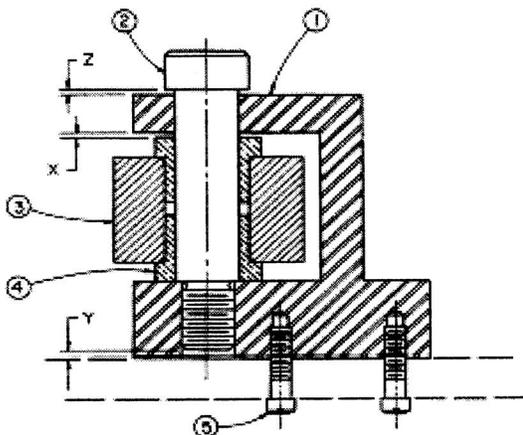
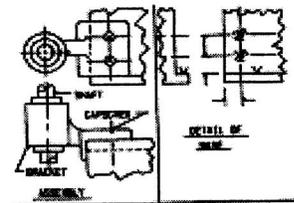
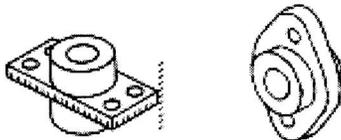
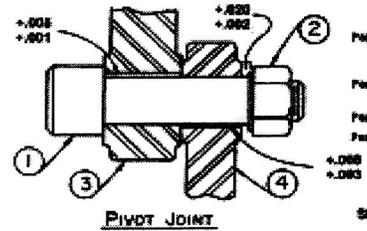
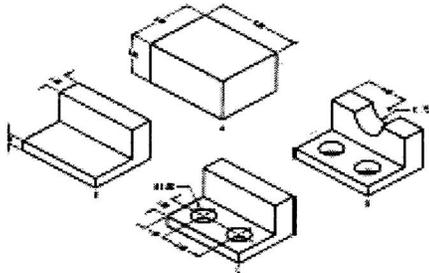
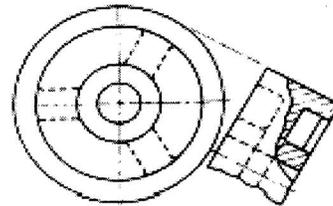
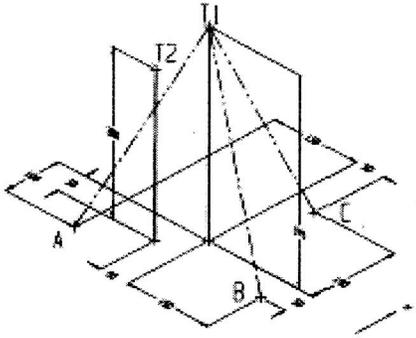


# H191 DRAWING PACKET

## AUTUMN 2002



F.D. Meyers - Editor

FUNDAMENTALS OF  
ENGINEERING  
FOR HONORS

Print Cost	\$5.90
Copyright Cost	\$0.00
<b>Total</b>	<b>\$5.90</b>

**PROBLEMS IN THIS PACKET**  
(Other problems will be provided by your instructor)

DRAWING ASSIGNMENT	PROBLEM NUMBER	TOPIC
3	ML-2	Orthographic Projection – Missing Lines
4	A6	Orthographic Projection – Missing Lines
5	A11	Orthographic Projection – Sketching
8	G15	Pictorial Drawings – Sketching
10	ML-1	Missing Lines with Pictorials
11	Text 13.2 BAR	Sketched graph
12	Text 13.9 & 13.11	Sketched graph & questions
13	G-69	Surface chart with EXCEL
14	G71	Pie chart with EXCEL
15	MV-1	Missing Views with Isometrics
17	SG-3-1	Space Geometry – Pierce point of line & plane
18	SG-3-2	Space Geometry – Intersection of planes
19	SG-4-1	Space Geometry – Angle between line & plane
20	SG-4-2	Space Geometry – Angle between planes
21,22	SG-6A	Space Geometry – 3D Lines and plane
25	F18-A	Reading & sketching section views
26	SECT 1-N	Reading & sketching section views
27	T49	Sketching special section views
28	B21	Section views – Assembly
31	DIM-1	Dimensioning (inches)
32	DIM-2	Dimensioning (millimeters)
34	1-4,2-4,3-4	Dimensioning and scaling
35,36	CAEG Section	Sectioned Assembly with CAEG
37	A24	Functional dimensioning (millimeters)
38	A25-A	Functional dimensioning (inches)
39	G27	Introduction to fits & tolerances (inches)
40	TOL-1A	Introduction to fits & tolerances (millimeters)
41	TOL-3B	Complex fits & tolerances
43	FB-1D	Fastening & Joining
44	FD-3B	Welding symbology
46,47	A31,a,b,c	Working drawing set
51	AD-1A	Geometric dimensioning & tolerancing
52	B33.1-.8 set	Reading a working drawing set
	MSP	Multi-view sketch paper
	ISP	Isometric sketch Paper

One or more lines are missing in each of the sets of views below. Sketch the lines with a soft pencil. Solve by visualization, naming points, naming lines, naming surfaces, sketching, or modeling.


TITLE	DATE:	NAME:	DWG:
	TIME:	INST:	TABLE:

One line is missing in each of the sets of views below. Sketch the missing line. Solve by visualization, naming points, naming lines, naming surfaces, sketching or modeling.

A 6 Orthographic Projection

1

2

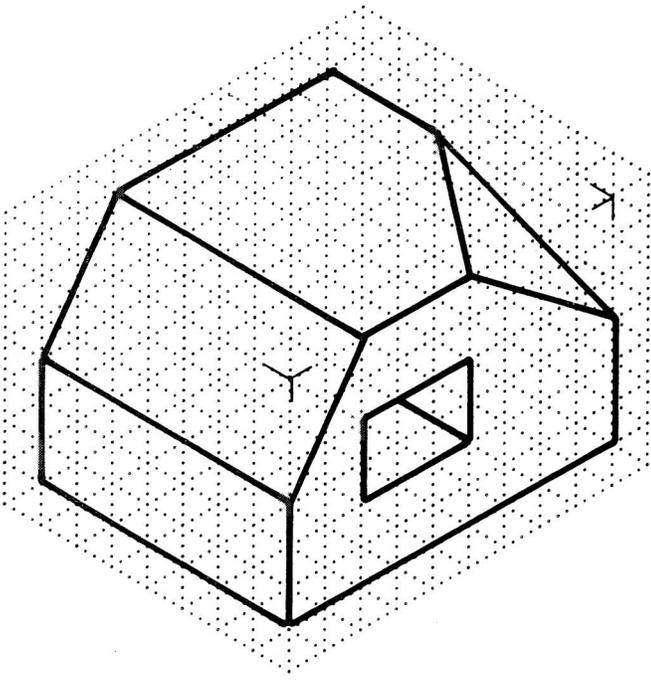
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4

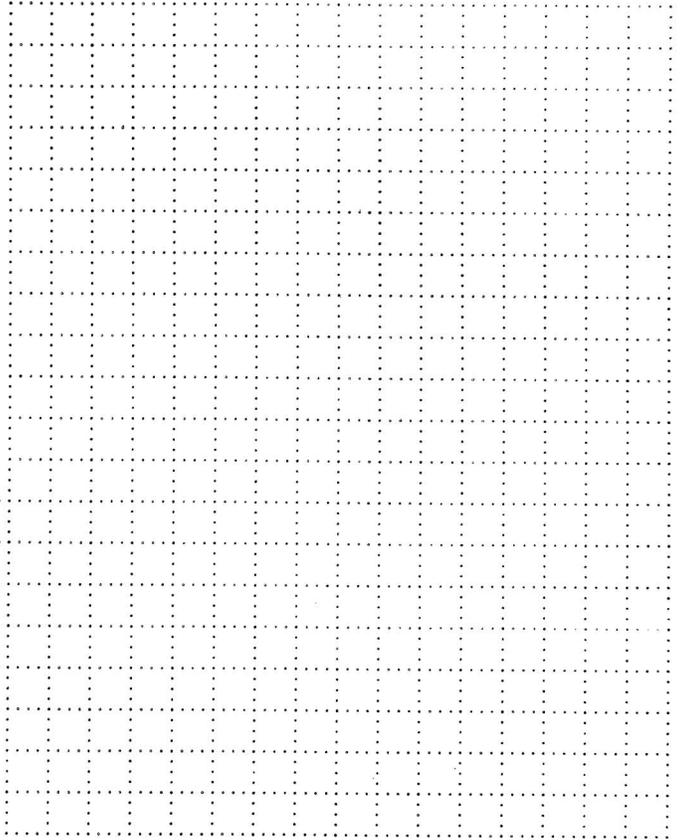
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6

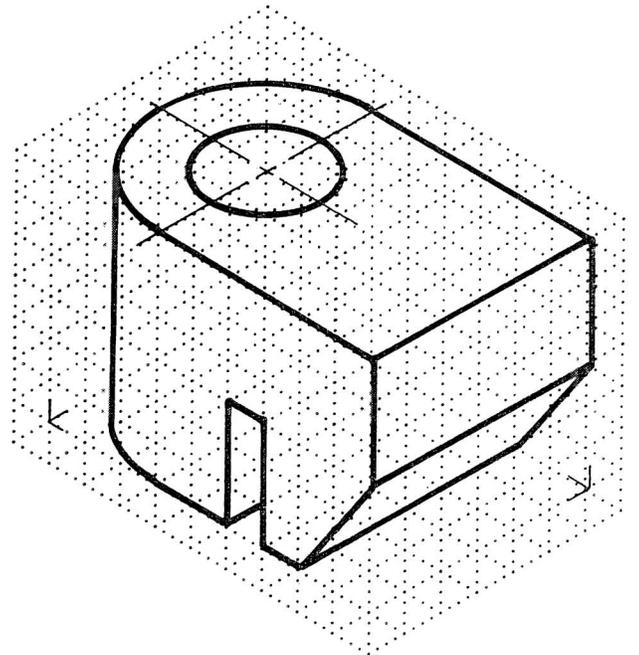
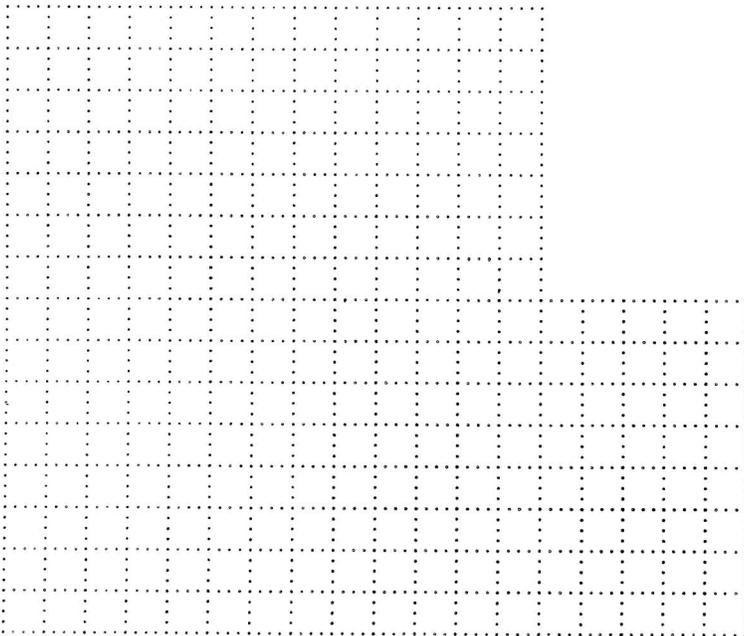
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	DATE		



Sketch front, top, and left side views



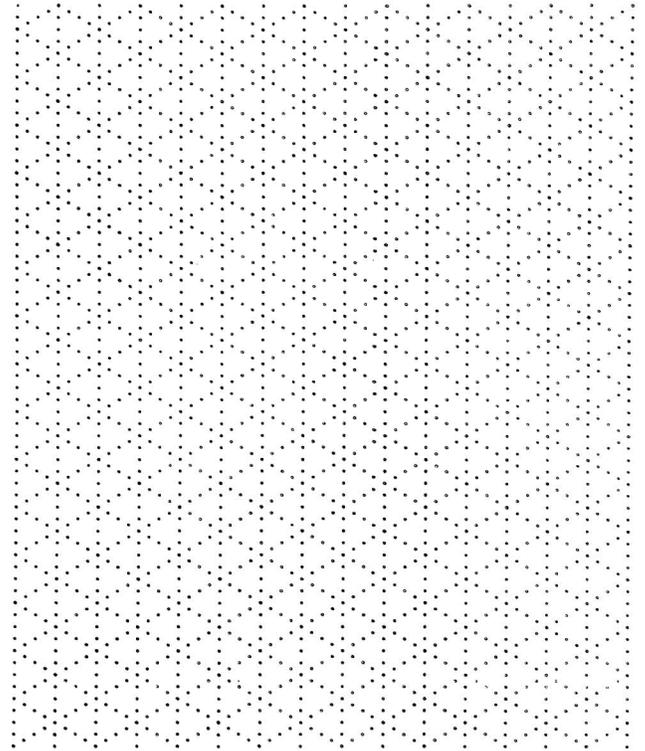
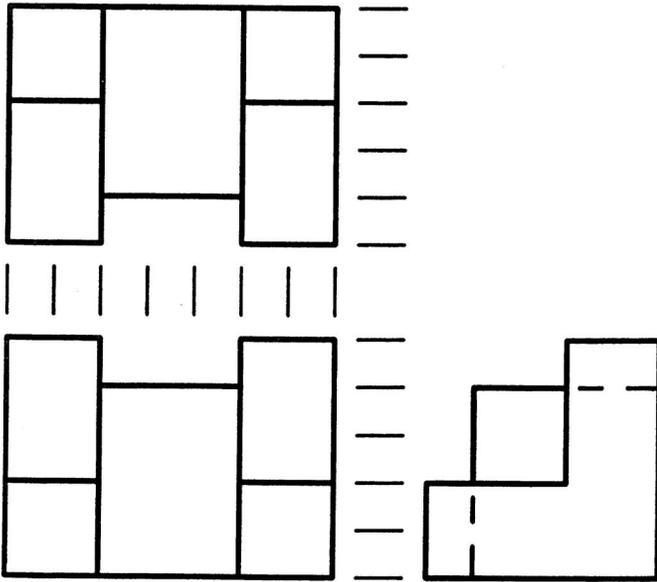
Sketch front, top, and right side views



	SCALE _____	NAME _____	DWG
	DATE _____	SECTION _____	

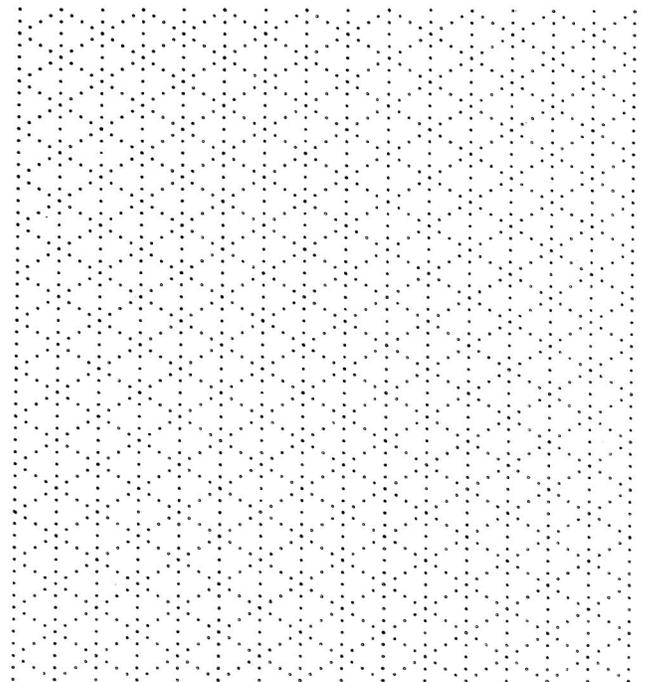
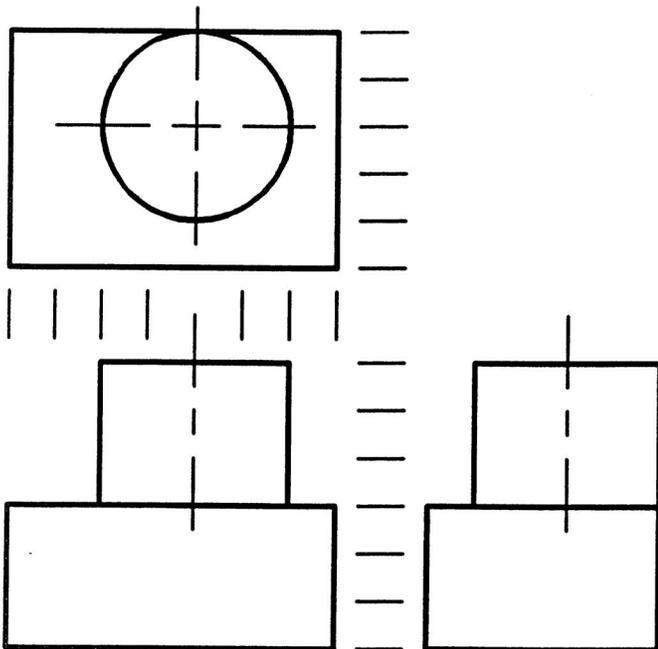
GIVEN: Three views of an object.

SKETCH: A pictorial view of the object.



GIVEN: Three views of an object.

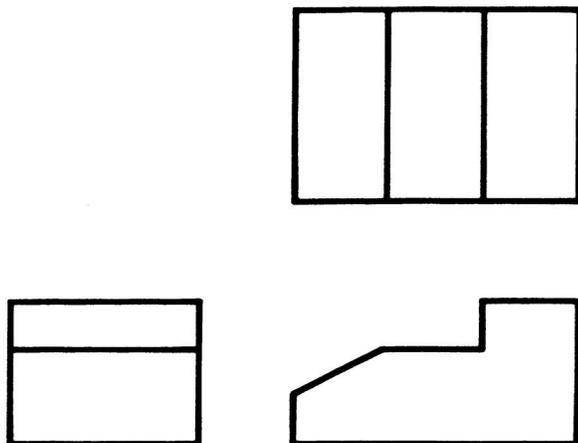
SKETCH: A pictorial view of the object.



