Problems for Engineering Graphics Communication

and Technical

Graphics Communication

Revised Edition

PROBLEMS FOR ENGINEERING GRAPHICS COMMUNICATION AND TECHNICAL GRAPHICS COMMUNICATION

Revised Edition

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**PROBLEMS FOR ENGINEERING GRAPHICS
COMMUNICATION AND TECHNICAL GRAPHICS
COMMUNICATION Revised Edition**

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Preface

Problems for Engineering Graphics Communication and Technical Graphics Communication, have been designed as a practical supplement for *Engineering Graphics Communication* and *Technical Graphics Communication.* But these problem books have been designed to be used with any engineering or technical graphics textbook.

Instructions are given with each page, but further instructions may need to be given by the instructor for individual problems. Many of the problems can be solved by sketching or through of computer-aided-design (CAD) or they can be solved by traditional methods.

The problems have been designed so that they make the students reference the textbook and the problems force the students to use problem solving techniques to determine the solution. The problems are designed to cover the basic principles of engineering and technical graphics but the workbook is not designed as a stand alone book. The workbooks include problems for sectioning, dimensioning, threaded fasteners, multiviews, sketching, isometrics, geometric construction, auxiliary views, and descriptive geometry.

These problems have been developed and used in the Department of Technical Graphics by graphics professionals over the last fifty years. Thousands of students all over the state of Indiana have used the problems over the years. Many individuals have made contributions to this workbook. This workbook is dedicated to these individuals and any royalties earned will be used by The Department of Technical Graphics to further develop and teach all young people the importance of technical graphics.
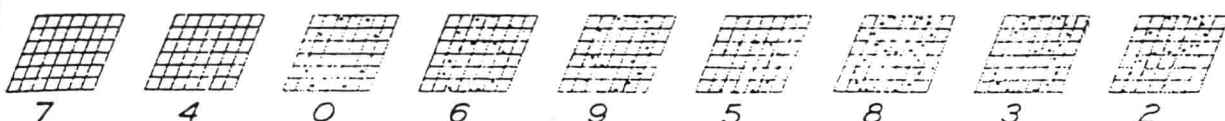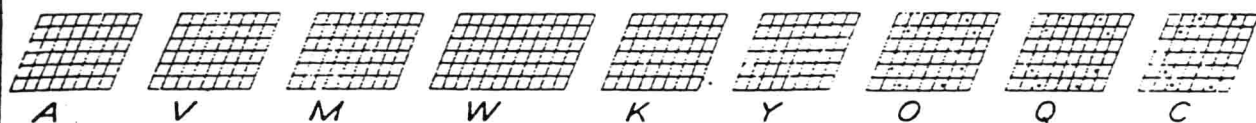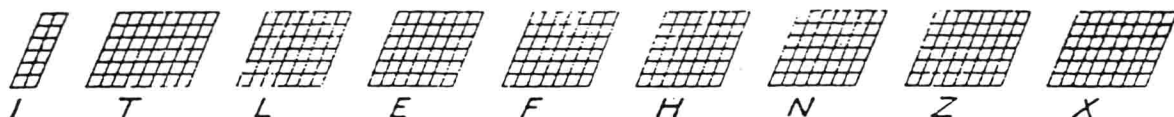
LETTERING

CONTENTS

CAPITAL LETTERS

INSTRUCTIONS: The grids below are identified for each letter and numeral. The height of each character equals the height of its grid and, except in the case of the two letters F and J, the width of each character is two units less than the width of its grid. The position of each curved outline is indicated by a series of small dots.

On the grids, using a pencil having a lead properly shaped and pointed, make each symbol on the appropriate grid. Follow the order of stroke and direction of stroke as given in the text reading references and related illustrations. In making each character look for possible related similarity to other characters as well as for the differences and pecularities.

I   T   L   E   F   H   N   Z   X

A   V   M   W   K   Y   O   Q   C

G   D   J   U   S   &   P   R   B

7   4   O   6   9   5   8   3   2

Practice those letters which your instructor indicated were poorly formed above.

LAST NAME	INITIALS	DATE	CODE NC	DRAWING NO.

SCALE

GRADE   PER. NO.

