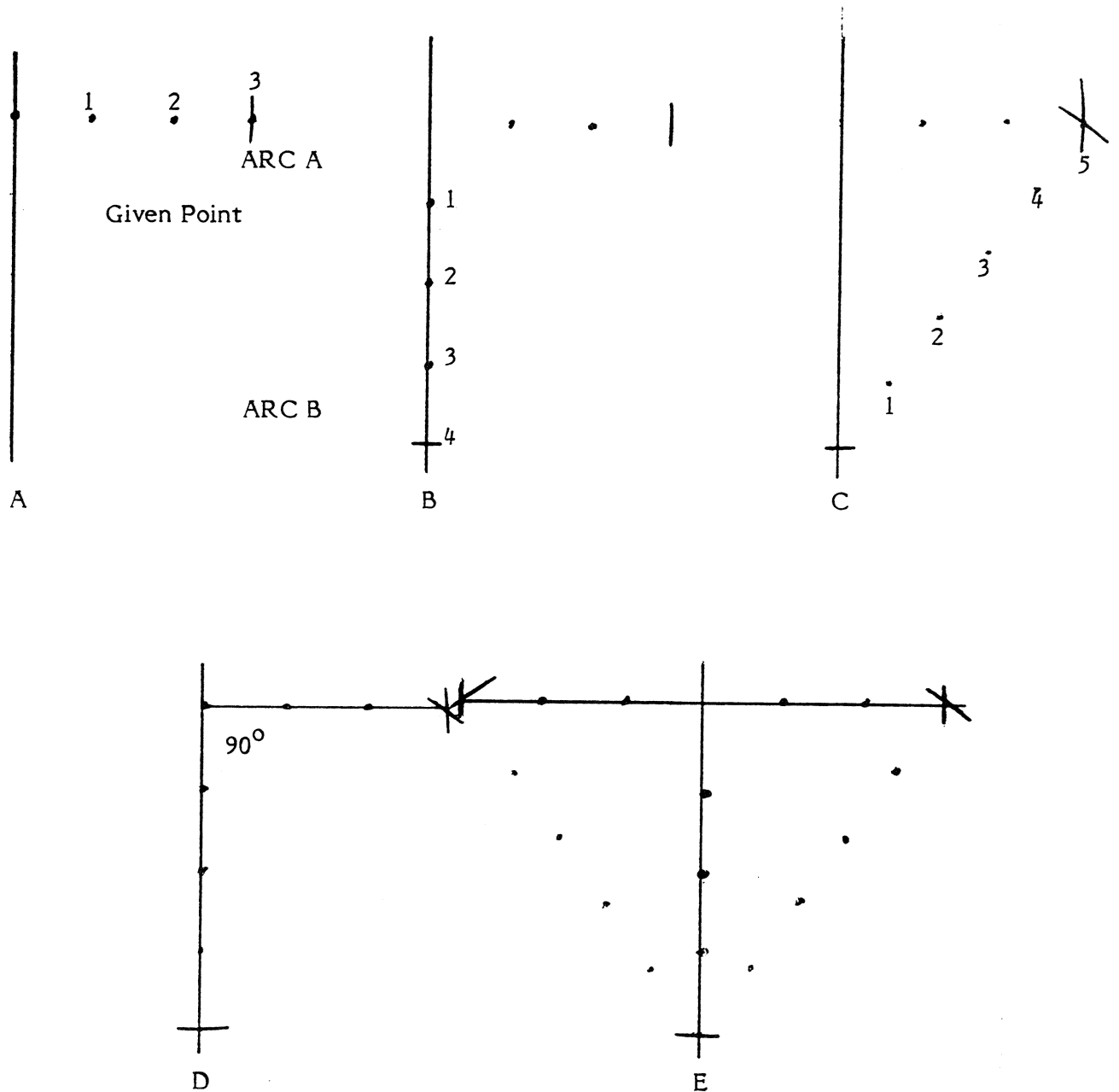


CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

Manipulative Lesson Plan

RESOURCE SHEET

TOPIC: Baselines for Machinery Location



See Figure 25  
Layout Unit XI, page 17

RESOURCE SHEET (Cont'd)RULES FOR ERECTING A PERPENDICULAR (At a given point on a line)

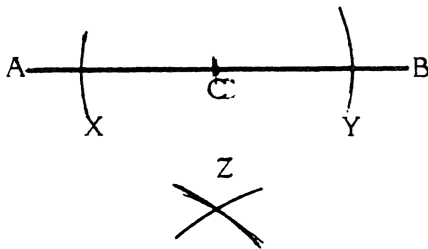
Two lines are perpendicular when they form an angle of 90 degree with each other.