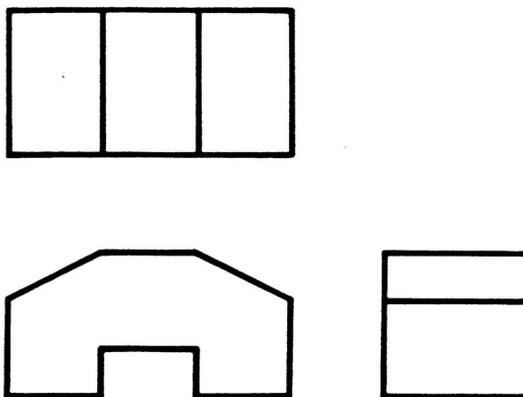
	DATE SCALE	NAME SECTION	SEAT # DWG
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One line is missing in each of the sets of views below. Draw the line in RED. Solve by visualization, naming points, naming lines, naming surfaces, sketching, or modeling.

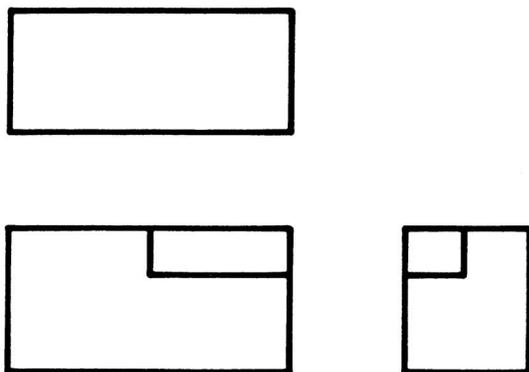
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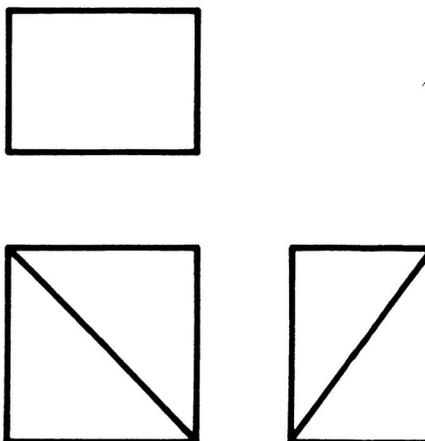
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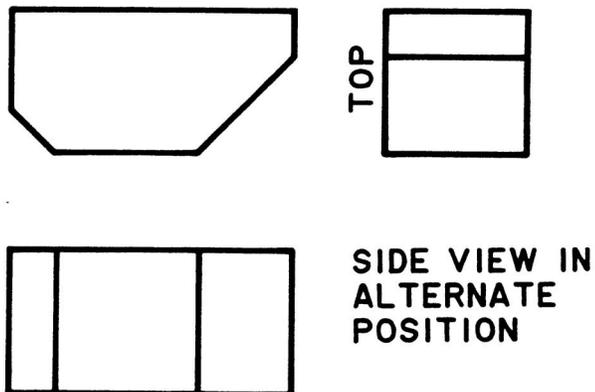
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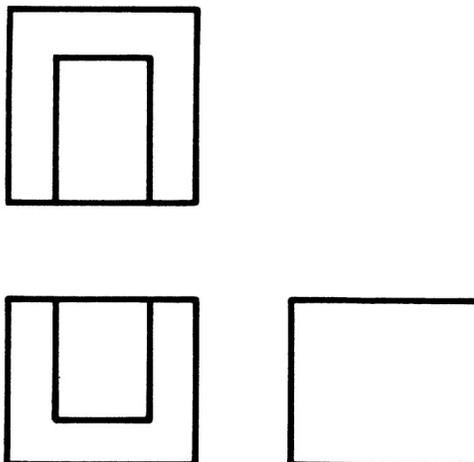
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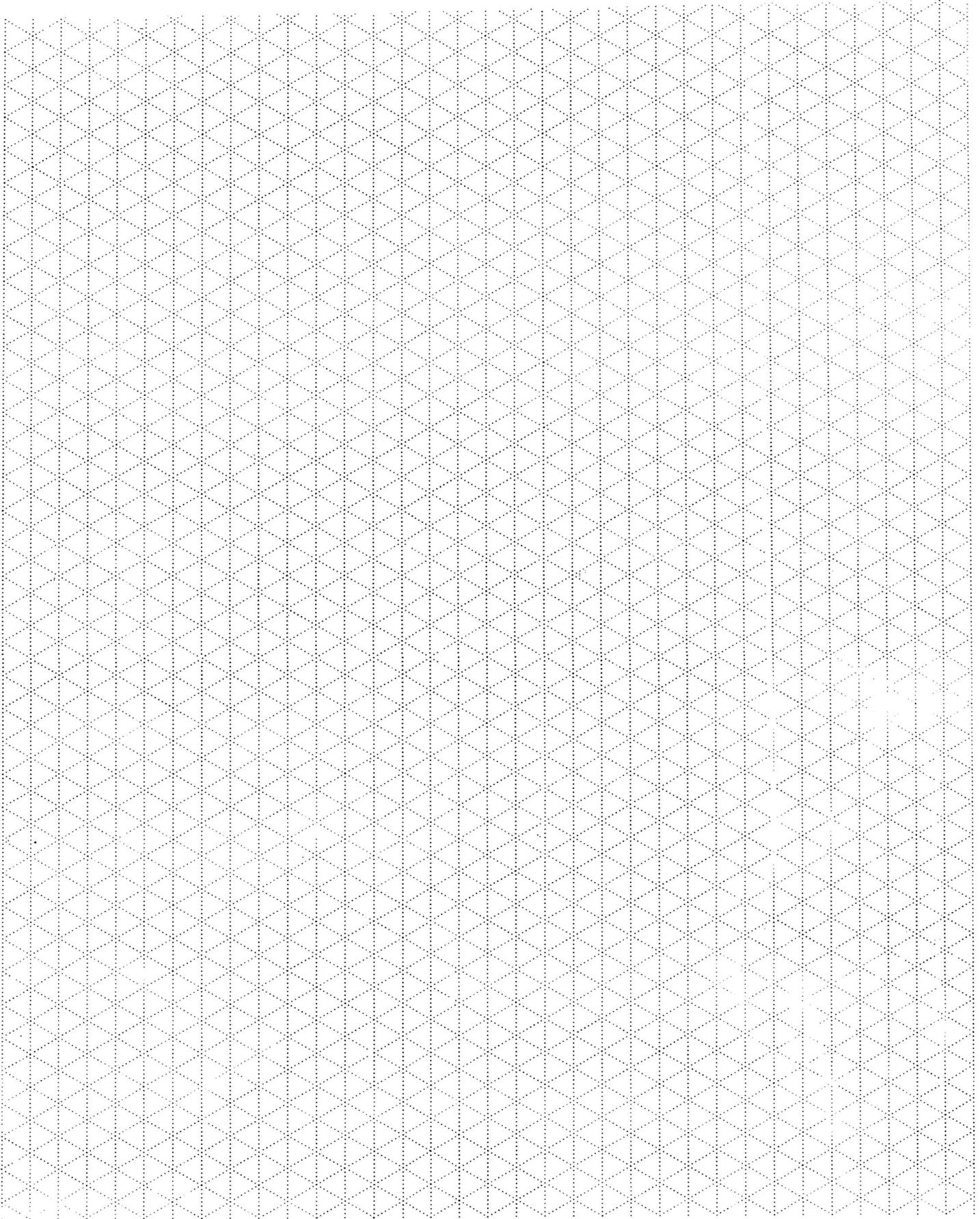
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6



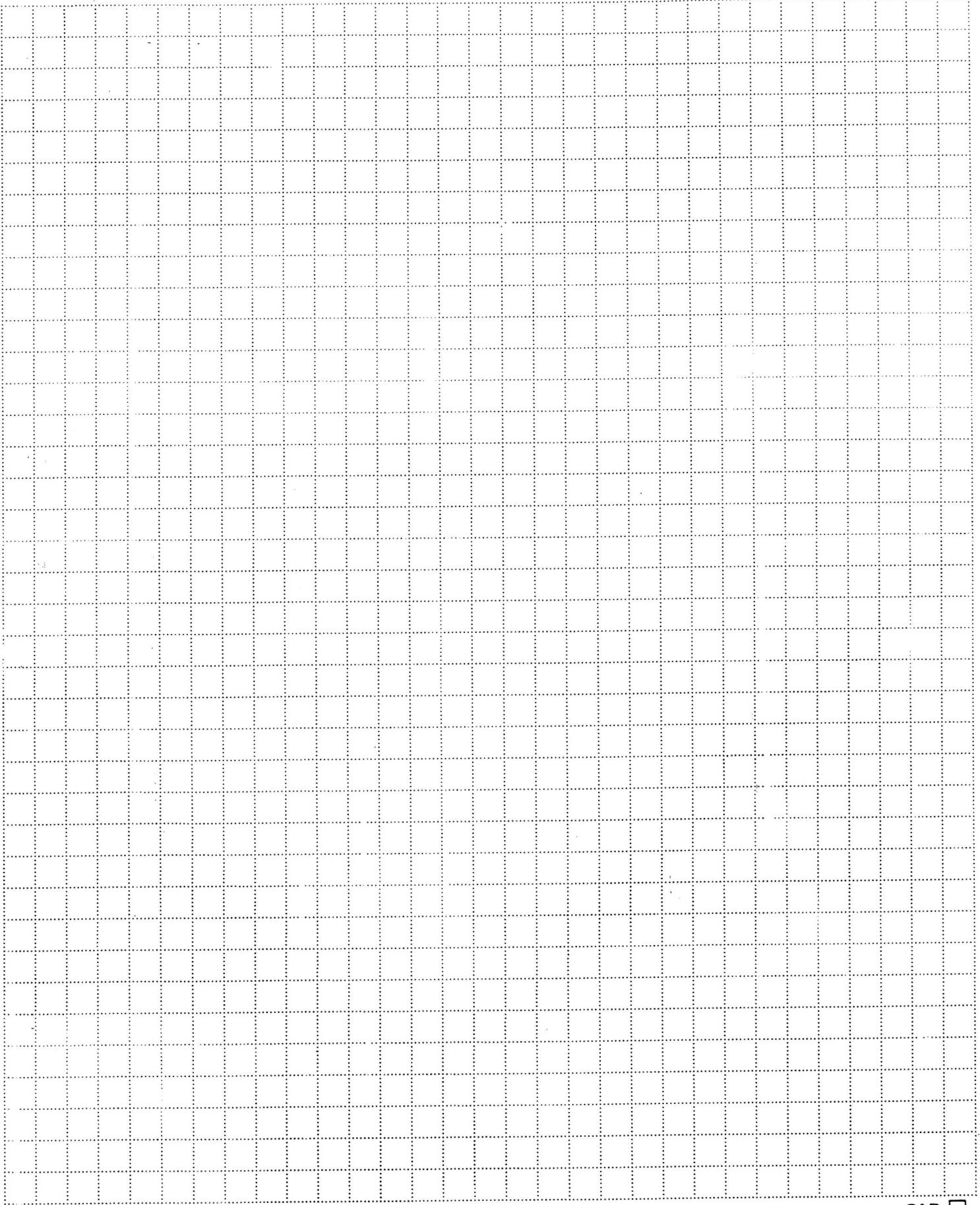
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C&R

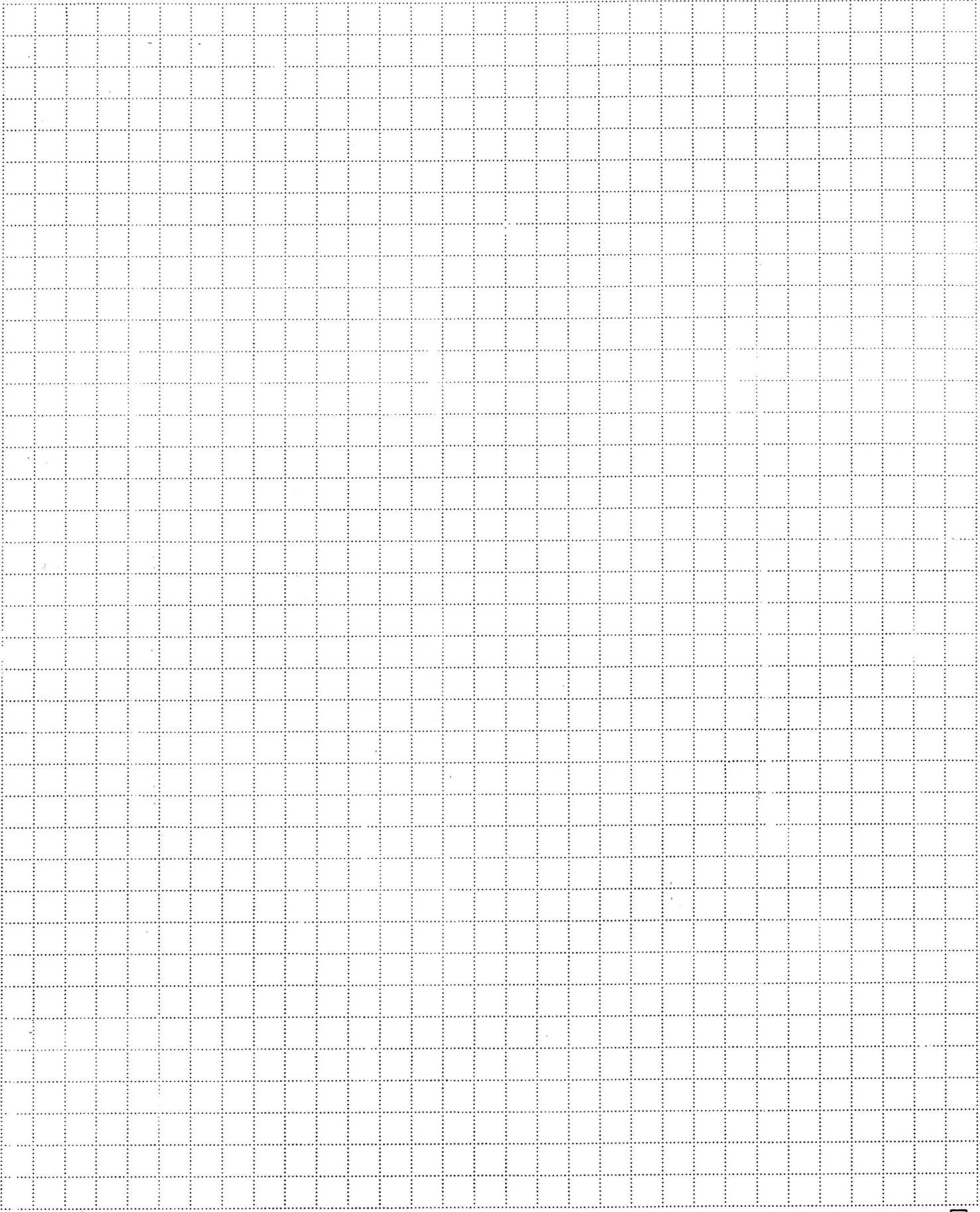
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1  
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C&R

	SCALE	NAME	TABLE	HOUR	DWG
		INSTR			



	SCALE	NAME	TABLE	C&R <input type="checkbox"/>	1
		INSTR			
					0

A bearing manufacturer has conducted life tests of a certain roller bearing operating at constant rotational velocities (RPM). Data from their tests is recorded below.

<u>RPM</u>	<u>Bearing life (Hrs.)</u>
500	50000
1000	45000
1500	37000
2000	28000
2500	22000
3000	17000
3500	12000
4000	8000
4500	5000
5000	3000
5500	2000
6000	1000

Create a line chart with Excel showing bearing life on the vertical axis and RPM on the horizontal axis. Label the graph. Graduate, calibrate and label the axes.

PIE & POLAR CHARTS

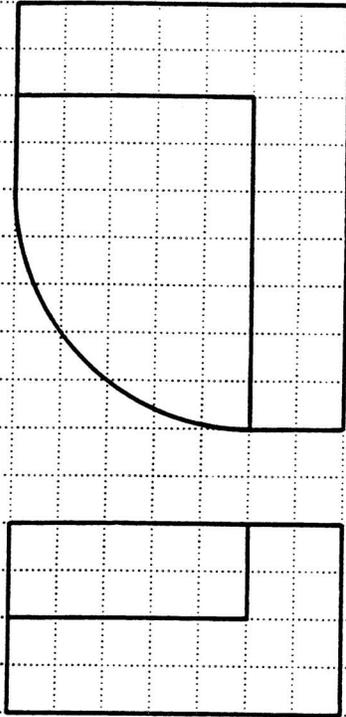
Pie charts are effective when the relative size of components of some total such as a budget are to be presented. The pie is divided into "slices" each of which is proportional in size to its portion of the entire entity being represented. The "slices" or sectors can be labeled, and can have their size shown as a percentage of the whole pie, as an absolute quantity, or both.

Datachip Industries has compiled the following data on how their sales revenue is used. The figures are based on one dollar (\$1) of sales. Create a pie chart with Excel to present the data in graphic form. Label each segment of the pie and show its proportion to the whole as a percentage. Identify the pie chart and its data with an appropriate title.

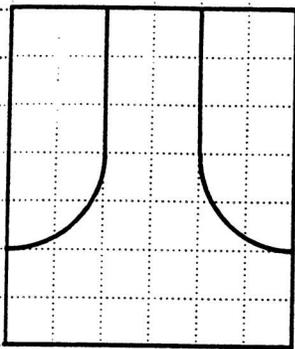
Item	Amount
Direct labor	\$ .26
Indirect labor	.12
Raw Material	.15
Advertising & Sales	.21
Shipping & Mailing	.07
Space rental & Misc.	.10
Profit	.09
Total	\$1.00

	SCALE DATE	NAME SECTION	DWG
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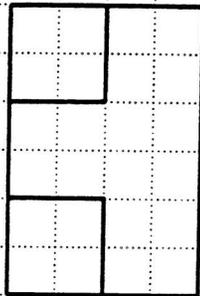
Sketch the top view  
of this object.



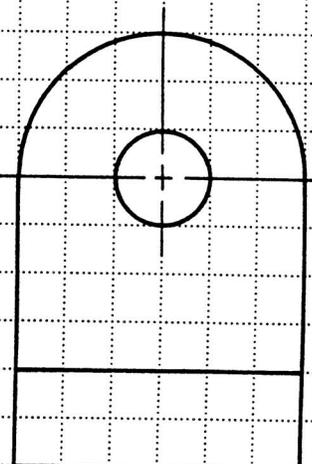
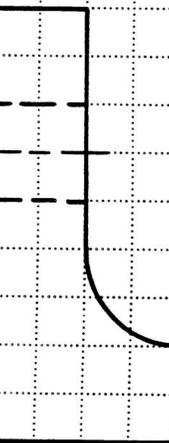
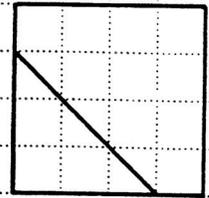
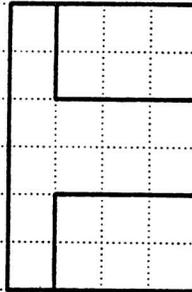
Sketch the front view  
of this object.