DRAWING NO.   1

INSTRUCTIONS: From this sheet the student is expected to determine how well he can recall identifying terms that are associated with geometric shapes. These are the terms with which one should have become familiar while in high school.
   Using the guide lines provided, letter the single word that provides the best identification for what has been shown. For example, the one word providing a limited description for the angle shown in (I) is the word RIGHT. Good lettering is expected.
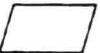
ANGLES

1) RIGHT

2)

3)

TRIANGLES

4)

5)

6)

QUADRILATERALS

7)

8)

9)

POLYGONS

10)

11)

12)

CIRCLES

13)

14)

15)

16)

17)

CONICS

18)

19)

20)

TERMS

21) N80°W

22)

23)

CONES

24)

25)

26)

CYLINDERS

27)

28)

PYRAMIDS

29)

30)

SCALE		
GRADE		PER. NO.
LAST NAME	INITIALS	DATE	CODE NO.	DRAWING NO. 2

USE OF THE ENGINEERS' (DECIMAL) SCALE AND INSTRUMENTS

INTRODUCTIONS: All engineers must be proficient in the use of scales. The scale reading problems on this sheet are intended to familiarize the student with the commonly used decimal scales Since all of the decimal scales are used similarly, the only difference being the number of divisions per inch (10, 20, 30, 40, 50) an understanding of the use of the scale marked FULL SIZE should make it possible for one to read and use all of the other decimal scales. The division on the various scales may represent different units of measurement. In using the scale marked FULL SIZE where each inch is divided into fifty parts, the one-tenth inch divisions are distinguishable and represent one-tenth of an inch, or, when representing very large objects or long ground distances on a drawing, each inch could represent 100 feet and the tenth-inch divisions ten feet.

Examples:

USING SCALE MARKED FULL SIZE	USING SCALE MARKED ¼ SIZE
If 1 in = 1 ft, then the smallest unit equals .02 ft.	If 1 in = 4 ft, then the smallest unit equals .1 ft
If 1 in = 10 ft, then the smallest unit equals .2 ft.	If 1 in = 40 ft, then the smallest unit equals 1 ft
If 1 in = 100 ft, then the smallest unit equals 2 ft.	If 1 in = 400 ft, then the smallest unit equals 10 ft

Prob. 1. Using the scale indicated, scale and record the length represented by each of the given lines to two decimal places wherever appropriate. Show "(inch) and '(foot) marks.

USE SCALE MARKED FULL SIZE   USE 40 SCALE

Full Size (1 in = 1 in)   Quarter Size 1 in. = 4.00 in.

1 in = 10 ft   1 in = 40 ft

1 in = 100 ft   1 in = 4000 ft

USE 50 SCALE   USE 20 SCALE

1 in = 5 in   Half Size 1 in. = 2.00 in.

1 in = 500 ft   1 in = 2000 ft.

1 in = 50 ft   1 in = 20 ft
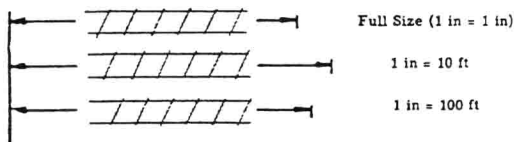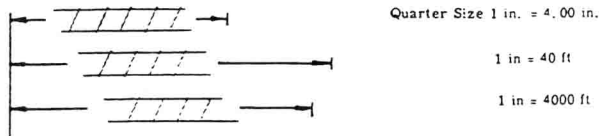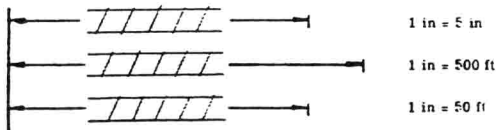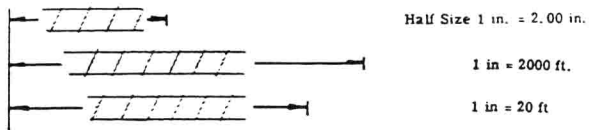
Prob. 2. How would the scale be specified on a drawing for each of the given lines. Record these scale statements using the guide lines that have been provided.
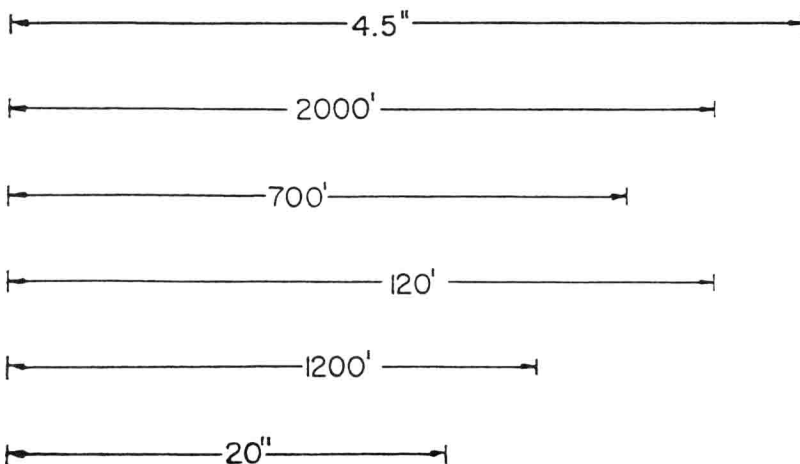
SCALE
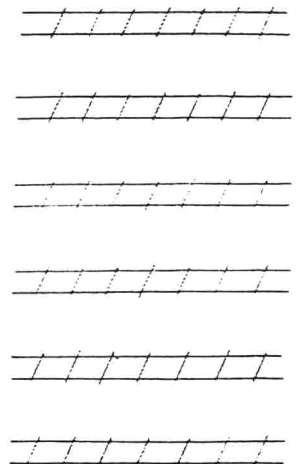
4.5"