Steps are as follows:

1. Swing equal arcs from the given point to intersect the given line.
2. Increase the size of the radius and swing equal arcs on the side of the line on which the perpendicular is to be erected. Use the intersecting points on the given line as centers.
3. Draw a line from the point at which the two arcs intersect to the given point.
4. This line is perpendicular at the given point to the given line.

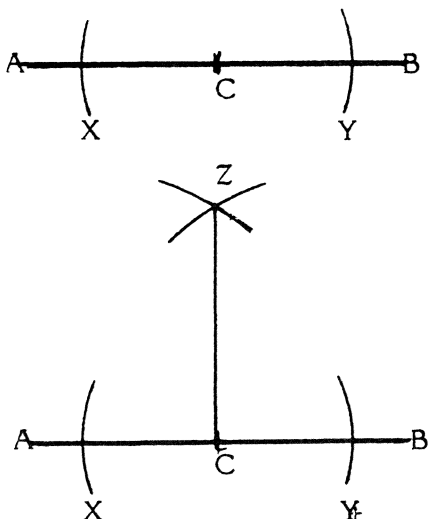
EXAMPLE:

Erect a perpendicular on line A-B at C.



## STEP ONE

Draw equal arcs from C (X + Y)



## STEP TWO

Swing equal arcs from X + Y, intersecting at Z

## STEP THREE

Connect C-Z

Line C-Z is perpendicular to line A-B at point C

## CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

## Manipulative Lesson Plan

RESOURCE SHEET

TOPIC: Baselines for Machinery Location

STEP BY STEP LAYOUT INSTRUCTIONS

The area where machinery is installed in a plant, factory, etc., is commonly termed the "field".

The field is where the primary work function of millwrights are performed. The primary work functions being the installation of machinery and equipment.

Drawings stating the locations or positions of mechanical objects usually make reference to points or surfaces. The points may be walls, floors, columns or other existing machines or equipment. From the drawing reference points, the millwright layout processes begin.

For the purpose of this lesson, using the (field) floor, the procedure for laying out the baselines using the 3-4-5 method is as follows:

1. Select a suitable measuring unit: 3-4-5 or multiples of same, (6-8-10, 12-16-20). The largest practical unit, the less minor errors will affect its accuracy.
2. Strike the first line on the floor as in Fig. 25A, and establish the given point.
3. Measure three units from the given point at approximately right angle from the straight line and swing arc A, in Fig. 25A.
4. Measure four units from the given point along the straight line and locate point B, in Fig. 25B.
5. Measure five units from point B and locate point C on arc line A, as in Fig. 25C.
6. Construct a line from point C through the given point on the initial line. It will be perpendicular to, or at right angles, to the initial straight line as in Fig. 25D.
7. If needed and conditions permit, the right angle lines have been established, the machine can be installed, either using the lines as centerlines for positioning the machine, or taking additional measurements from the baselines to align the machine.

## CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

## Manipulative Lesson Plan

APPRENTICE'S PACKET

TOPIC: Baselines for Machinery Location

To The Apprentice:

When installing machinery, it is important that Millwright Apprentices realize the necessity for following the proper sequences in setting and squaring of machinery. The sequences are selected to give the mechanic the most effective, timesaving machinery layouts. This lesson is one of the most important of the whole series, because it is the first accurate demand made on the Millwright when setting and aligning machinery.

Objectives: Upon completion of this lesson, the Apprentice will be able to:

1. Establish a baseline and erect a perpendicular at a point on the baseline.
2. Square the right triangle and establish a centerline parallel to existing centerlines.
3. Square and align all equipment in any given plane.
4. Gain confidence in his ability to carry out an accurate series of procedures.