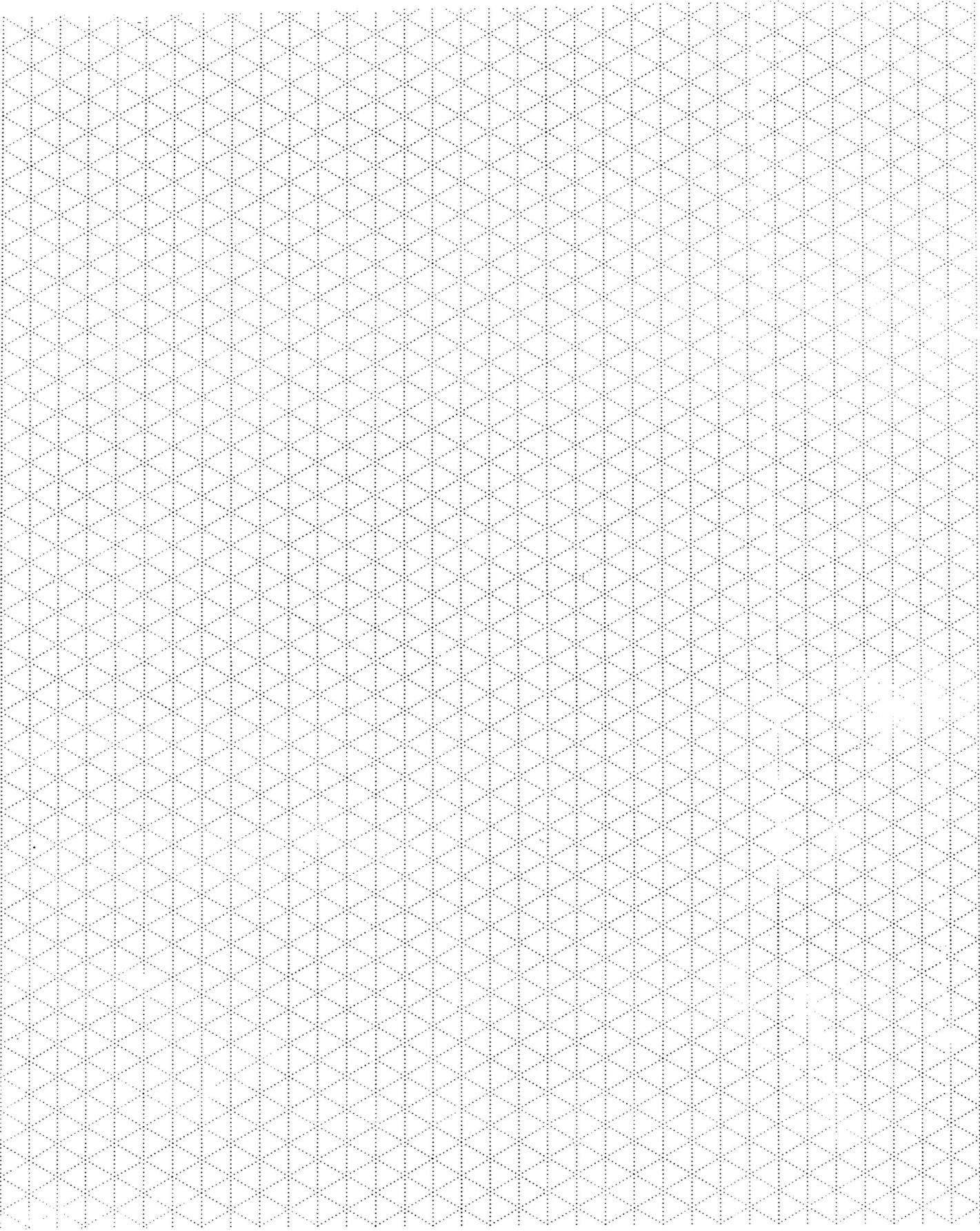
Sketch the right side  
view of this object.



Sketch the front view  
of this object.



TITLE:	DATE:	NAME:		DWG:
	TIME:	INST:	HOUR: TABLE:	



C&R

	SCALE	NAME	TABLE	HOUR	DWG
		INSTR			

1  
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## SG-3 INTERSECTIONS

### PIERCE POINT OF A LINE AND A PLANE

#### CONCEPT:

Assuming that the straight line is neither parallel to nor in the plane, it will intersect the plane at a point common to both the line and the plane.

**Cutting Plane Method** —*Schaums Outline Series, Descriptive Geometry* by Minor C. Hawk, McGraw-Hill, 1962.

The intersection of a line and an oblique plane can be determined by using a cutting plane that contains the given line. The line of intersection of the cutting plane with the oblique plane and the given line must intersect or be parallel because they both lie in the cutting plane. (See the figure below). Since the cutting plane appears as an edge in a principal view (one of the view ports on the CADD system) the relationship between the line of intersection and the given line is not apparent in that view port. The other view ports, however, reveal the relationship.

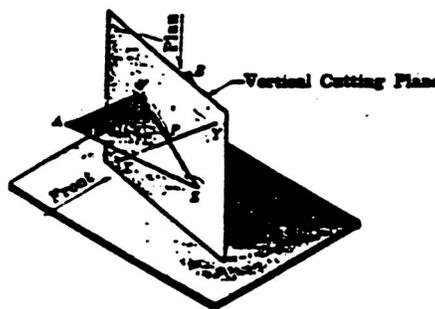


Fig. 4-1. A Pictorial View of the Vertical Cutting Plane Method

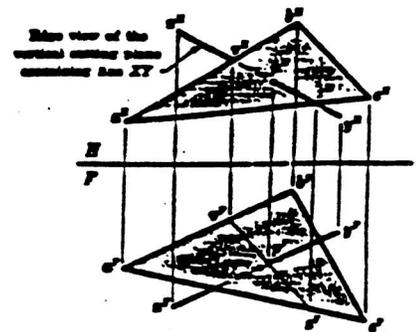


Fig. 4-4. A Line Intersecting an Oblique Plane (Vertical Cutting Plane Method)

#### PROBLEM - Load Blank3 file

A plane (yellow) is intersected by a control cable (red). The coordinates of the plane and the cable are given below. Locate the pierce point of the control cable with the plane. Show the pierce point in all views with a point (+).

Plane (yellow)

(0, 0, 0) (2, 0, -1)  
(2, 0, -1) (2, -1.5, -2.30)  
(2, -1.5, -2.30) (0, -1.5, -1.3)  
(0, -1.5, -1.3) (0, 0, 0)

Control Cable (red)

(-0.4, -0.5, -2.4) (2.4, -0.5, 0.5)

## **SOLUTION**

**Change color to cyan (powder blue)**

**Assume a cutting plane contains the red line in the upper left view port. Draw the intersection of this cutting plane with the yellow plane in the upper left view port. Do this by **CREATE, LINE, ENDPTS, INTRSC**. At the prompt, click on the vertical yellow line at the extreme left side of the view port, then click on the red line. At the depth prompt press F1 (First). The cursor now has a point on the plane. Click on the vertical yellow line at the extreme right side of the view port, then click on the red line. At the depth prompt, select F1 (First). Notice the cyan line is shown in all the views. This line is on the plane. Where this line crosses (intersects) the red line is the only point that is common to the line and the plane; therefore, this must be the pierce point. Create a point at this intersection.**

**Prove your point is the pierce point by getting an edge view of the plane. The point will be on both the edge view and the line in this view. If it is not, then you have made an error and need to redo the problem. Save this view to use in your layout.**

**Make a layout using the front view, top view and the auxiliary view showing the plane as an edge and the coordinates of pierce point.**

## **INTERSECTION OF PLANES.**

### **CONCEPT:**

Two planes intersect in space to form a line. The cutting plane method can be executed twice to establish two pierce points that will define the line of intersection between the planes.

### **PROBLEM**

A yellow plane and a red plane are defined by the coordinates below. Determine the line of intersection between the two planes. Draw the line of intersection in cyan.

Use **CREATE, LINE, STRING** using the coordinates given below:

Yellow Plane (0, 0, 0) (1, 1.5, 1.5) (1.25, 0.5, 1) (0, 0, 0)

Red Plane (0, 0.25, 1) (0, 1.25, 1.5) (1.25, 0.75, 0.5) (0, 0.25, 1)

### **SOLUTION**

Find the pierce point of one of the lines of either plane with the other in the same manner as described in the instructions for finding the pierce point of a line and plane. Repeat the process for another line. Connect the two pierce points. This line defines the line of intersection between the planes. Make sure that the line of intersection reaches the limits of each plane.

Prove that the line of intersection determined above is the true intersection between the planes by creating a new view that yields both planes as an edge. If the line of intersection is true, then if you get a point view of the line of intersection, both planes will appear as an edge. What is the angle between these planes (dihedral angle)? Dimension the angle and save the view to use in your layout.

Make a layout using the front and top views of the planes and the line of intersection. Also include the view that shows a point view of the line of intersection and the dihedral angle with its dimension.

## SG-4 ANGLES BETWEEN PLANES, LINES, AND OTHER PLANES

### ANGLE BETWEEN A LINE AND A PLANE IN SPACE.

#### CONCEPT:

The angle between a line and a plane in space is determined when an edge view of the plane and a true length of the line occur in the same view. **YOU MUST HAVE A TRUE LENGTH AND AN EDGE VIEW IN THE SAME VIEW!!!!**

Before starting the problem, load your Blank3 file]

#### PROBLEM

A mine tunnel (red line) is heading in the direction of a vein of coal (yellow plane). At what angle will the mine tunnel meet the vein of coal? How much farther must the mine tunnel be extended to meet the vein of coal? 1" = 60 feet

Tunnel (red line)

Start: X = 1.3333 Y = 0.6667 Z = 0.3333

End: X = 0.9167 Y = 0.3333 Z = 0

Coal Vein (yellow plane)

(0,0,0) (1.0833, -0.5, -0.3333)

(1.0833, -0.5, -0.3333) (0.6667, 0.6667, -1)

(0.6667, 0.6667, -1) (0,0,0)

#### Step 1

Get the coal vein to appear in TRUE SIZE in an auxiliary view. The mine tunnel will also appear in the view but will not be true length Save this view for your layout.

#### Step 2

In the status window switch from 3D to 2D construction. Change color to brown. Construct a line perpendicular to the mine tunnel in the view showing the coal vein TRUE SIZE. The brown line that you just made should be True-Length in this view. Check It!

### Step 3

In the status window switch back to 3D construction. Now you want the coal vein to appear as an edge and the mine tunnel to appear in true length. To get this view, draw a new view using the 2 PT option and pick the **ENDENT** of the brown line. Think about it. If the brown line is **TL** and perpendicular to the red line, it stands to reason that a point view of the brown line will yield a true length of the red line. The coal vein (yellow plane) will then appear as an edge. Save this view for your layout.

### Step 4

Check that the mine tunnel is indeed true length. We will need a construction line thru the end of the mine tunnel nearest the coal seam. The reason for this construction line is to enable us to determine how much farther we have to go to reach the coal seam. After put in the construction line, extend the mine tunnel to the coal seam using your **EDIT** commands. Now break the mine tunnel at the construction line. This means that you make two lines instead of one. Now you can determine how much farther you have to go to reach the coal seam. Since the scale is 1"=60', multiply the true length of the extension by 60 to determine the scaled dimension and note it on your drawing. Determine the acute angle that the mine tunnel makes with the coal vein and dimension it in the correct location. Save this view to use in your layout.

### Step 5

Make a layout of your drawing by capturing the front and top views as well as the two auxiliary views. Make sure the quantitative information is shown on your layout.

## **DIHEDRAL ANGLES - ANGLE BETWEEN PLANES.**

### **CONCEPT :**

Get a point view of the common line between the planes and you will have an edge view of both planes which gives you the Dihedral Angle.

### **PROBLEM**

Two planes that have a common line between them are given below as coordinates. Determine the angle between these planes (Dihedral Angle).

Yellow Plane

(0, 0, 0) (2, 1, 2) (3, -1, 1) (0, 0, 0)

Red Plane

(0, 0, 0) (2, 1, 2) (4, 1, -1) (0, 0, 0)

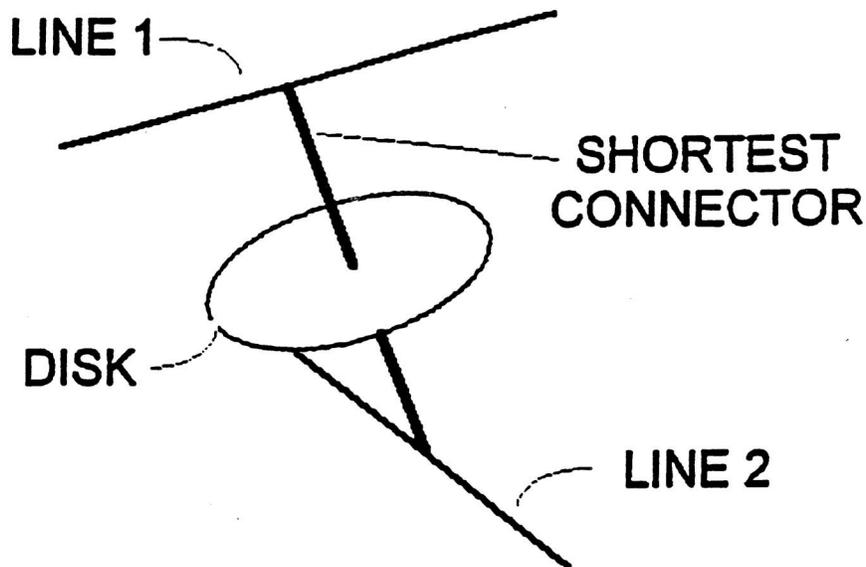
### **PROCEDURE**

Get a view such that the common line is a point. Measure and dimension the dihedral angle.

Prepare a layout showing Top, Front, Pictorial, and the point view of the line with dimensional angle.

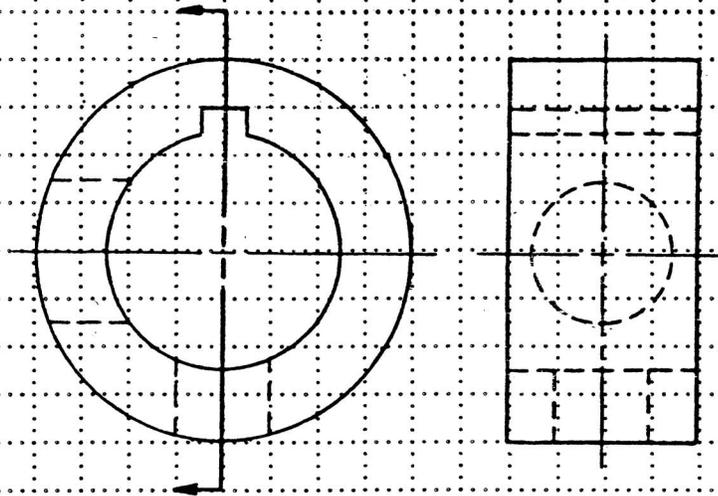
## Space Geometry

A green dashed (Type 2) line has endpoints at  $(0, 0, 1)$  and  $(3.5, 2.1, 2.5)$ . A red phantom (Type 4) line has endpoints at  $(0.5, 2.5, -2.5)$  and  $(4.5, 1, -1)$ . These lines do not intersect. A three and one-half inch ( $3\frac{1}{2}$ ) diameter blue circular disc is to be installed so that the plane of the disk is parallel to BOTH lines, and so that the center of the disk is equidistant from both lines. (This means that the center of the disk will be at the center of the shortest connector between the two lines.)

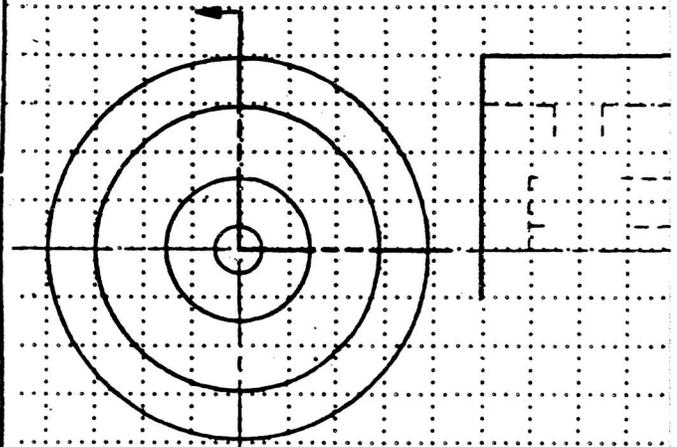


**NOTE:** This problem requires more thinking than drawing. Review all of the facts about perpendicular lines and planes. Try simulating the model using pencils and a plane (such as a floppy disk). Review the different ways to create new views using CAD. Notice the differences between constructing perpendiculars using 2D and 3D construction in CAD.

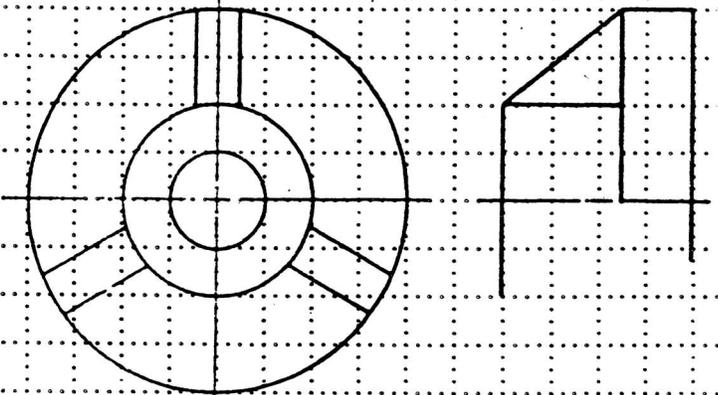
1. Construct a CAD model of the two lines and the disk.
2. Create a drawing that shows the TOP, FRONT, SIDE, and ISOMETRIC views of the lines and circle.
3. Add and label a view that shows the normal view of the disk.
4. Add and label a view that shows the edge view of the disk. Dimension the shortest connector line in this view.
5. Add a standard title block to the drawing.