2000'

700'

120'

1200'

20"

LAST NAME	INITIALS	DATE	CODE NO.

SCALE

GRADE | PER. NO.

DRAWING NO. 3

INSTRUCTIONS: Using the civil engineer's (Decimal) scale, determine the value of each dimension identified by a letter and record the value at the location provided above each exercise. It should be noted that a different scale has been specified for each exercise. Record all values in decimal form. All radii, diameters and bolt circle dimensions are indicated by the letters R, D and BC respectively.

A = ___ B = ___ C = ___ D = ___
E = ___ F = ___ G = ___ H = ___
J = ___ K = ___ L = ___
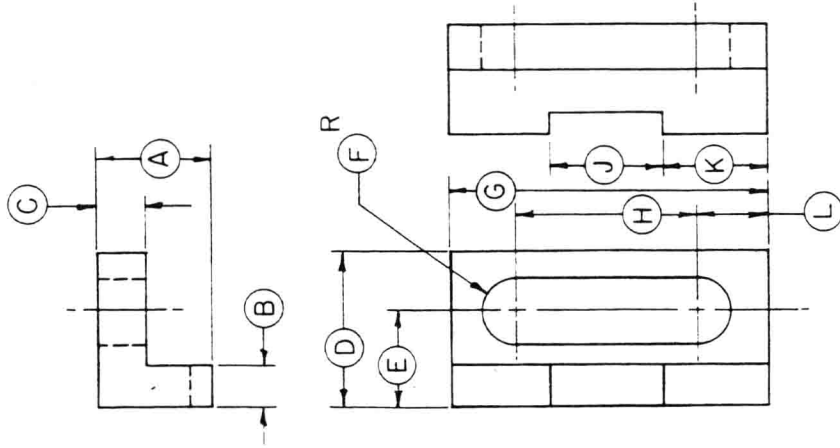
SCALE 1 = 4