References:

Carpentry Instructional Material for Millwrights  
Unit II, Mathematics, page 29  
Unit IV, Installation and Maintenance of Machinery, page 10  
Unit XI, Layout Tasks, pages 16 & 17

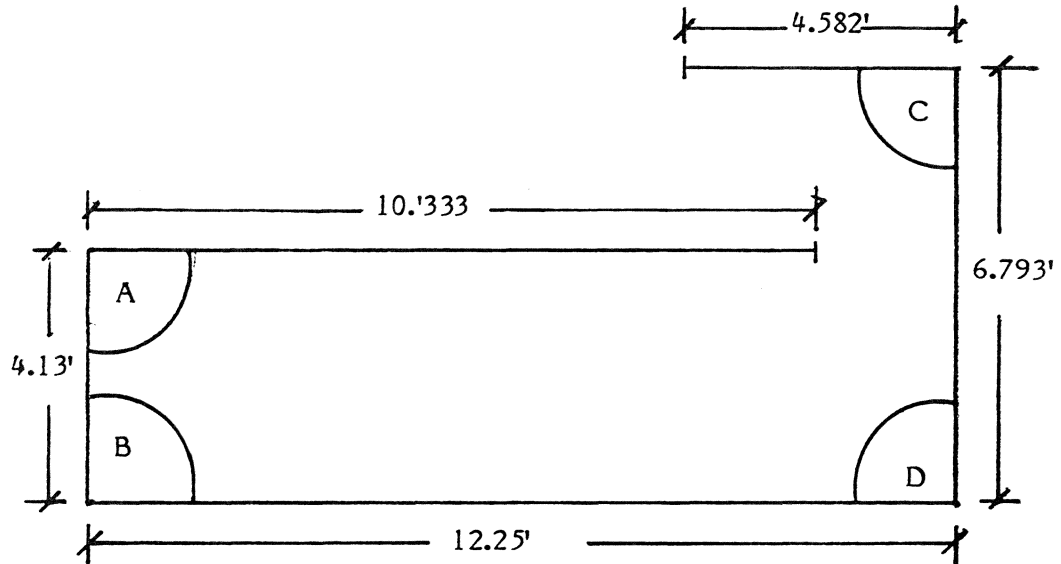
Equipment and/or Tools Needed: (Per groups of four (4) students)

1. Apprentices who have chalk boxes in their tool boxes can assist the instructor by volunteering to bring them to class for use.
2. The school will provide a bucket and mop for clean up, plus rags.
3. The instructor has the rest of the necessary equipment at the school.
4. The apprentices will bring a tape measure.

Materials Needed: (To be arranged for by the instructor)

1. One (1) box of classroom chalk.



**CLASS EXERCISE****INSTRUCTIONS:**

1. Layout to be done on concrete floor.
2. All angles  $90^{\circ}$ .
3. Angle A + B are to be formed using the 3-4-5 method.
4. Angles C + D are to be formed using the swing-arc method.



## CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

## Manipulative Lesson Plan

APPRENTICE PACKET

TOPIC: Floor Layout

To The Apprentice:

On most construction sites, the millwright is required to layout machinery or supports from a given blueprint. This floor layout lesson is designed to challenge your ability to construct the given shapes with some of the important dimensions missing.

Objectives: Upon completion of this lesson, the Apprentice should be able to:

1. Understand a blueprint of a required floor layout.
2. Transfer dimensions from a blueprint to construct the layout.
3. Layout an accurate  $90^{\circ}$  angle using only a marker and two tape measures.
4. Compute the final total perimeter and area required.

References:

U.B.C. & J., Unit XI, Layout Tasks, read pages 32-35.

Millwrights and Mechanics Guide (Audel), read pages 43-50.