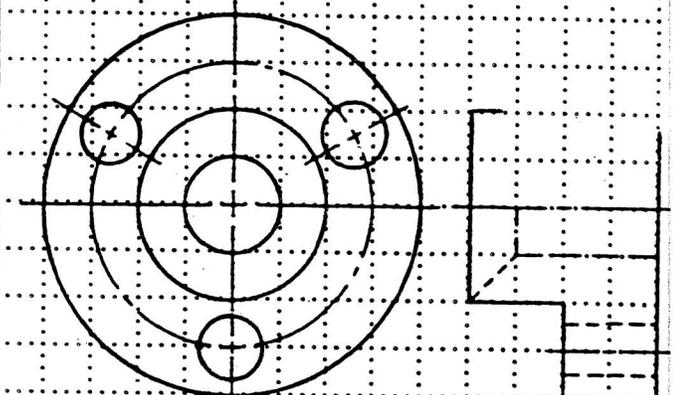
Sketch a full section view in place of the given right side view.



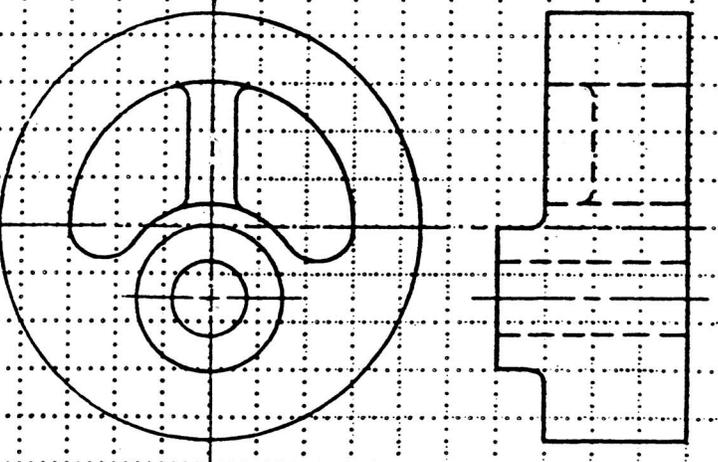
Sketch a half section view.



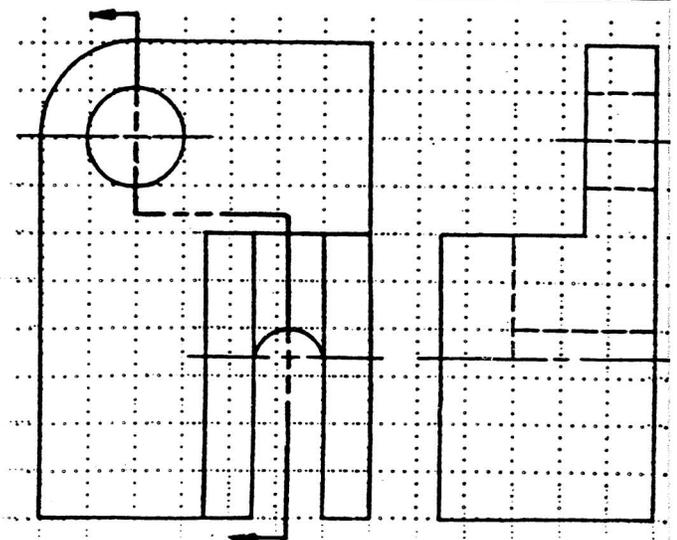
Complete the right side view as a half section view (sketch). Center hole is through.



Complete the right side view as a half section view (sketch).

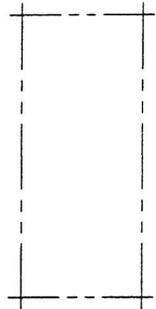
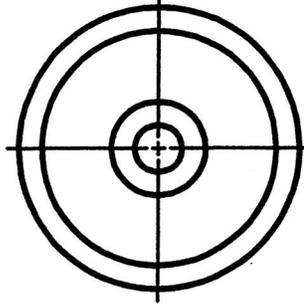
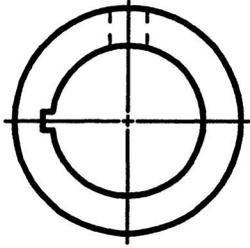
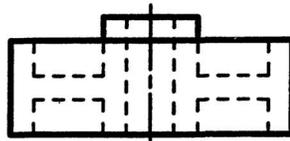
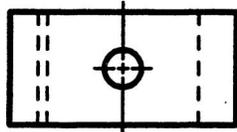


Complete the right side view as a full section view (sketch).



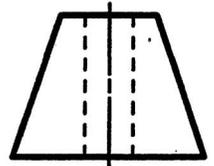
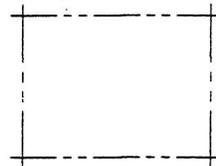
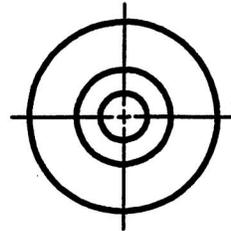
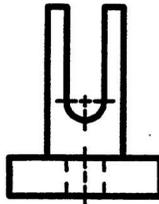
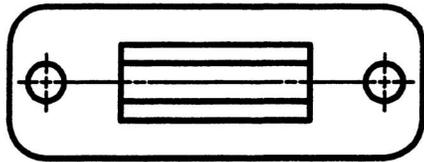
Complete the right side view as an offset section view (sketch).

TITLE	SCALE	NAME	DWG
	DATE		



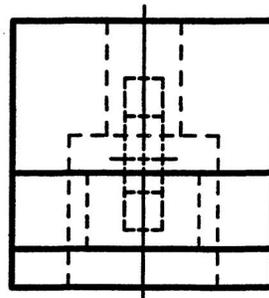
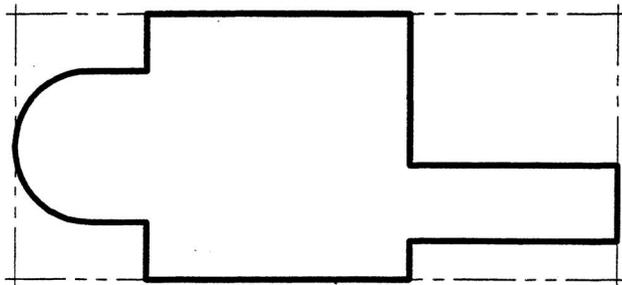
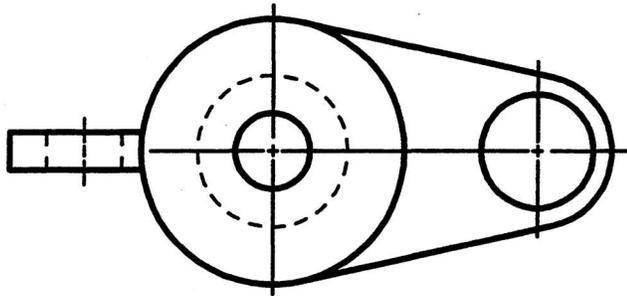
SKETCH A RIGHT FULL SECTION VIEW.

SKETCH A RIGHT HALF SECTION VIEW.



SKETCH A FRONT FULL SECTION VIEW.

SKETCH A FRONT HALF SECTION VIEW.



SKETCH A FRONT FULL SECTION VIEW.

TITLE

DATE:

NAME:

DWG:

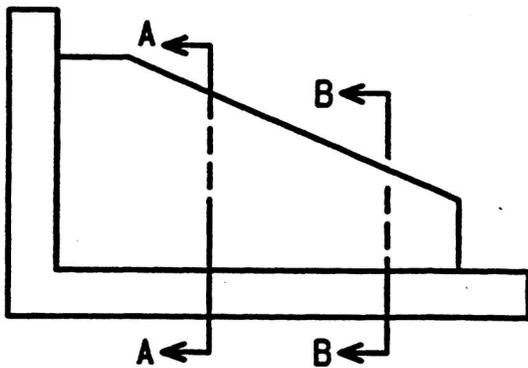
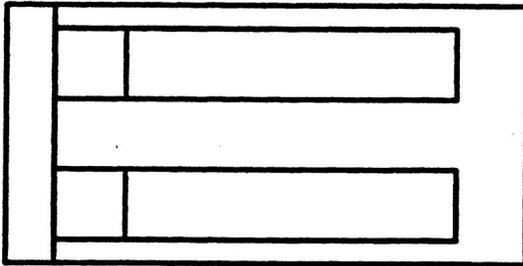
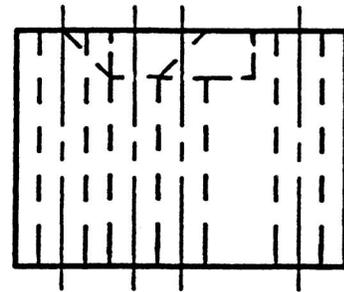
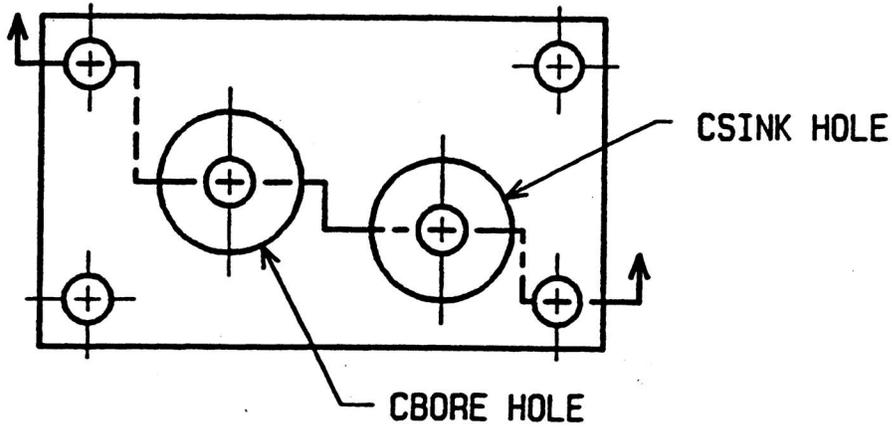
TIME:

INST:

HQR:

TABLE:

Given the top and right side views of the object, sketch the front view as an offset section.

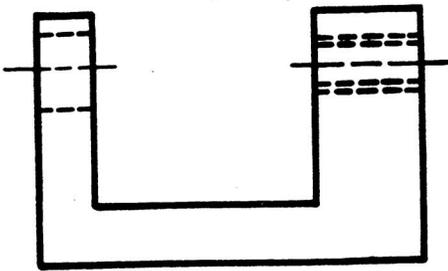


SECTION A-A

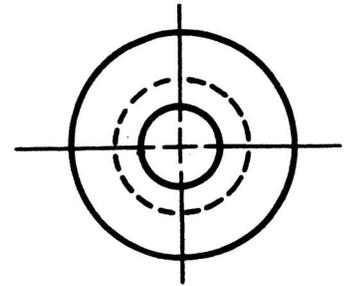
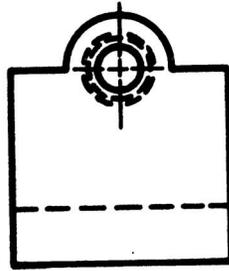
SECTION B-B

TITLE	SCALE	NAME			DWG
	DATE	INSTR	TABLE	HOUR	

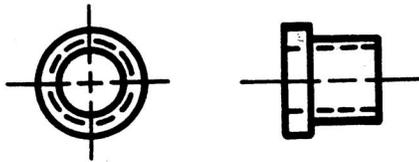
B 21 Section Views – Assembly



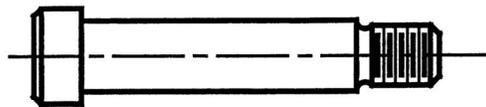
① BASE



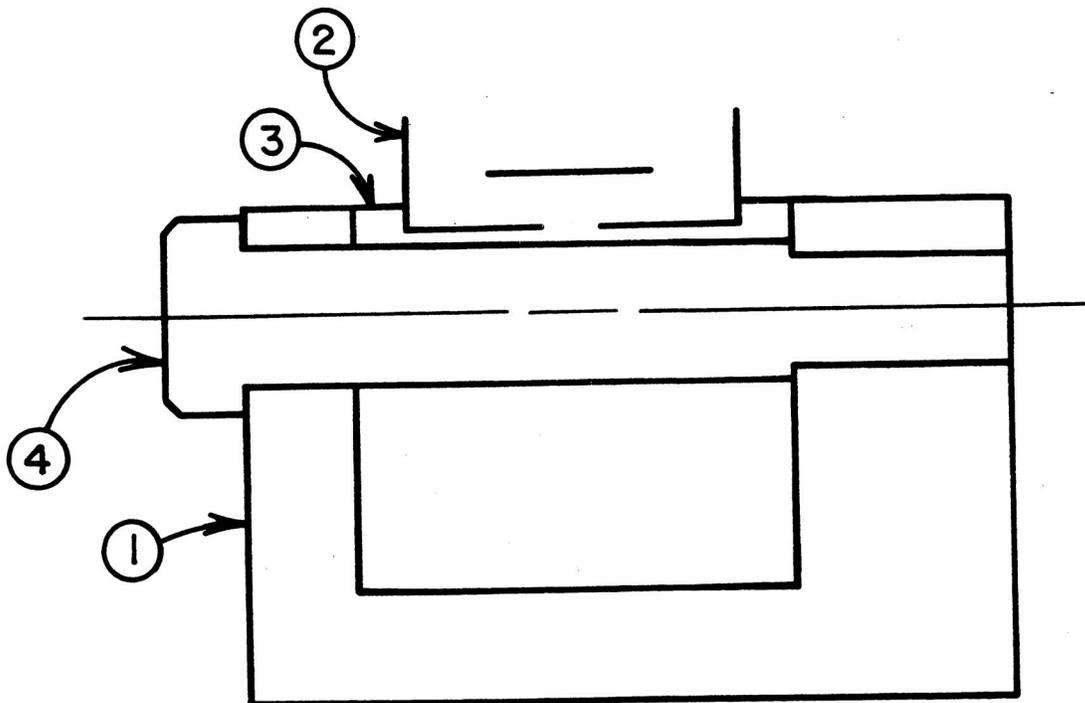
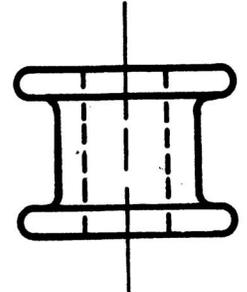
② ROLLER



③ BUSHING  
2 REQUIRED



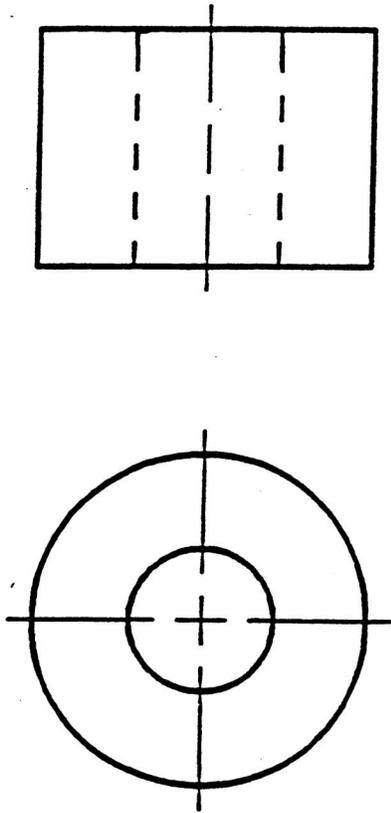
④ SOCKET HEAD  
SHOULDER SCREW



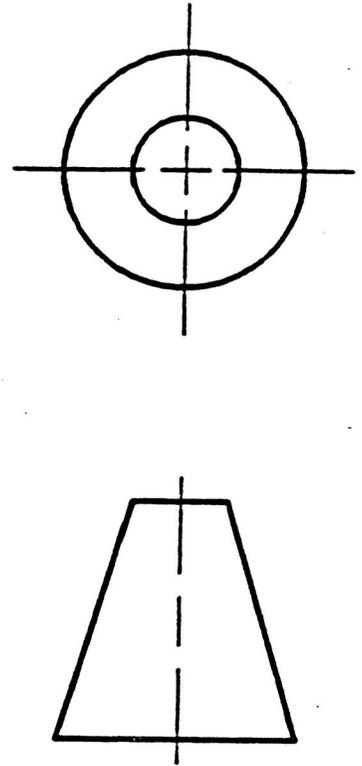
Complete the sectioned assembly. Assembly is full size; details are half size.

	SCALE DATE	NAME SECTION	DWG
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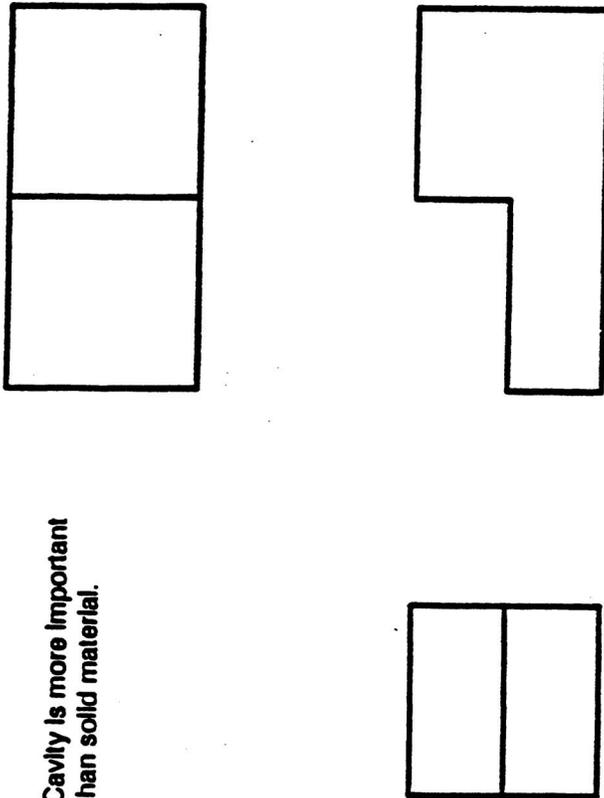
You have positive and negative cylinders.



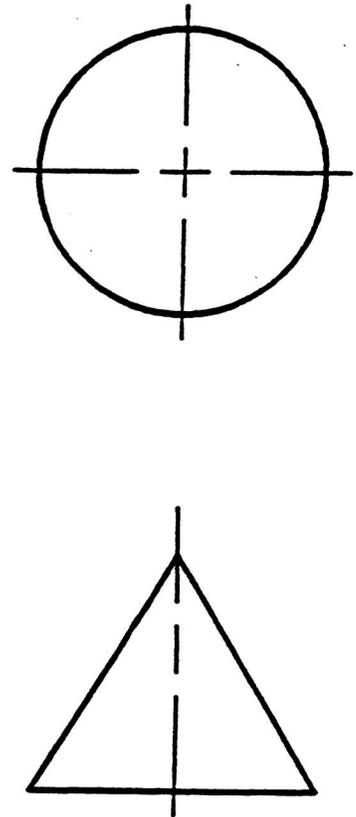
Diameters of bases are more important than angles.