A = ___ B = ___ C = ___ D = ___
E = ___ F = ___ G = ___ H = ___
J = ___ K = ___ L = ___

SCALE 1 = 2

A = ___ B = ___ C = ___
D = ___ E = ___ F = ___
G = ___
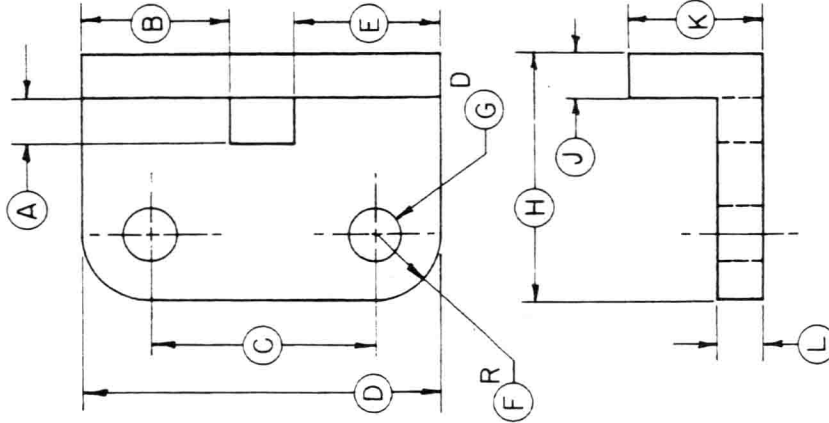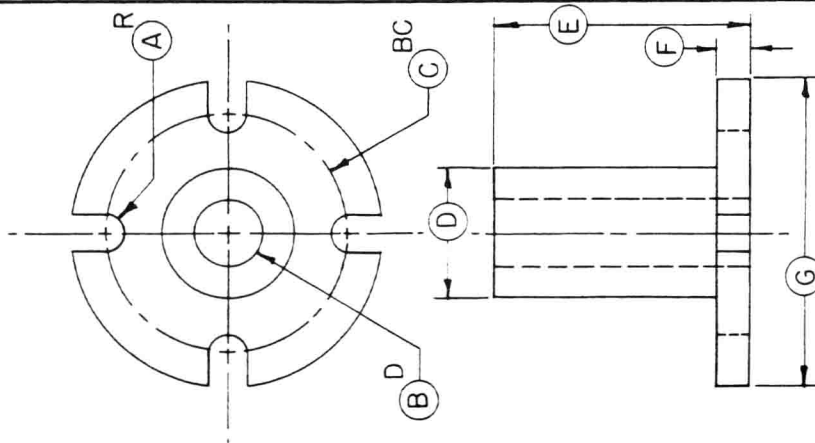
SCALE 1 = 1

SCALE	
GRADE	PER. NO.
LAST NAME	INITIALS	DATE	CODE NO.	DRAWING NO. 4

These problems are to be solved using the T-square,
triangles, scale and dividers as appropriate.

Prob. 3. A control panel is to have 8 toggle switches
placed in a horizontal row. For appearance they are
to be equally spaced, with the end switches located
as shown. Locate the remaining 6 switches.
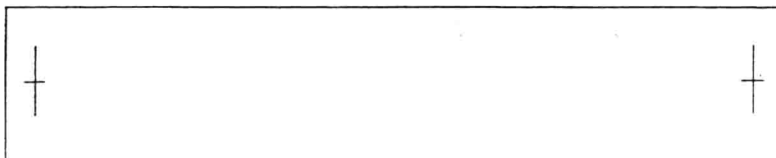
Prob. 4. Scale: 1 in. = 200 ft. Divide the space between 1st and 2nd
Avenues so that the west lot abutting 1st Avenue will be two times the
width of the center lot. The east lot is 50% wider than the west lot.
Locate the lot lines.

How wide is the center lot? _____

N

1ST AVE.

GARFIELD   ST.

2ND AVE.
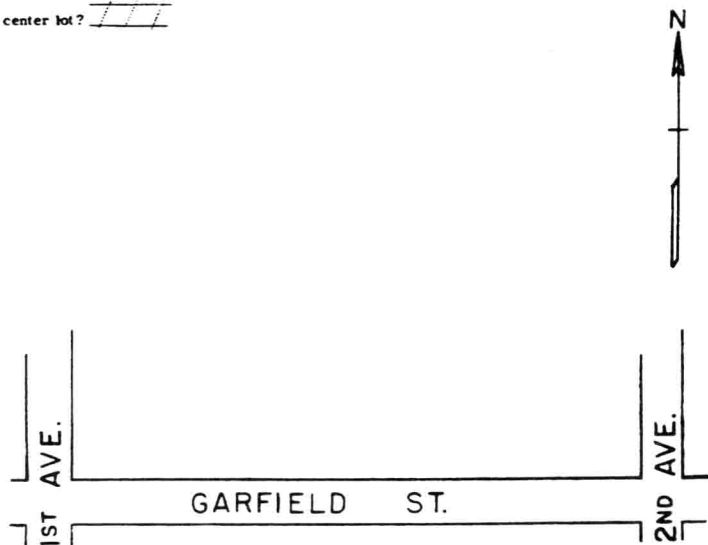
		SCALE	
		GRADE	PER. NO.
LAST NAME	INITIALS	DATE	CODE NO.	DRAWING NO.