Equipment and/or Tools Needed: To be supplied by each apprentice

1. One (1) tape measure 16' or larger
2. One (1) chalk box w/75' string

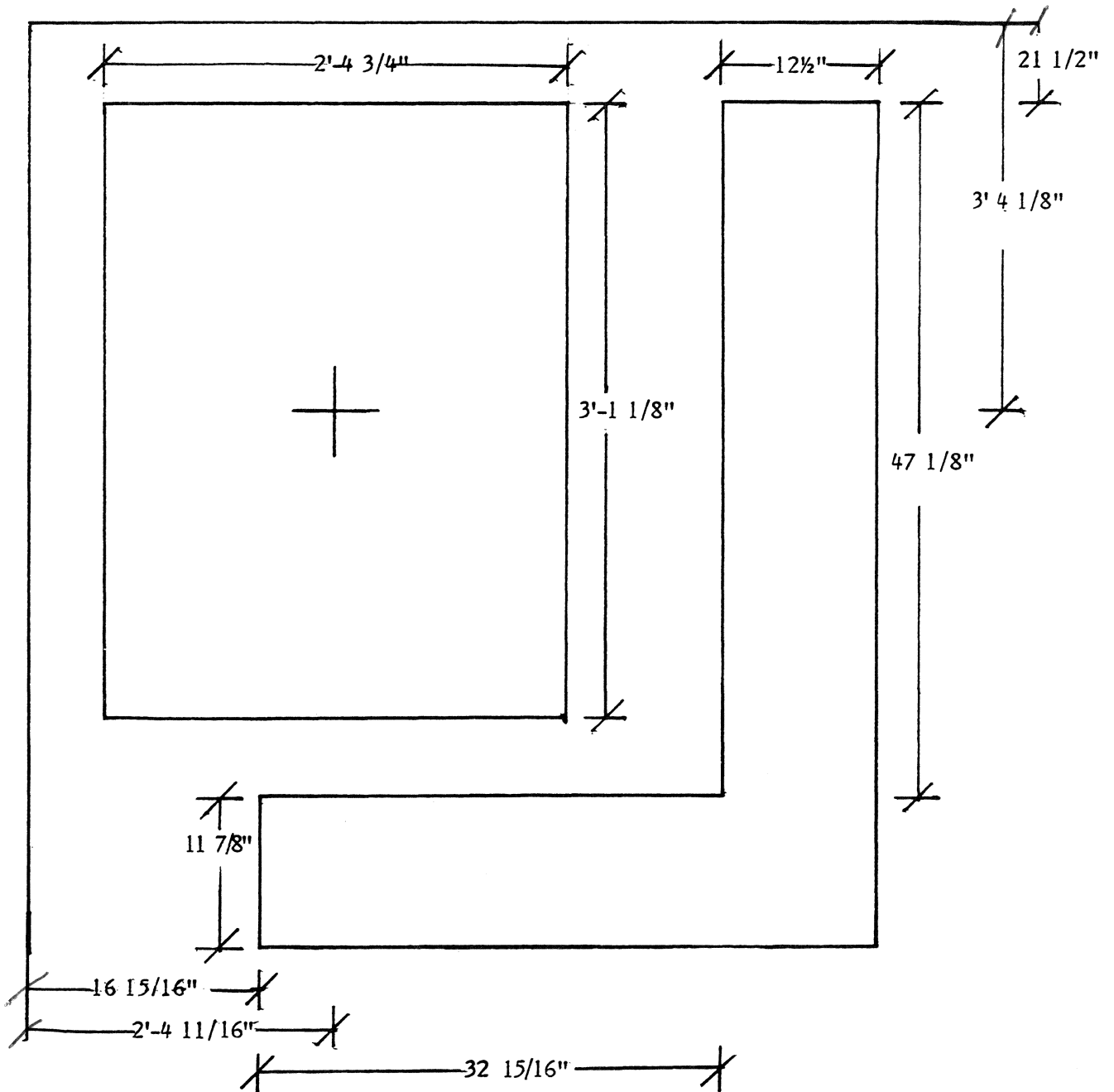


Manipulative Lesson Plan

RESOURCE SHEET

TOPIC: Floor Layout

DIRECTIONS: Layout entire plan -





## CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

## Manipulative Lesson Plan

APPRENTICE PACKET

TOPIC: Layout Using Perpendicular Distance Multipliers

To The Apprentice:

For many on the job situations, the millwright is called upon to layout angles on the floor for large machinery. Where the size of the layout would make using a small protractor impractical, a table of "Perpendicular Distance Multipliers" has been developed. When used properly, a great degree of accuracy in laying out of angles can be obtained.

Objectives: Upon completion of this lesson, you should be able to:

1. Recognize the need for an accurate method of laying out large angles on the floor.
2. Understand the principles involved and how to use a table of perpendicular distance multipliers.
3. Layout accurately any angle using the table.

References:

Carpentry Instructional Manual for the Millwright - United Brotherhood of Carpenters, Unit XI, Layout Tasks, read pages 19-20.

Equipment and/or Tools Needed: Provided by each student

1. 1 - chalk box with 75' string
2. 1 - pencil
3. 1 - tape measure (16' or longer)
4. 1 - table of multipliers (in packet)

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**CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.**

## Manipulative Lesson Plan

TOPIC: Layout Using Perpendicular Distance Multipliers

**CLASSROOM EXERCISE FOR PERPENDICULAR DISTANCE MULTIPLIERS**

## LAYOUT LEGS FOR ANGLES:

1. On a line 4" long a  $32^{\circ}$  Angle
2. On a line 6" long a  $44^{\circ}$  Angle
3. On a line 3" long a  $10^{\circ}$  Angle
4. On a line 5" long a  $19^{\circ}$  Angle
5. On a line 3" long a  $62^{\circ}$  Angle