Dimension these objects using two-place decimal dimensions.

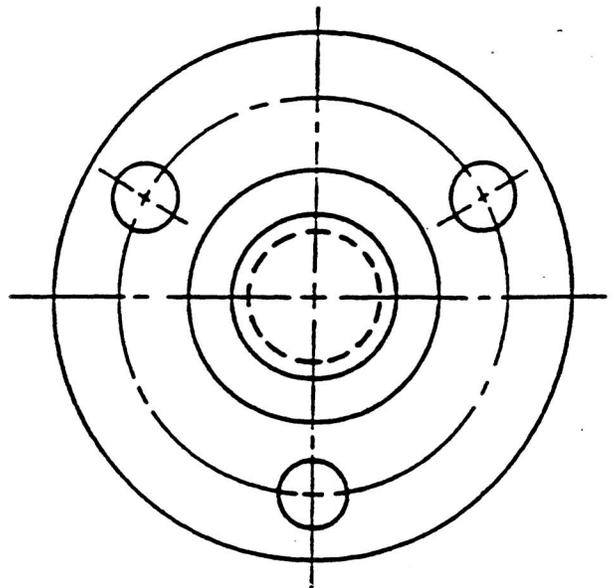
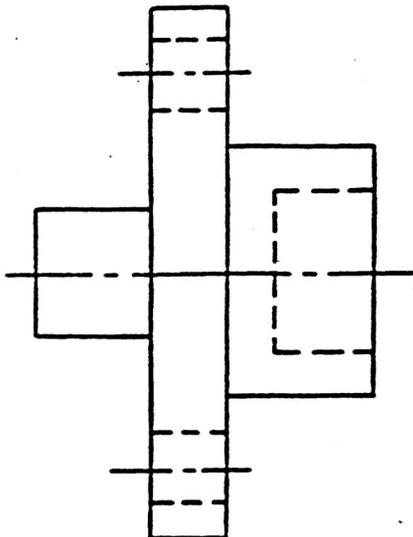
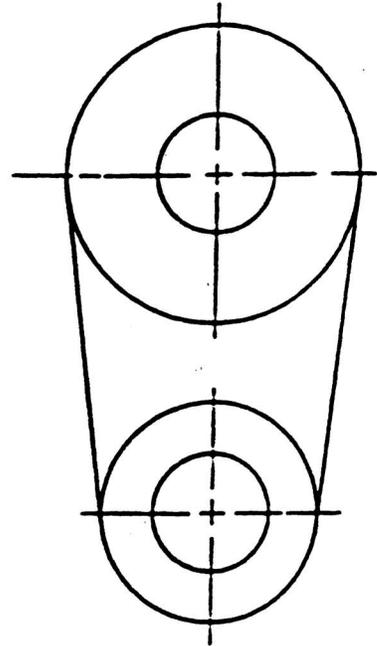
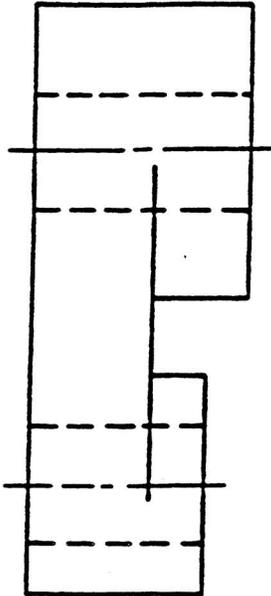


Cavity is more important than solid material.



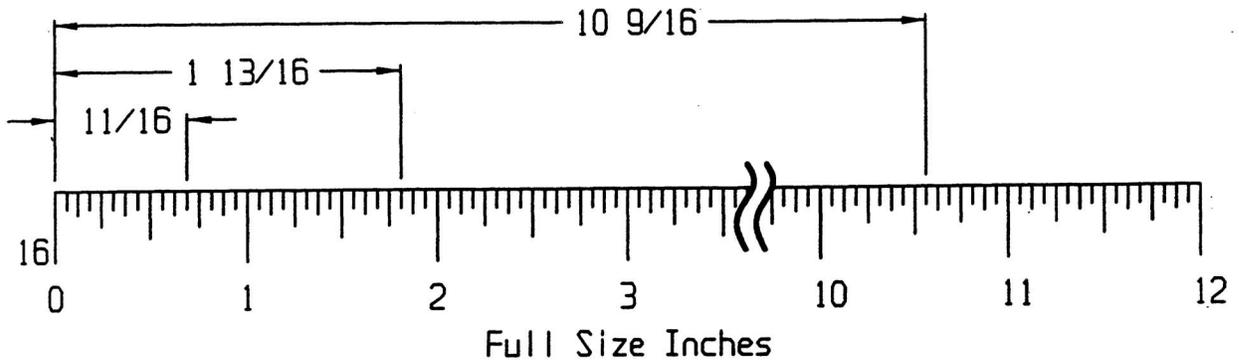
DATE: _____	NAME: _____	Dwg. _____
TIME: _____	INST: _____ HOUR: _____ TABLE: _____	

Describe the sizes of these objects by selecting and placing appropriate dimensions.  
Use one-place metric dimensions.

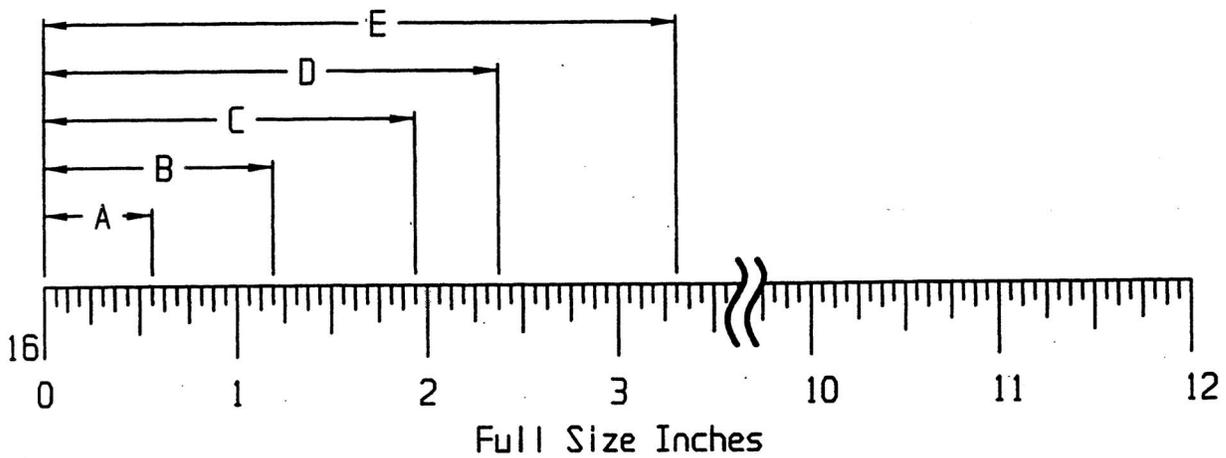


Title _____	DATE _____	NAME _____	Dwg. _____
	TIME _____	INST. _____ HOUR: _____ TABLE: _____	

EXAMPLE

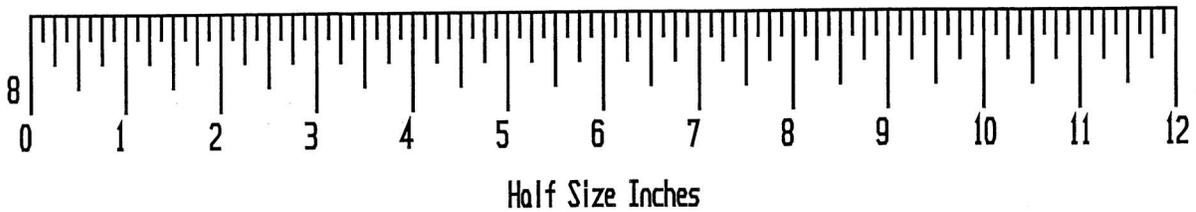


WRITE THE VALUE OF EACH MEASUREMENT IN THE SPACE BELOW.



A \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_ D \_\_\_\_\_ E \_\_\_\_\_

SKETCH DIMENSIONS FOR THE FIVE GIVEN VALUES

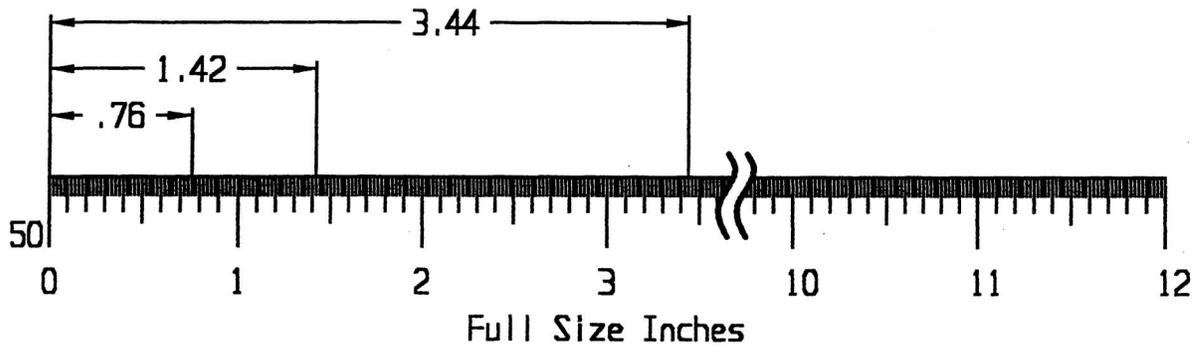


F  $\frac{7}{8}$  G  $3 \frac{3}{8}$  H  $5 \frac{1}{4}$  I  $8 \frac{1}{8}$  J  $10 \frac{3}{4}$

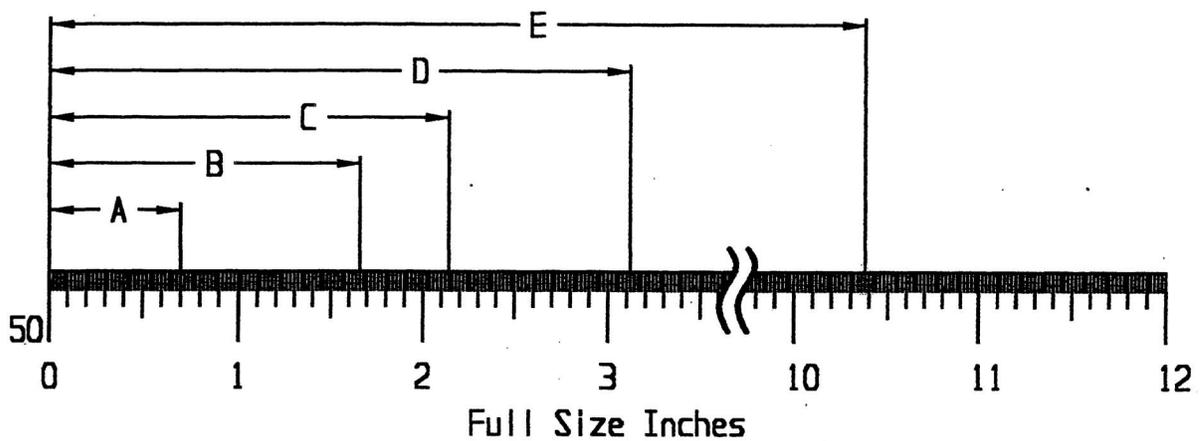
TITLE  
1/16 INCH SCALE

DATE: _____	NAME: _____	DWG: _____
TIME: _____	INST: _____	HOUR: _____
		TABLE: _____

EXAMPLE

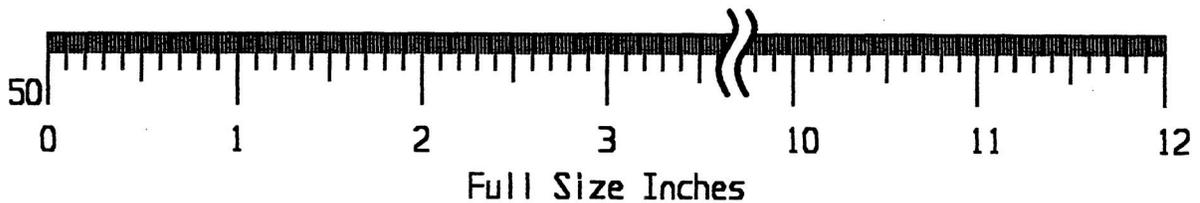


WRITE THE VALUE OF EACH MEASUREMENT IN THE SPACE BELOW.



A \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_ D \_\_\_\_\_ E \_\_\_\_\_

SKETCH DIMENSIONS FOR THE FIVE GIVEN VALUES



F .82 G 1.66 H 2.14 I 3.20 K 11.18

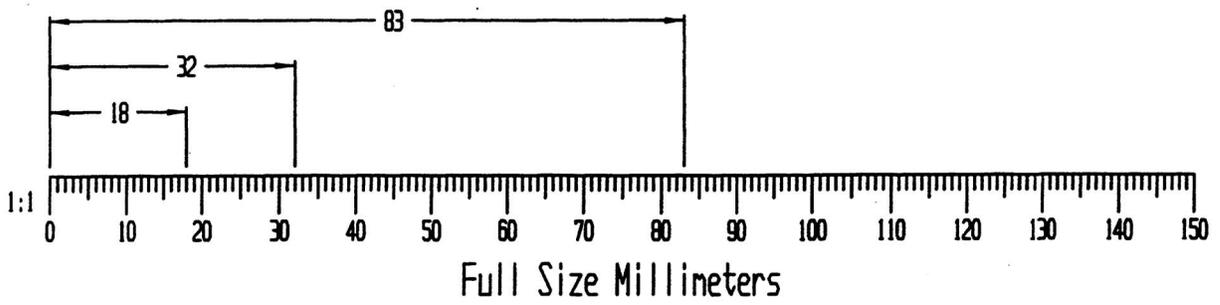
TITLE  
1:50

DATE: \_\_\_\_\_  
TIME: \_\_\_\_\_

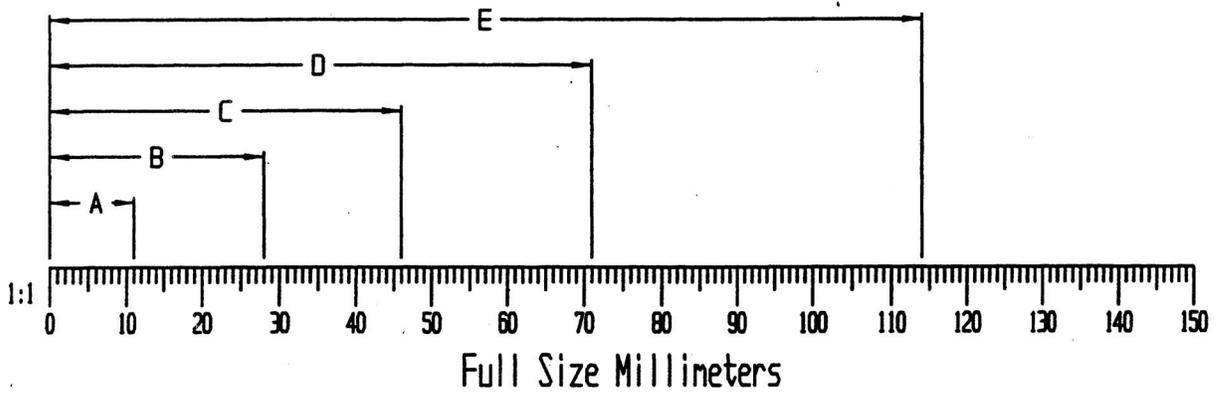
NAME: \_\_\_\_\_  
INST: \_\_\_\_\_ HOUR: \_\_\_\_\_ TABLE: \_\_\_\_\_