DRAWING NO.

5

Prob. 5. Represented below is a vertical section of a 7.50' diameter tank. To maintain a desirable working pressure the level should not go below 39% of its capacity. Locate this low-level line at which the float mechanism starts the refilling process. Show where the indicator would rise to indicate the low level line.

How far is the indicator from the bottom at 39% capacity? _____

SCALE: _____

FULL LINE

INDICATOR

Prob. 6. A map that had been reproduced photographically, was found for which no scale was indicated. However, one distanc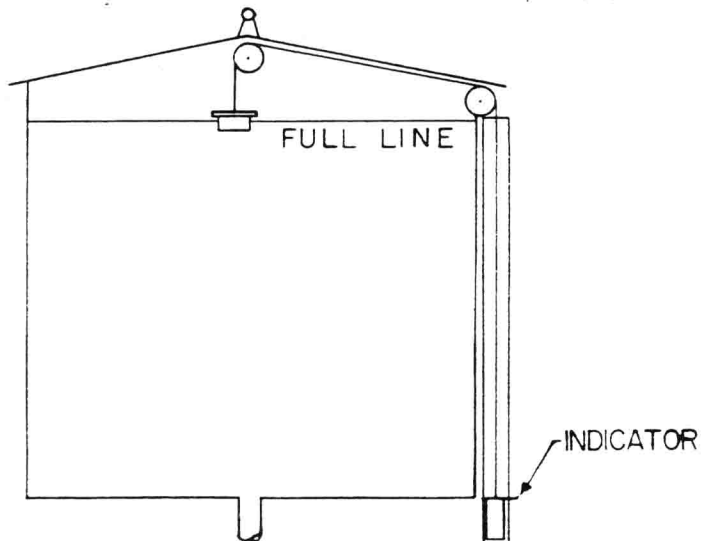e was known to be 1570'. Using this knowledge make a scale that could be used on the map. The smallest division is to represent 100'. The scale should be patterned after the one shown in the illustration, but to save time in this problem the divisions need be shown only between the 0 and 1000' marks.

Show construction.

AMES AVE.

IBM

MAIN STREET

NORTHEAST EXPRESSWAY

GM CORP.

ACE PAINT CO.

BECK AVE.

I65 (PROPOSED)

1570'

O

MAP SCALE

EXAMPLE   0   100   200
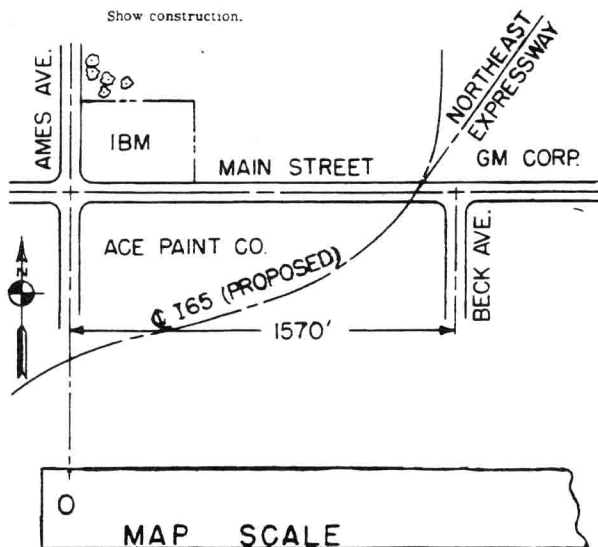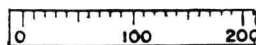
LAST NAME	INITIALS	DATE	CODE NO.	SCALE	
				GRADE	PER. NO.
				DRAWING NO.	6