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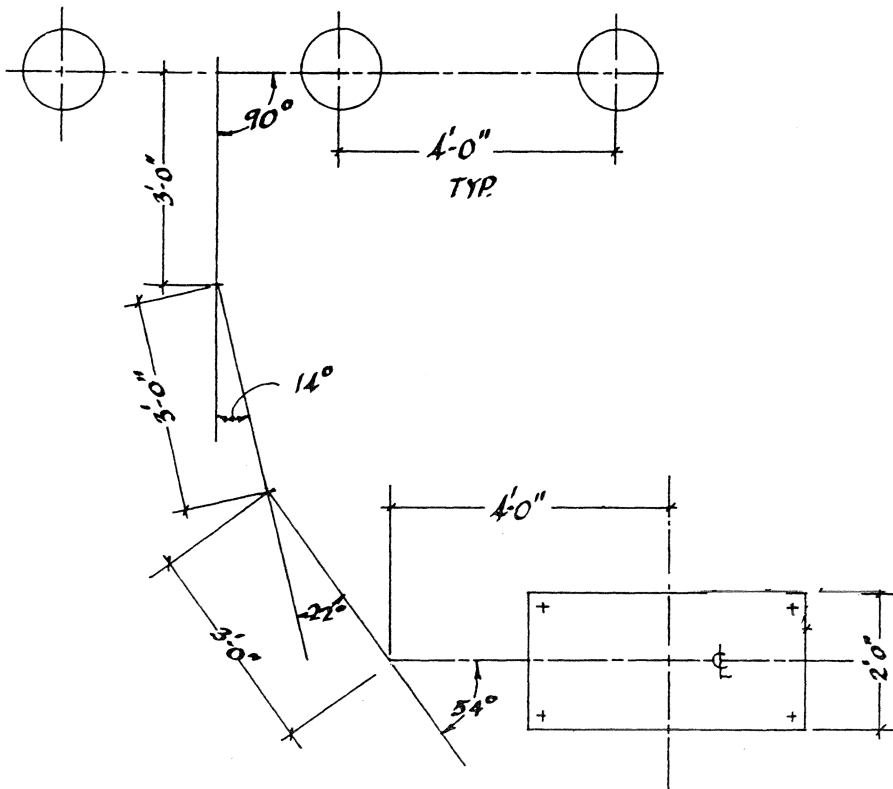
## Manipulative Lesson Plan

MANIPULATIVE EXERCISETOPIC: Layout Using Perpendicular Distance Multipliers

Following the procedure listed on pages 19-20 in your text, complete the following layout.

## PERPENDICULAR DISTANCE MULTIPLIERS

Angle	Multiplier	Angle	Multiplier	Angle	Multiplier
1	.18	16	2.87	31	6.01
2	.35	17	3.06	32	6.25
3	.52	18	3.25	33	6.49
4	.70	19	3.44	34	6.75
5	.88	20	3.64	35	7.00
6	1.05	21	3.84	36	7.27
7	1.23	22	4.04	37	7.54
8	1.41	23	4.25	38	7.81
9	1.58	24	4.45	39	8.10
10	1.76	25	4.66	40	8.39
11	1.94	26	4.88	41	8.69
12	2.13	27	5.10	42	9.00
13	2.31	28	5.32	43	9.33
14	2.49	29	5.54	44	9.66
15	2.68	30	5.77	45	10.00