DWG: \_\_\_\_\_

EXAMPLE



WRITE THE VALUE OF EACH MEASUREMENT IN THE SPACE BELOW



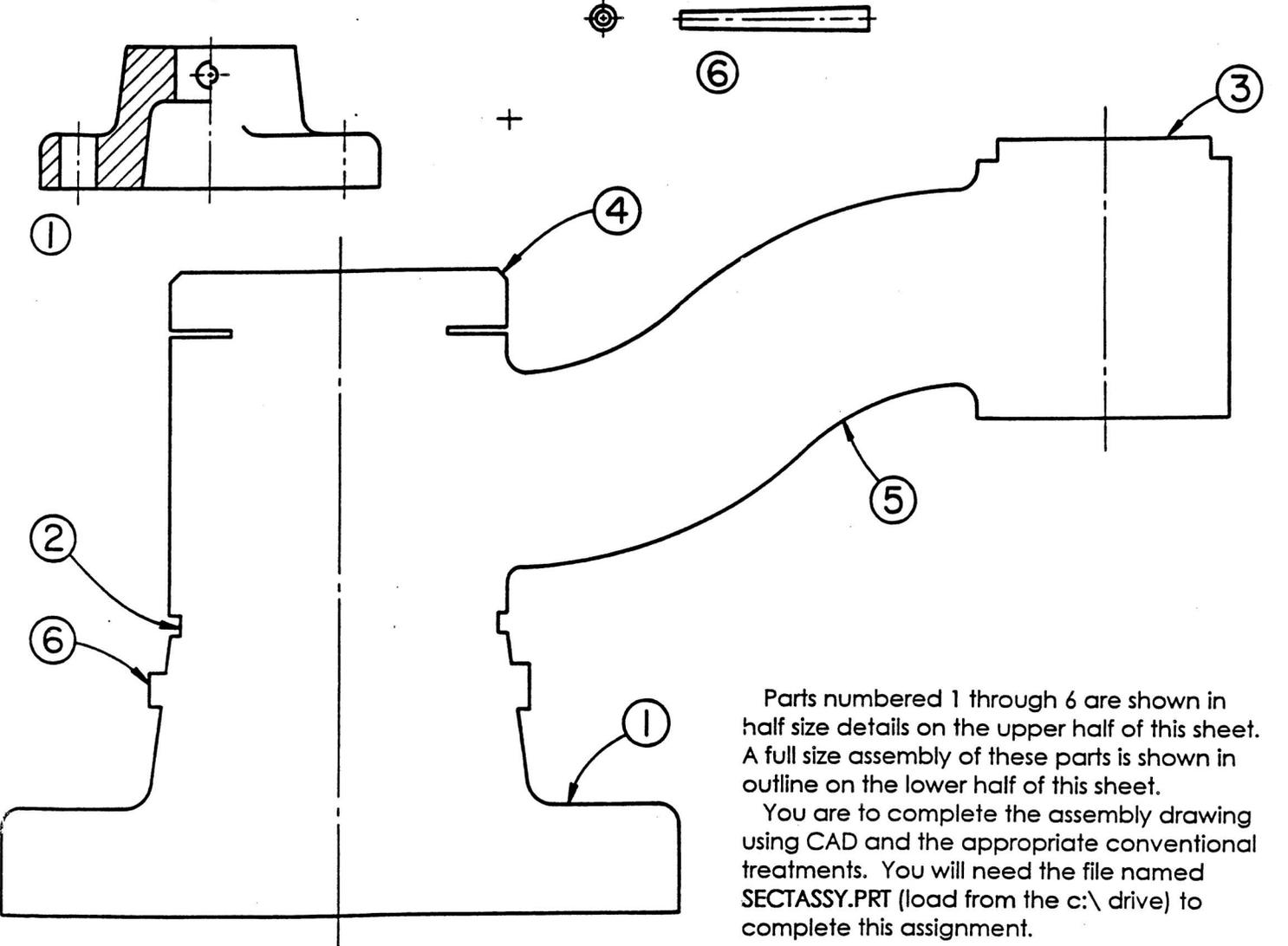
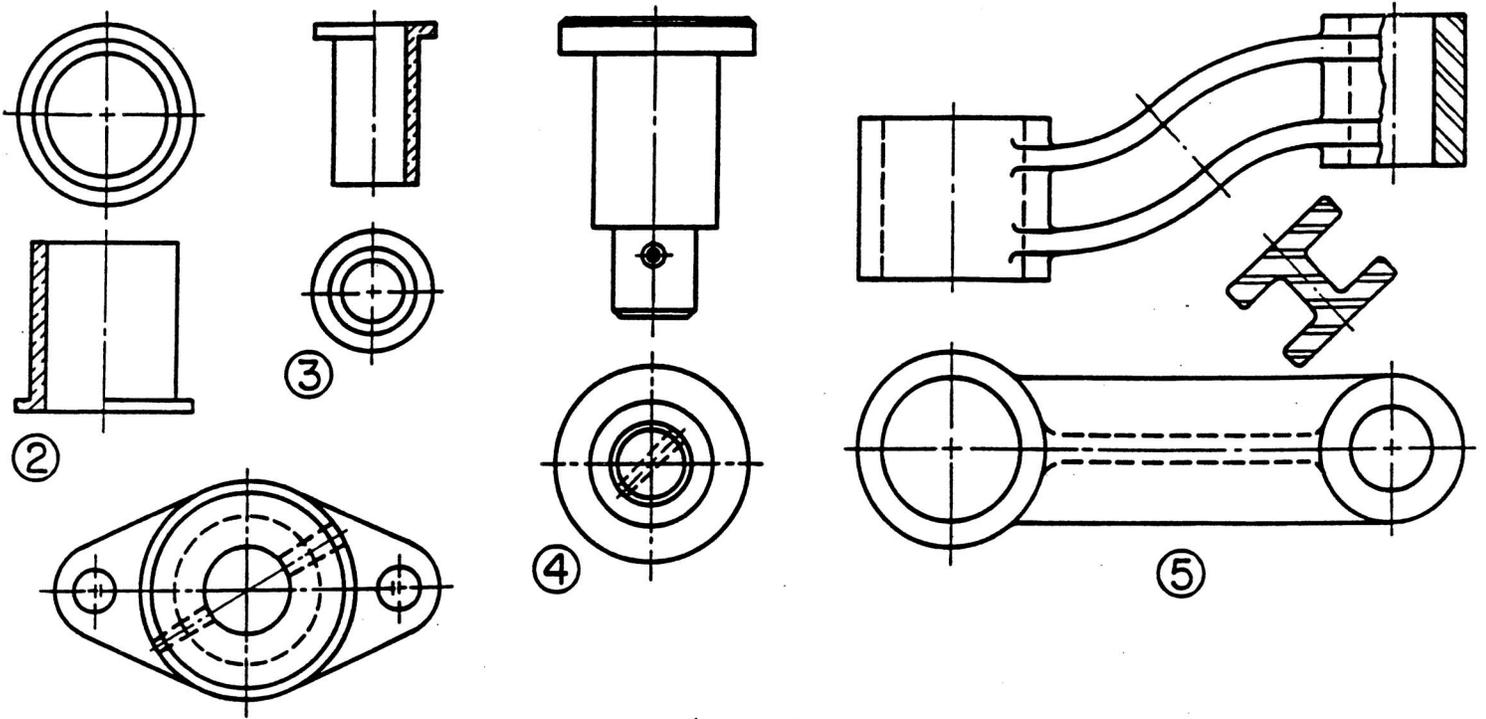
A ..... B ..... C ..... D ..... E .....

SKETCH DIMENSIONS FOR THE GIVEN VALUES



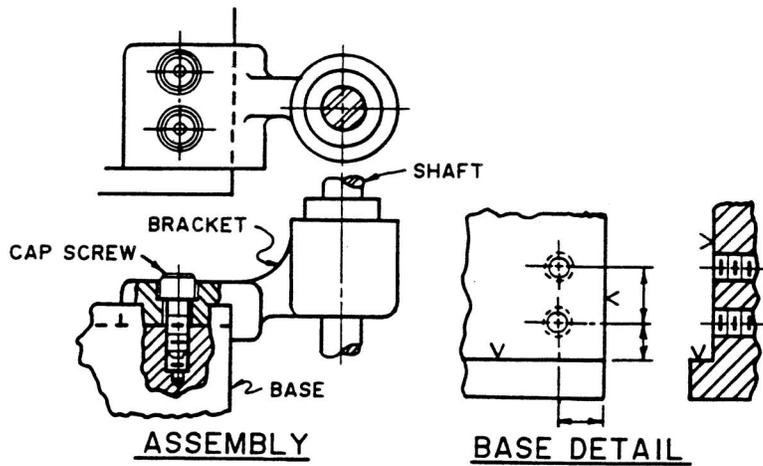
F 5 ..... G 39 ..... H 64 ..... I 86 ..... J 142 .....

TITLE MILLIMETERS	DATE: .....	NAME: .....	DWG: .....
	TIME: .....	INST: ..... HOUR: ..... TABLE: .....	

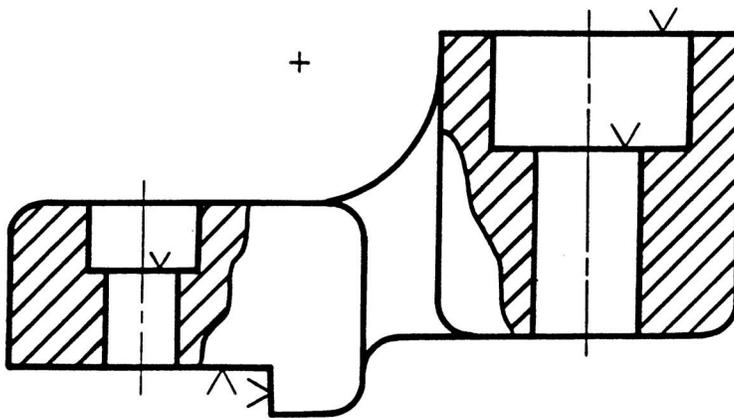
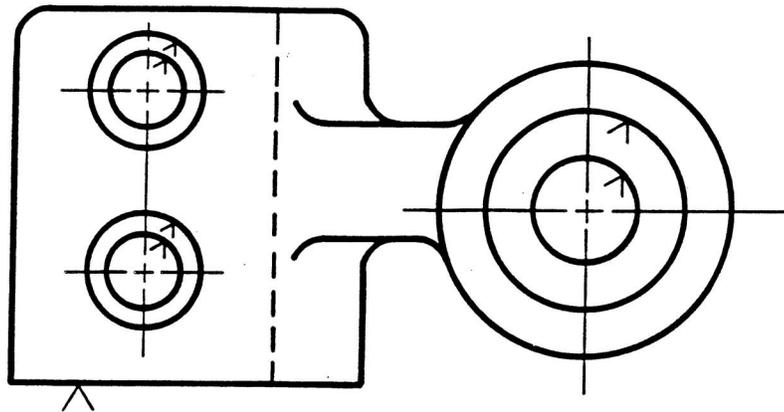


Parts numbered 1 through 6 are shown in half size details on the upper half of this sheet. A full size assembly of these parts is shown in outline on the lower half of this sheet.

You are to complete the assembly drawing using CAD and the appropriate conventional treatments. You will need the file named SECTASSY.PRT (load from the c:\ drive) to complete this assignment.



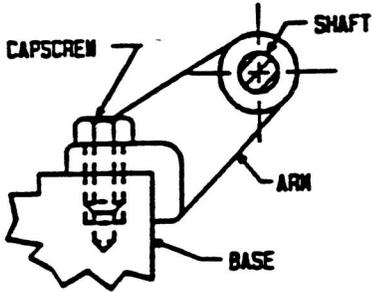
The function of the Bracket is to support the Shaft in the position indicated in the Assembly. Threaded holes for the Cap Screws will be located as shown on the Base Detail. You are to select and place the dimensions required to complete the Detail drawing of the Bracket. The function of the Bracket must be considered. Remember to locate finished surfaces and center lines relative to each other rather than to unfinished surfaces.



**METRIC**

	SCALE DATE	NAME SECTION	DWG
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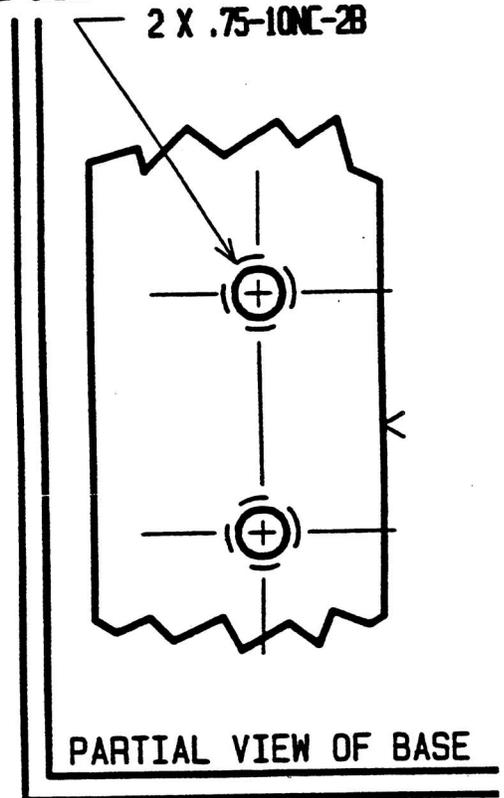
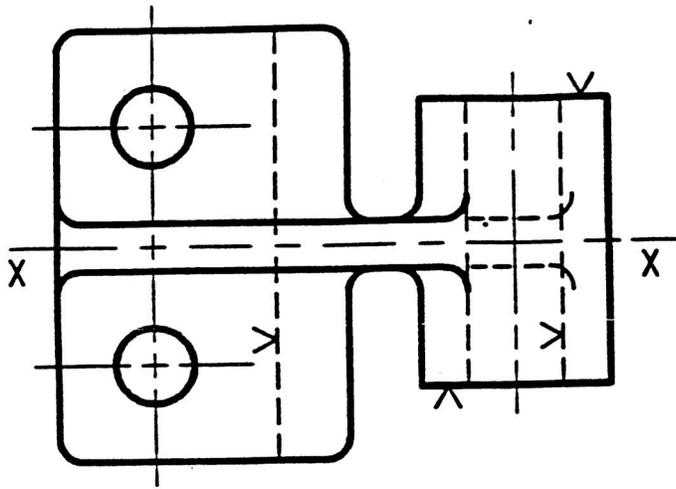
DIMENSIONS - Functional in Inches



ASSEMBLY

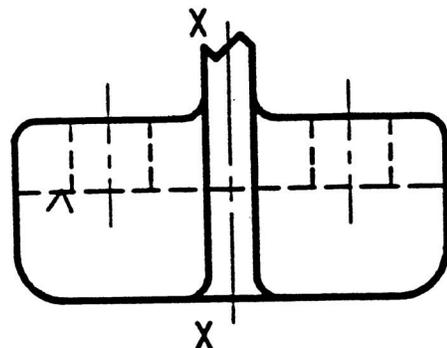
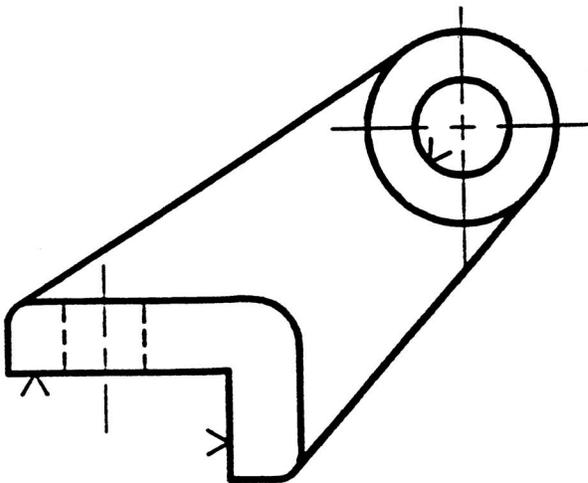
The function of the ARM is to support the SHAFT at the correct distances above and to the right of the BASE. Note that a partial view of the BASE is shown as well as a complete set of views of the ARM. You should complete the detail drawing of the ARM and the partial detail of the BASE by adding needed dimensions and notes. Keep in mind the functional relationships of the parts and locate features relative to centerlines and finished surfaces rather than to unfinished surfaces.

NOTE: SCALE IS HALF SIZE.



PARTIAL VIEW OF BASE

OBJECT SYMMETRICAL ABOUT AXIS X-X



INCHES

TITLE	SCALE	NAME			DWG
	DATE	INSTR	TABLE	HOUR	

TOLERANCES - Single Fits

Calculate the missing values for each situation shown below.

Use the tables for preferred limits and fits for cylindrical parts. (USAS B4.1) Check using the system tolerance relationship.

INTERFERENCE IS NEGATIVE CLEARANCE!

Clearance Fit (RC8)

Nominal Size \_\_\_\_\_

Basic Size \_\_\_\_\_

Minimum Clearance \_\_\_\_\_

Maximum Clearance \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

Clearance Fit (RC3)

Nominal Size \_\_\_\_\_

Basic Size \_\_\_\_\_

Minimum Clearance \_\_\_\_\_

Maximum Clearance \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

Transition Fit (LT3)

Nominal Size \_\_\_\_\_

Basic Size \_\_\_\_\_

Maximum Clearance \_\_\_\_\_

Maximum Interference \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

Transition Fit (LT5)

Nominal Size \_\_\_\_\_

Basic Size \_\_\_\_\_

Maximum Clearance .0004

Maximum Interference .0019

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

Interference Fit (FN5)

Nominal Size \_\_\_\_\_

Basic Size \_\_\_\_\_

Minimum Interference \_\_\_\_\_

Maximum Interference \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

Interference Fit (FN2)

Nominal Size \_\_\_\_\_

Basic Size \_\_\_\_\_

Minimum Interference .0006

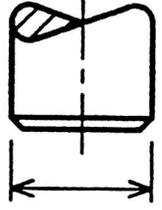
Maximum Interference .0019

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

TITLE	SCALE	NAME	DWG
	DATE		

METRIC TOLERANCES - Single

Using the given nominal sizes and fit specifications, calculate all values for basic sizes, hole and shaft sizes, clearances, and interferences. Use ANSI standard B4.2, Preferred Limits and Fits (Metric). Check by calculating tolerances of the systems.



**Free Running (H9/d9)**

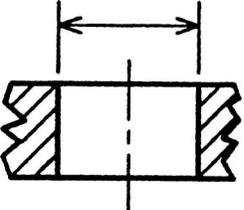
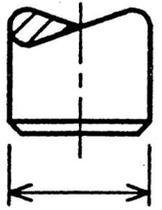
Nominal Size \_\_\_\_\_

Basic Size 20

Minimum Clearance \_\_\_\_\_

Maximum Clearance \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

**Close Running (H8/f7)**

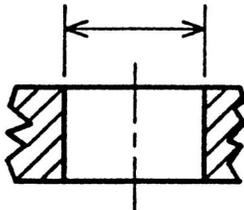
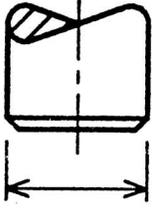
Nominal Size \_\_\_\_\_

Basic Size 20

Minimum Clearance \_\_\_\_\_

Maximum Clearance \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

**Locational Interference (H7/p6)**

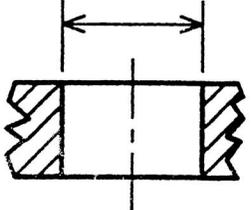
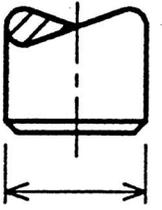
Nominal Size \_\_\_\_\_

Basic Size 10

Minimum Interference \_\_\_\_\_

Maximum Interference \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

**Force (H7/u6)**

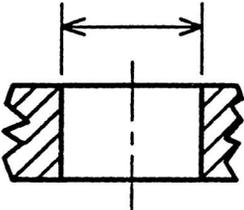
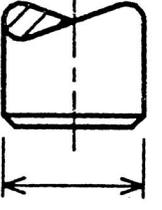
Nominal Size \_\_\_\_\_

Basic Size 10

Minimum Interference \_\_\_\_\_

Maximum Interference \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

**Sliding ( )?**

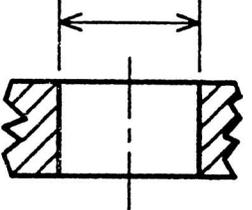
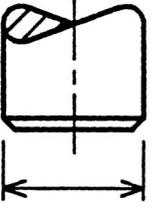
Nominal Size \_\_\_\_\_

Basic Size 40

Minimum Clearance \_\_\_\_\_

Maximum Clearance \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$

**Force ( )?**

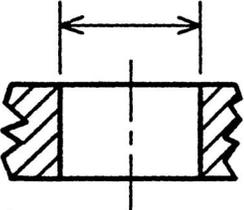
Nominal Size \_\_\_\_\_

Basic Size 100

Minimum Interference \_\_\_\_\_

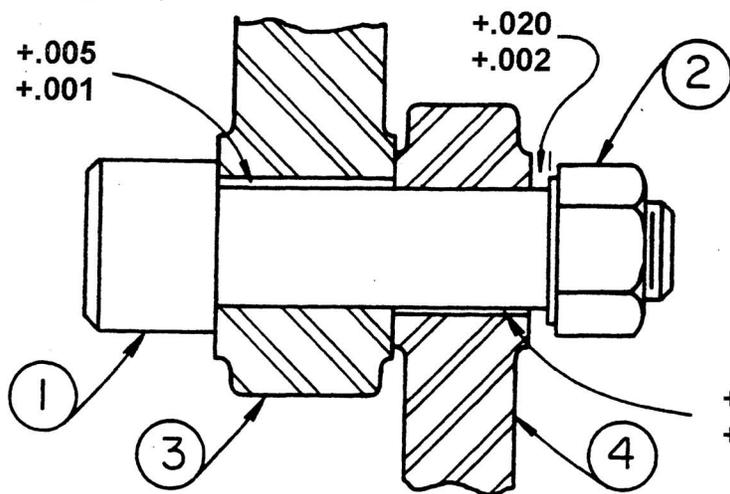
Maximum Interference \_\_\_\_\_

$T_s = CL_{max} - CL_{min} = T_1 + T_2$



TITLE	SCALE	NAME	DWG
	DATE		

Complete the dimensions of the Detail Drawings. When the parts are made according to the dimension values you give, they should fit together as indicated in the Assembly Drawing.