Given below are several combinations of the 30° - 60° and 45° triangles which form angles in increments of 15°. In the table to the right of the problem, list the value for each of the angles indicated by the letters.
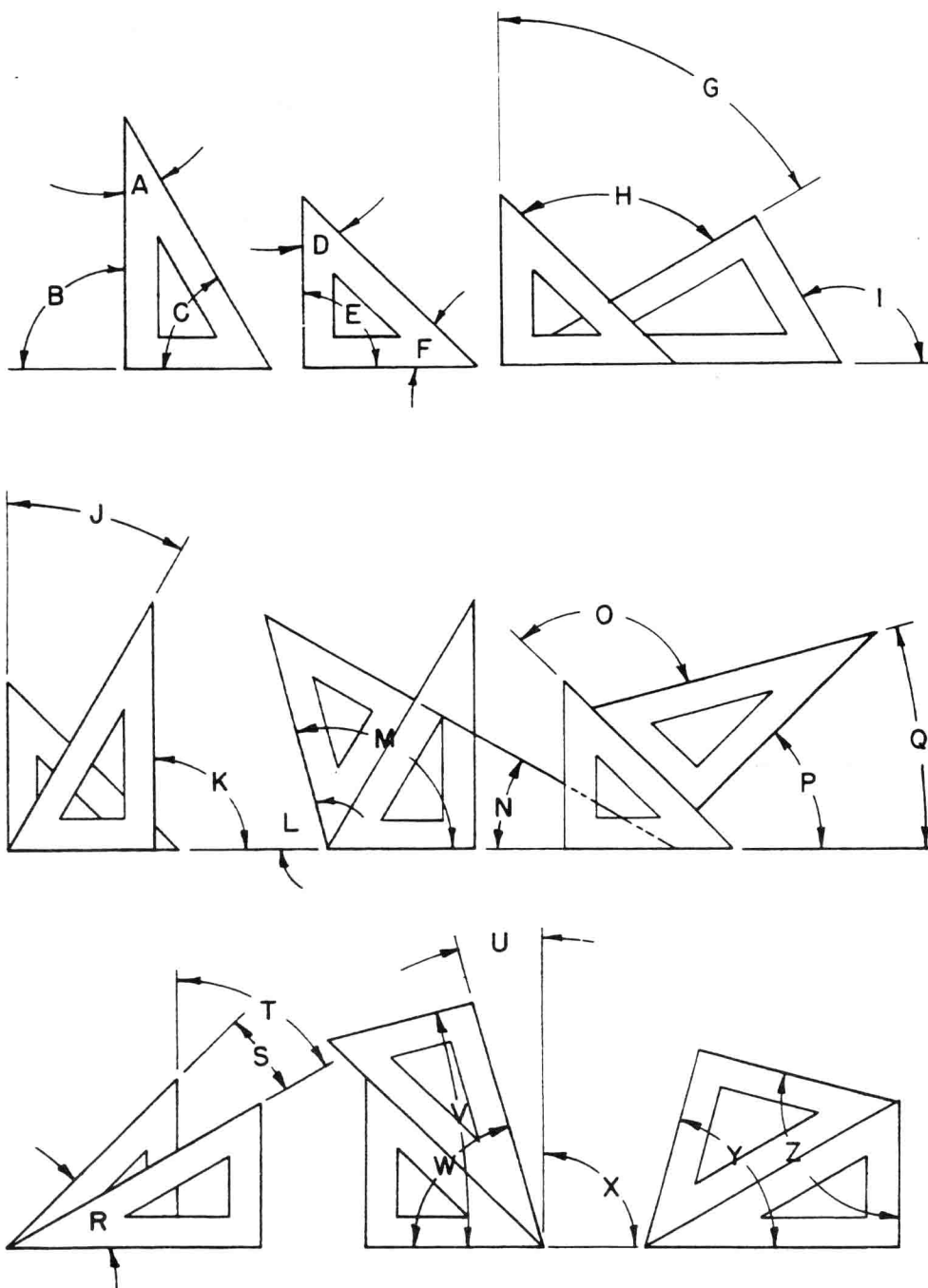
ANGLE	VALUE
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

AUXILIARY LINE METHOD - EQUAL DIVISIONS: Mark off equal
divisions along an auxiliary line making any angle with the given line.
Lines drawn parallel to a line joining the last mark and the end of the
given line will divide the given line into equal parts.