GROUP LAYOUT TASK

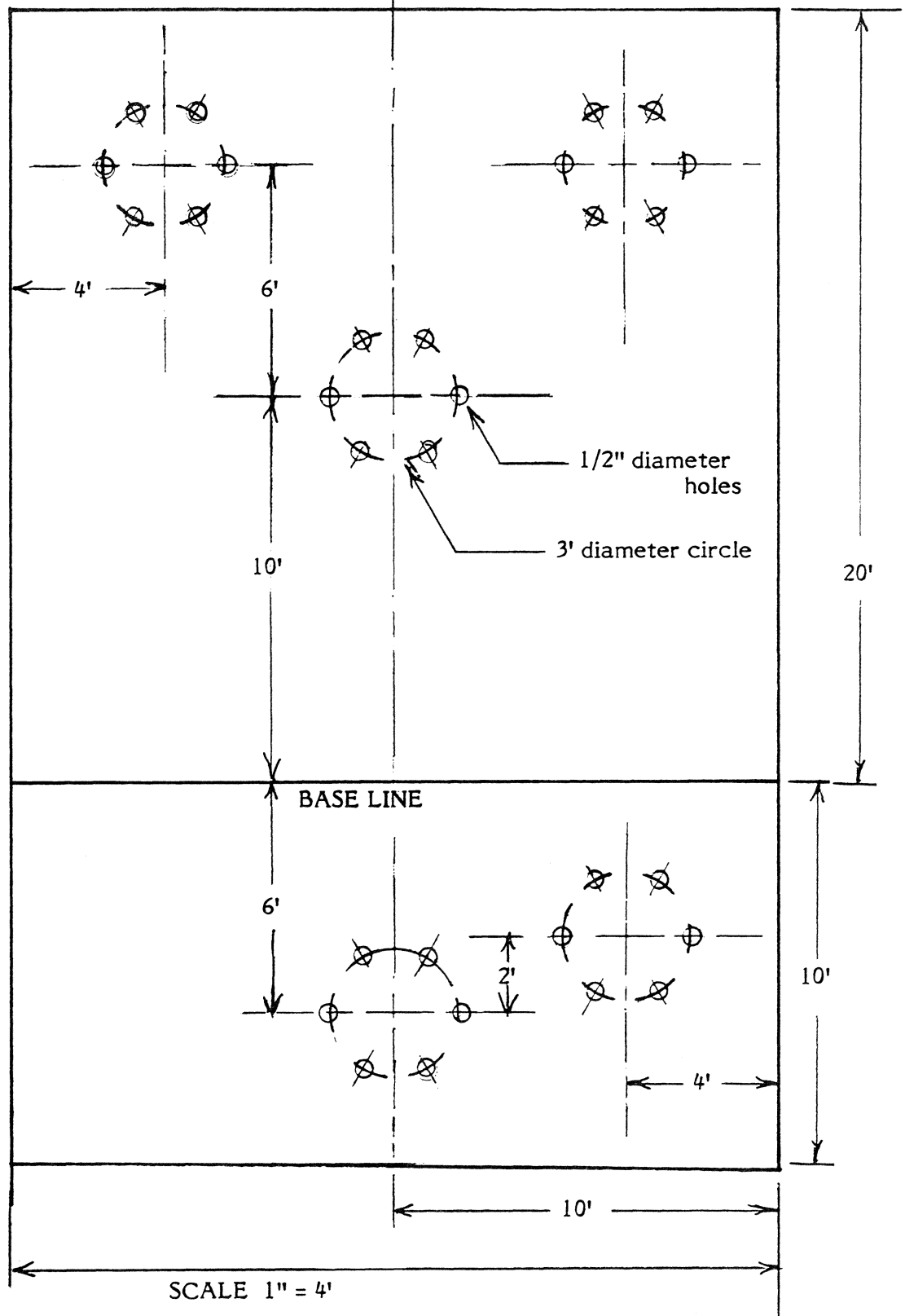


Notes to Students

- 1) Use string and pencil method to layout 3' diameter circles (use nail to hold center point)
- 2) Divide 3' diameter circles into 60° sectors using the framing square method.

Note: anchor bolt holes will not be drilled in shop floor

- 4) If a dimension is not shown, use scale to determine dimension.



## CARPENTERS 46 NORTHERN CALIFORNIA COUNTIES J.A.T.C.

## Manipulative Lesson Plan

APPRENTICE'S PACKET

TOPIC: Layout for Drilling Holes

To The Apprentice:

When laying out holes in a plate, the apprentice must appreciate the importance of accuracy. This can only be attained through care in preliminary measurement for squareness and the trueness of the sides from which the measurements are taken. Good plate preparation aids in sharper, clearer scribe lines.

Objectives: Upon completion of this lesson, the Apprentice will be able to:

1. Determine the squareness and trueness of the edges of a steel plate.
2. Prepare the surface of the plate for layout.
3. Identify locations of holes accurately and mark as such.

References:

Carpentry Instructional Material for the Millwright, Unit XI Layout Tasks, Apprenticeship and Training Department, United Brotherhood of Carpenters and Joiners of America, Washington, D.C., pages 3-6.

Equipment and/or Tools Needed: To be furnished by Apprentices

1. One (1) metal scribe
2. One (1) two foot framing square
3. One (1) wire brush
4. One (1) tape measure (any size)

Materials Needed: (To be arranged for by the instructor)

1. One (1) steel plate per student (1/16" x 10½" x 9¼")
2. One (1) can blueing (with brush) per four (4) students

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