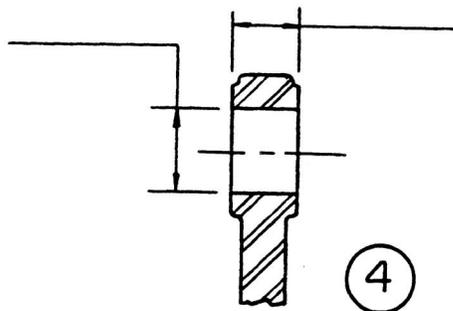
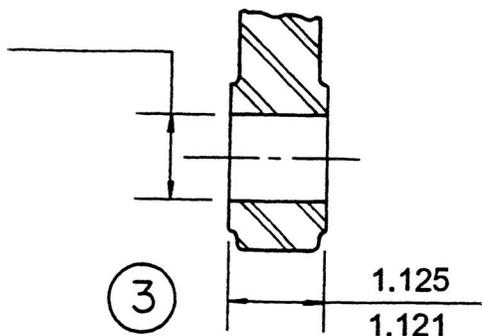
- Part 1. American Standard Socket-head Shoulder Screw \* (Shoulder 5/8 D. x 1 3/4 L.)
- Part 2. Semi-finished Hex. Nut (1/2 - 13NC - 3)
- Part 3. Fixed Link
- Part 4. Pivot Link

PIVOT JOINT

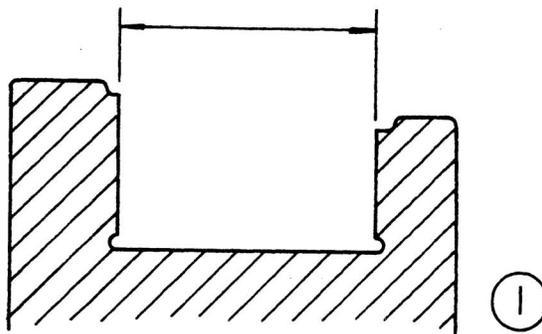
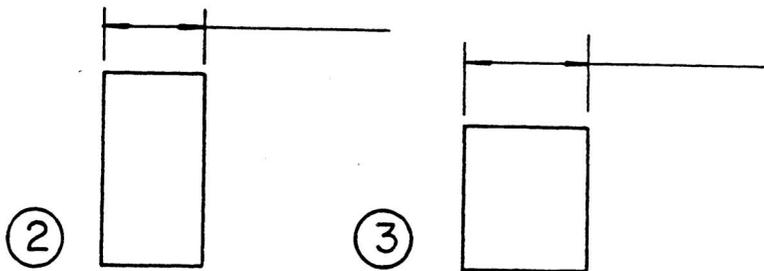
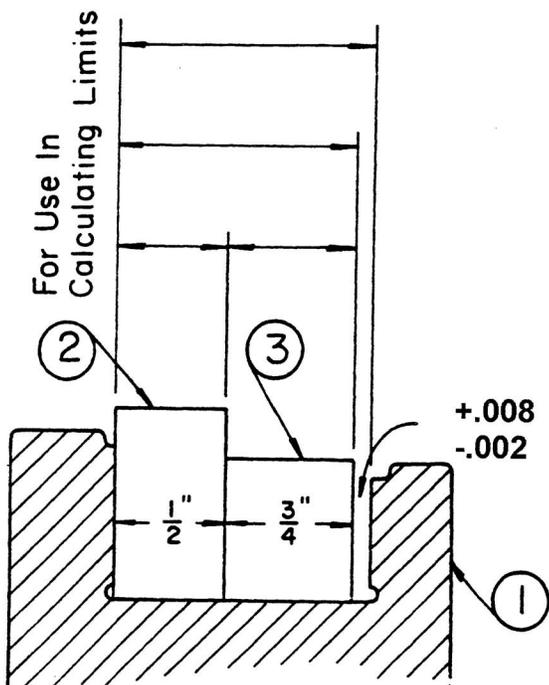
Shoulder screw information

5/8 D - .6230  
.6210

1 3/4 Length - +/- .005



For Use In Calculating Limits



C&R

SCALE	NAME	TABLE	HOUR	DWG
	INSTR			

1,2. Given the thread specification: **M10 x 1.5 - 6g**

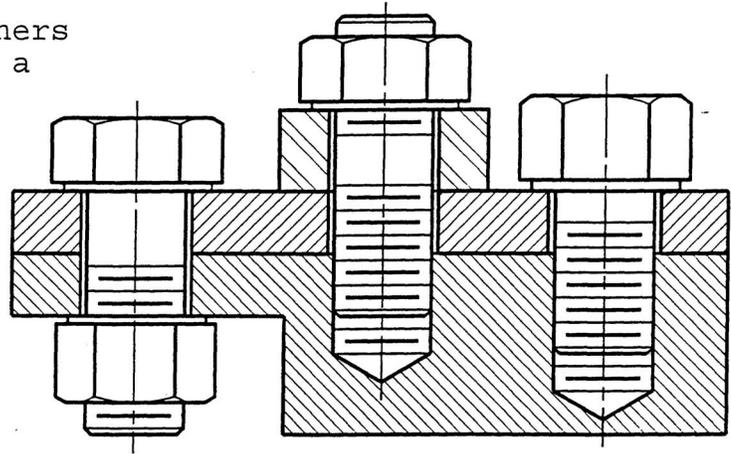
What is the *major diameter*? (give size & units) \_\_\_\_\_

What is the *tolerance*? \_\_\_\_\_

What is the *pitch*? (give size & units) \_\_\_\_\_

Is this an *internal* or an *external thread*? (circle one)

3,4,5. Identify the 3 fasteners shown here by adding a note to each one.



6,7. Given the thread specification: **.50 - 20UNF - 2A**

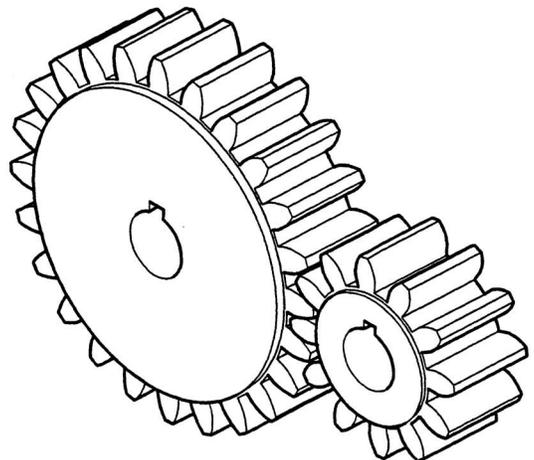
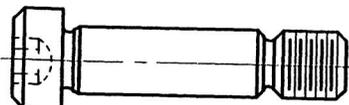
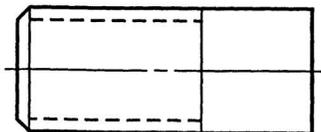
What is the *pitch*? (give size & units) \_\_\_\_\_

Is this an *internal* or *external thread*? (circle one)

What is the *thread form*? \_\_\_\_\_

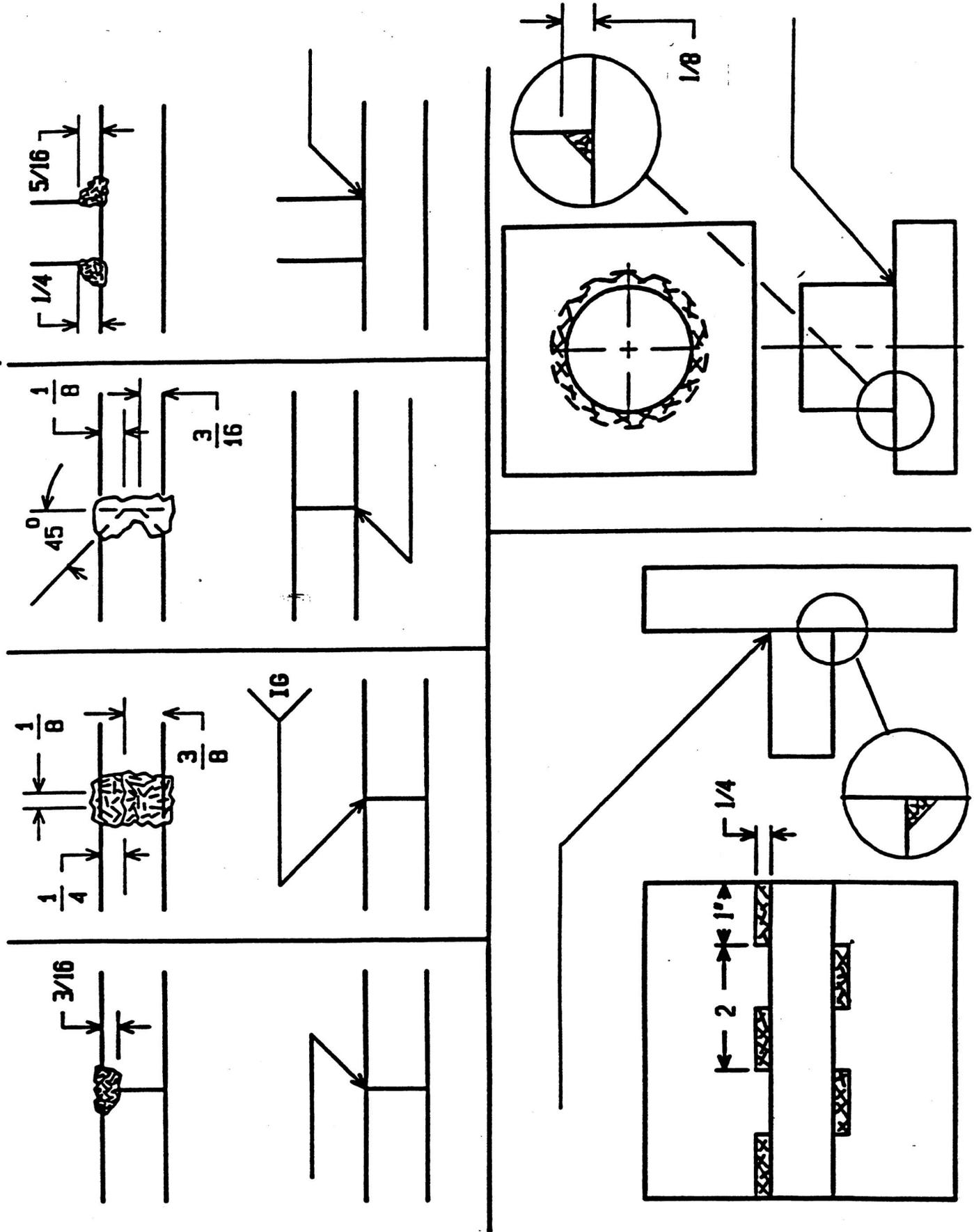
What is the *major diameter*? (give size & units) \_\_\_\_\_

8,9,10. Identify the items shown here by adding a note to each.

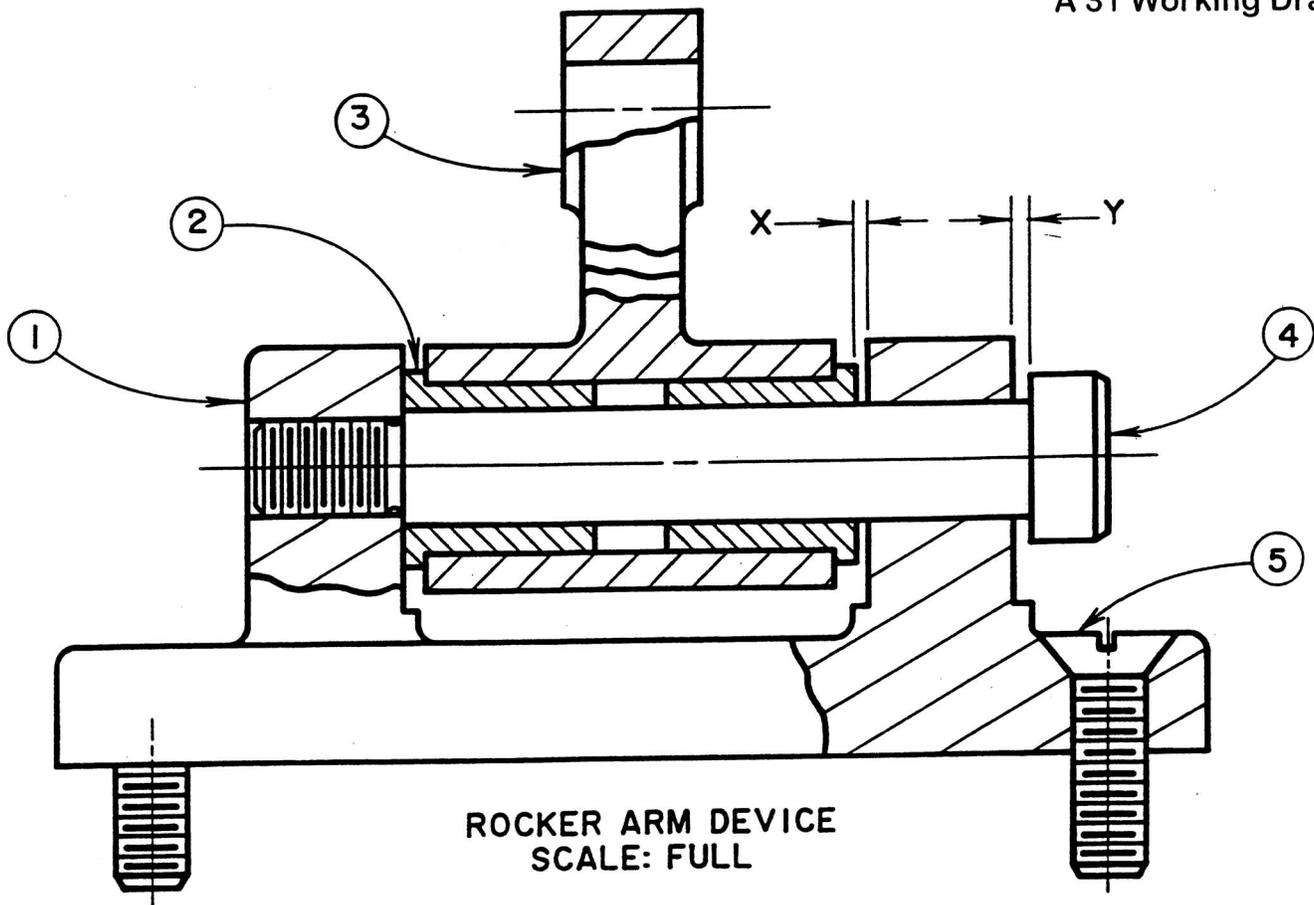


	DATE SCALE	NAME SECTION SEAT #	DWG
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The first illustration in each rectangle describes a weld. Give the appropriate AWS symbol for that weld on the second illustration.



FILE	DATE	NAME	DWG.
	TIME	POST. HOUR. TABLE.	



ROCKER ARM DEVICE  
SCALE: FULL

PARTS LIST				
PC. NO.	REQ	NAME	MAT'L	NOTES
1	1	SUPPORT	CI	SEE DETAIL DWG
2	2	BUSHING	BRO	DO
3	1	ARM	CI	DO
4	1	SHOULDER SCREW	.625 X 3.25, .50-13UNC-3A	
5	4	CAP SCREW	FLAT HD, .375-16UNC-2A X 1.25	

Pc 4 with Pc 1 Clearance .003/.008 Clearance at X: .005/.020  
 Pc 4 with Pc 2 Clearance .004/.009 Clearance at Y: .004/.019  
 Pc 3 with Pc 2 Interference .002/.006 General tolerances: ± .02

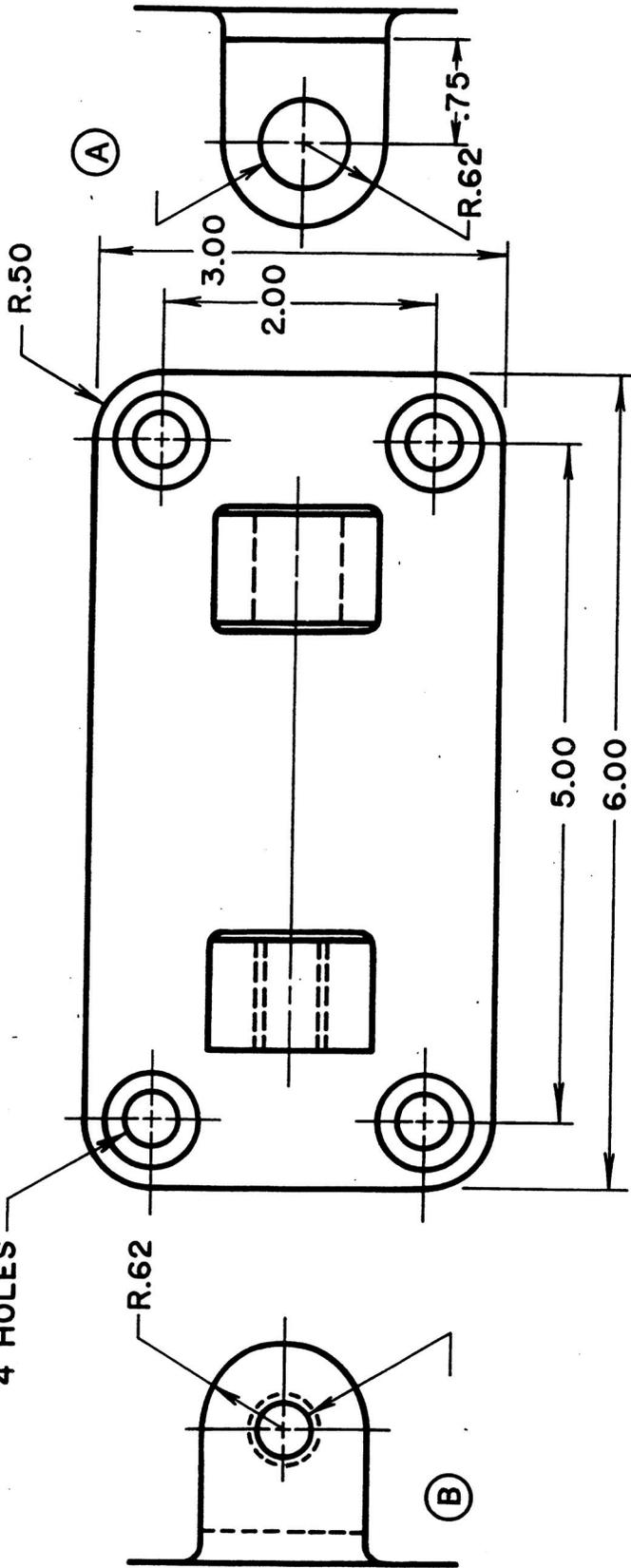
Unless otherwise given, scale detail drawings for nominal sizes.