AUXILIARY LINE

PARALLEL

A

B

GIVEN LINE
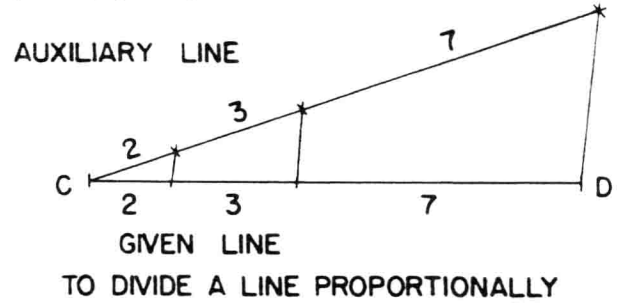
TO DIVIDE A LINE EQUALLY
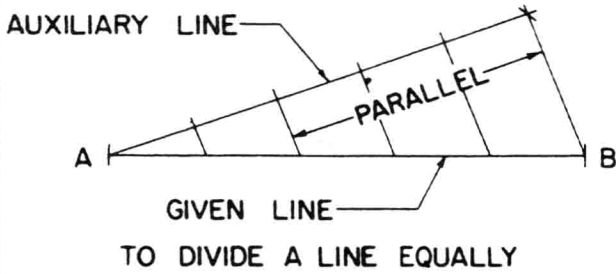
AUXILIARY LINE METHOD - PROPORTIONAL DIVISIONS: Mark off
the given proportions along an auxiliary line. Lines drawn parallel to
a line joining the last mark and the end of the given line will divide the
given line proportionally.

AUXILIARY LINE

7

3

2

2   3   7

C   D

GIVEN LINE

TO DIVIDE A LINE PROPORTIONALLY

Prob. 1   Using the dividers and the auxiliary line method, divide the line
CD into five equal parts. Make the auxiliary measuring line extend from
point C.

D

C
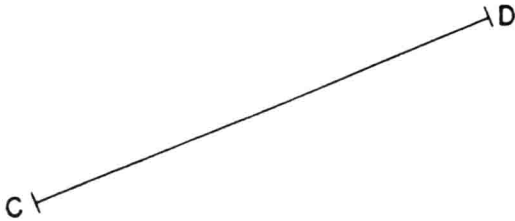
Prob. 2   Using a scale and the auxiliary line method, divide the line EF
into 5 equal parts. Make the auxiliary measuring line extend from point E.

E

F
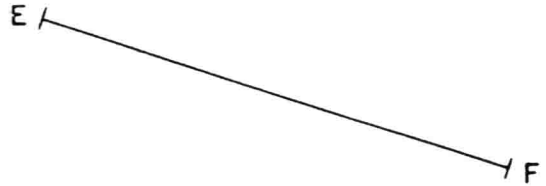
Prob. 3   Using the auxiliary line method, divide the line GH
proportionally into three parts so that the length of the second
segment is twice the length of the first segment, and the length
of the third segment is twice the length of the second segment.
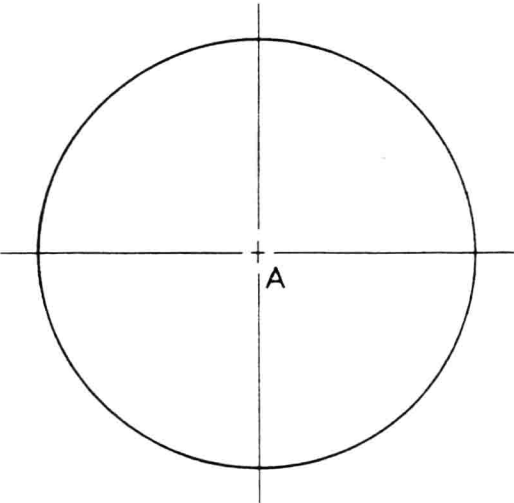
H

G
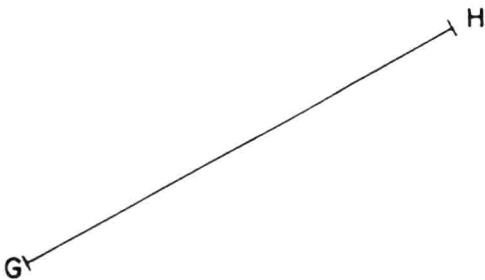
Prob. 4   Using the compass, bisect the line ST. Using the triangles, bisect
the line UV to check if the line ST is the bisector of line UV. Show the lines
which prove or disprove this.

S

U

V

T
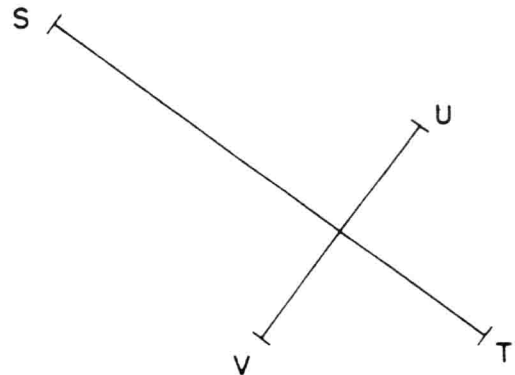
SCALE		
GRADE		PER. NO.
LAST NAME	INITIALS	DATE	CODE NO.	DRAWING NO. 8

INSTRUCTIONS: (1) Draw 4 arcs of 14.30 R tangent to the circle A and to the circle defined by points 1, 2, and 3. The four centers are to lie to the left of the vertical centerline through A. Circle A has a 4.90R. (2) Draw an arc of 10.20 R through the center of the circle that has points 1, 2, and 3, and tangent to the arc that lies farthest to the right. Mark each tangent point with a short mark normal to the line.

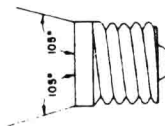SCALE: To be determined from the information given.
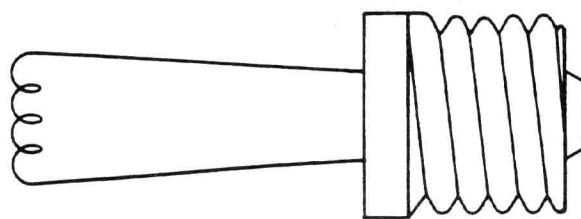
A

2

1

3

SCALE : _ _ _ _ _ _

		SCALE	
		GRADE	PER. NO.
LAST NAME	INITIALS	DATE	CODE NO.	DRAWING NO. 9

Prob. 2. Complete the front view of the sunlamp. A middle section through the lamp shows the lens portion to be a circular arc of 3.58 radius with its center in the lamp base as shown. The straight sides of the conical reflector are blended into the lens portion with .55 R (radius) arcs. Mark all points of tangency and the centers of the arcs.

SCALE: Full Size

1.55

CONICAL PORTION

TANGENT POINTS

R

Mark all tangent points and centers. Determine tangent points before drawing arcs. All arcs are to start and stop at tangent points.
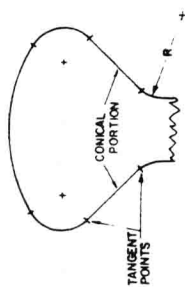
Prob. 1. Complete the front view of a 40 watt electric lamp. The top of the lamp is a portion of a sphere, with a radius of 1.12, tangent to the conical portion shown. Use only an approved geometrical method to find the location of the center of the arc. A trial and error method is not acceptable. Construction lines should be light and thin; finished object lines should be of medium width and very black. Tangent points are to be established before final drawing of the arc and are to be marked.
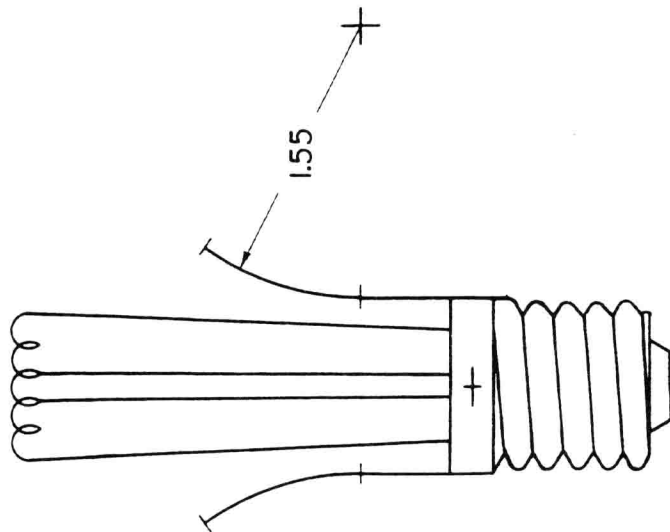
SCALE: Full Size

105°   105°

SCALE		
GRADE		PER. NO.
LAST NAME	INITIALS	DATE	CODE NO.	DRAWING NO. 10