A set of Engineering Drawings consists of an Assembly Drawing, a Parts List or Bill of Material, and Detail Drawings of all non-purchased parts. In this case the Assembly Drawing and Parts List are furnished.

You are to finish the set of drawings by completing the detail drawings of Parts 1, 2, and 3.

	SCALE DATE	NAME SECTION	DWG
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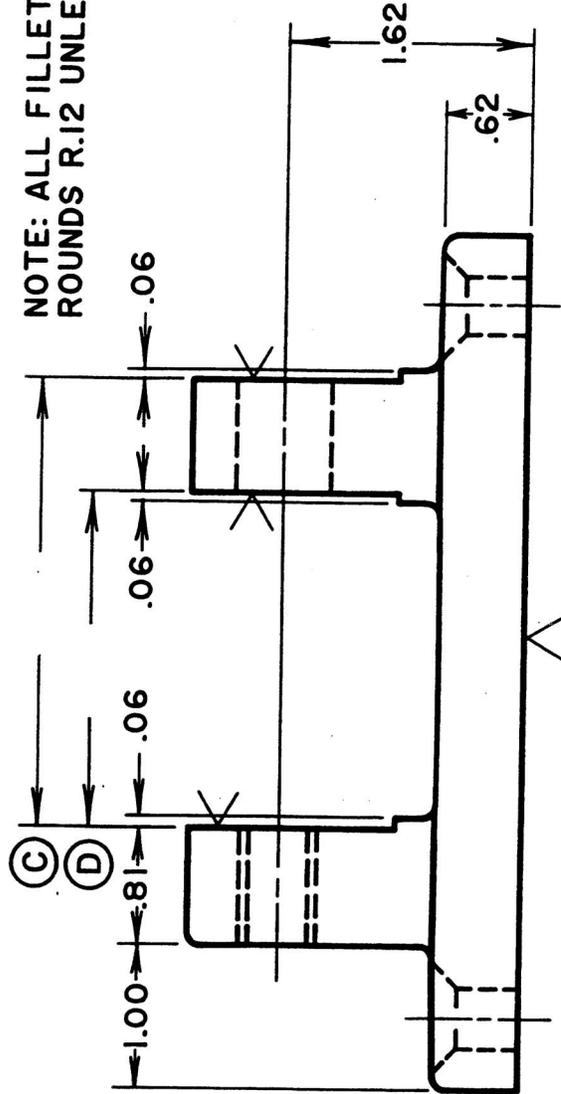
Ø.44, CSK Ø.75 AT 82°  
4 HOLES



(A)

(B)

NOTE: ALL FILLETS AND  
ROUNDS R.12 UNLESS NOTED



(C)

(D)

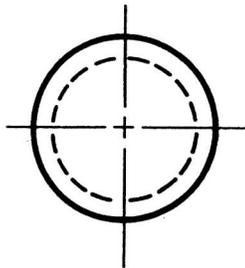
PC. NO. 1	SUPPORT	1 REQ	SH NO
MTL: CI	SCALE .75=1.00	DATE 1-6-88	2 OF 4

You are to complete this drawing by supplying dimensions at A, B, C, and D and also rewriting the note in the upper left-hand corner.

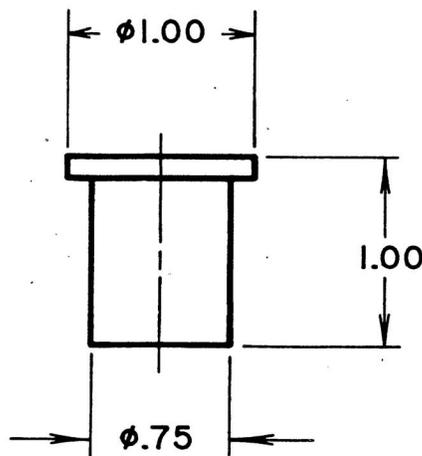
TITLE	SCALE	NAME	DWG
	DATE		

You are to complete this drawing by supplying all missing dimensions and line work.

(G)



(H)



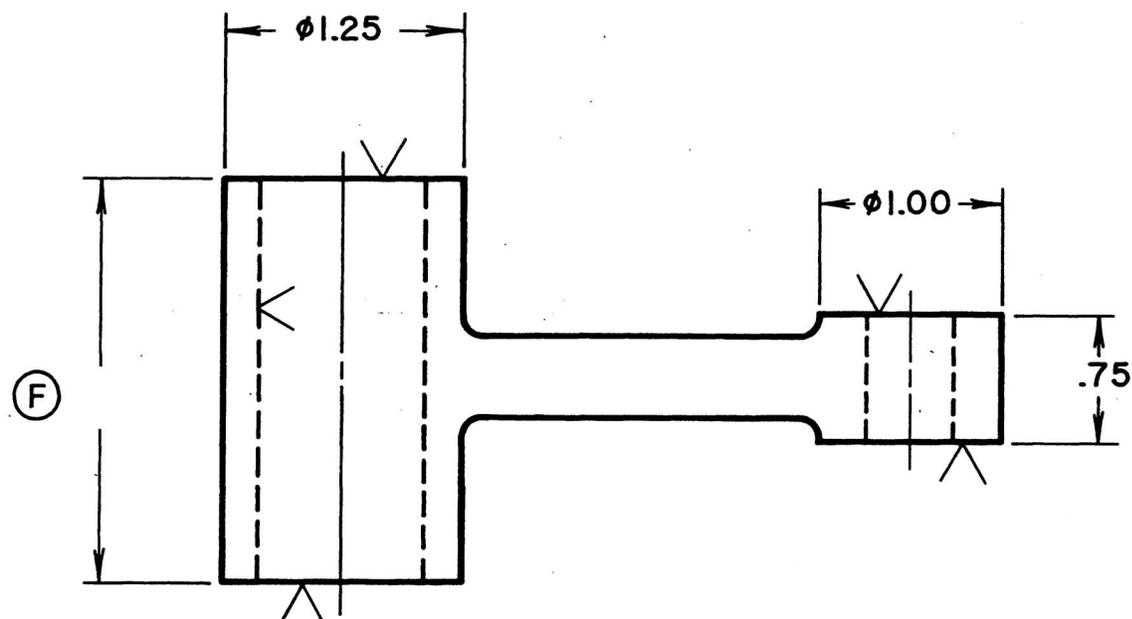
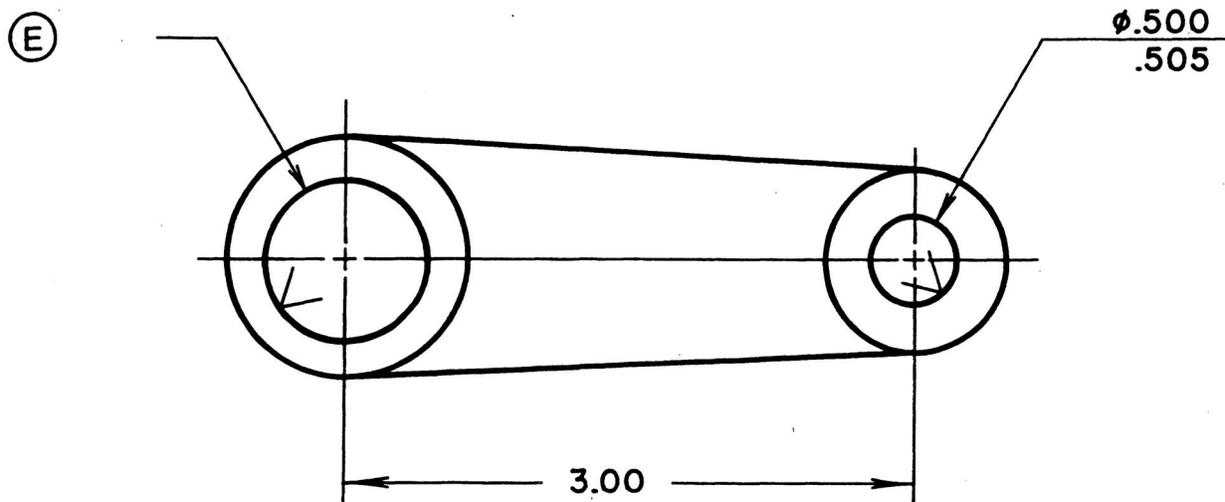
NOTE: FINISH ALL OVER

PC. NO. 2	BUSHING	2 REQ	SH NO
MTL: BRZ	SCALE: FULL	DATE 1-6-88	3 OF 4

	SCALE DATE	NAME SECTION	DWG
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You are to complete this drawing by supplying all missing dimensions and line work.

A 31c Working Drawings



NOTE: ALL FILLETS AND ROUNDS R.12 UNLESS NOTED

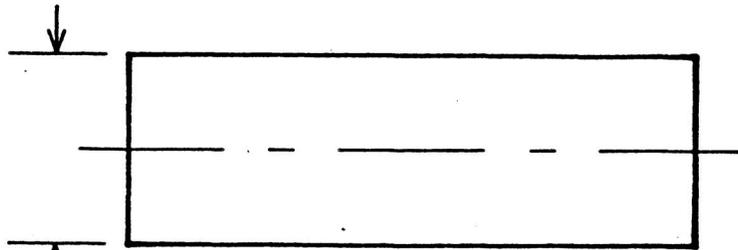
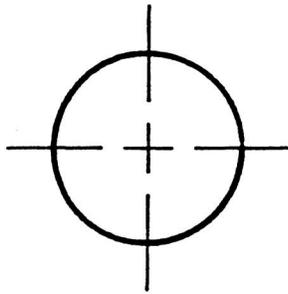
PC. NO. 3	ARM	I REQ	SH NO
MTL: CI	SCALE: FULL	DATE 1-6-88	4 OF 4

TITLE	SCALE	NAME			DWG
	DATE	INSTR	TABLE	HOUR	

GEOMETRIC DIMENSIONING & TOLERANCES - Symbolology

Make a drawing which illustrates the total tolerance allowed on this shaft. Note the virtual condition of this part. At the LEAST MATERIAL CONDITION what would the straightness tolerance be? \_\_\_\_

Note the limits on the diameter here:

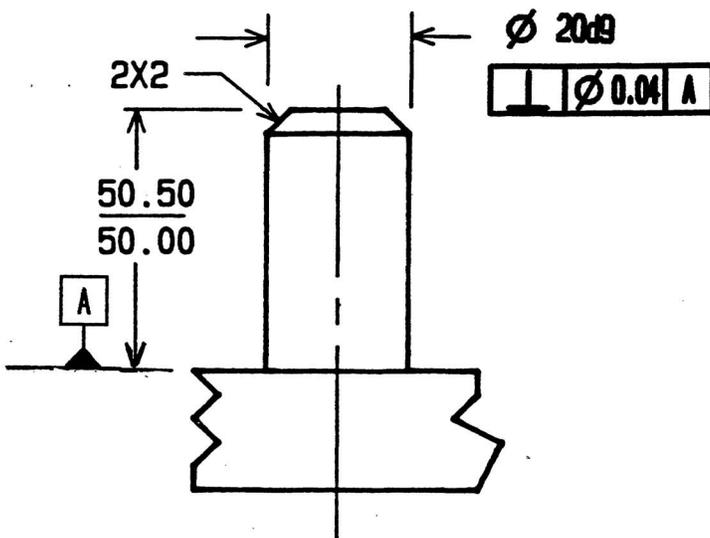


MILLIMETERS

$\varnothing 16_{-0.06}^0$

—	$\varnothing$	0.04	$\textcircled{M}$
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What are the limits of the diameter for the cylindrical projection? \_\_\_\_\_  
 Make a sketch showing the meaning of the Feature Control Frame.



	DATE	NAME		DWG
	SCALE	SECTION	SEAT #	

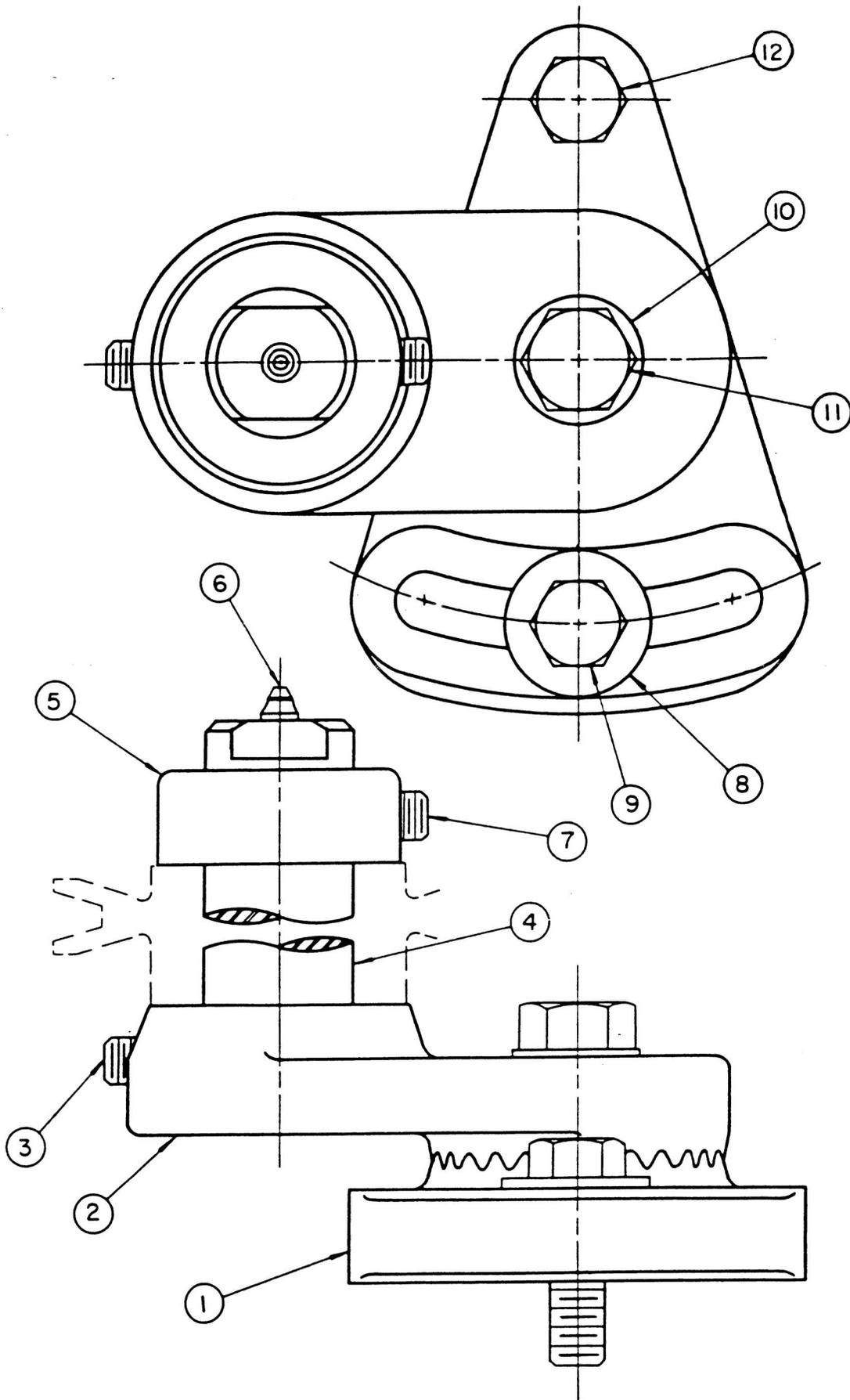
UNIVERSAL DRIVE TENSIONER

1. What is the total number of parts furnished with this machine? \_\_\_\_\_
2. Is an idler Sheave among the items furnished with this machine? \_\_\_\_\_
3. Are all the furnished items manufactured by the Brewer Machine and Gear Co.?  
(Disregard ASA items.) \_\_\_\_\_ If not, which item is purchased elsewhere?  
\_\_\_\_\_
4. How many different Sheaves can be mounted on this machine? \_\_\_\_\_
5. How is the Zerk fitting attached to its mating part?  
(Check answer.) \_\_\_\_\_ Threading; \_\_\_\_\_ Welding; \_\_\_\_\_ Pressing
6. What type of fastener is Item No. 7? \_\_\_\_\_
7. What is the nominal diametral clearance between Item No. 9 and its mating part?  
\_\_\_\_\_
8. How far does the threaded end of Item No. 9 extend beyond its mating part when  
snuggly assembled? (Use nominal values.) \_\_\_\_\_
9. What is the maximum distance the threaded end of Item No. 12 can extend beyond  
its mating part? (Use general tolerances.) \_\_\_\_\_
10. What, if anything, is apparently wrong with the specification of Item No. 12?  
\_\_\_\_\_
11. How far must Item No. 11 be backed off axially before the Arm can be rotated  
relative to the Base? (Use nominal values.)  
(Check answer.) \_\_\_\_\_ more than .13"; \_\_\_\_\_ less than .13";  
\_\_\_\_\_ exactly .13".
12. What is the minimum angular increment through which the Arm can be rotated  
relative to the Base? (Use nominal value.) \_\_\_\_\_
13. Repeated assembly and disassembly of the Tensioner is likely to result in thread  
damage at one particular location. Give the item numbers of the parts involved.  
\_\_\_\_\_ and \_\_\_\_\_. What design modification do you suggest  
to correct this condition? \_\_\_\_\_
14. What is the maximum angular adjustment of which the Base is capable?  
(Calculate, using nominal values.) \_\_\_\_\_ degrees.

C&R

	SCALE	NAME	TABLE	HOUR	DWG
		INSTR			



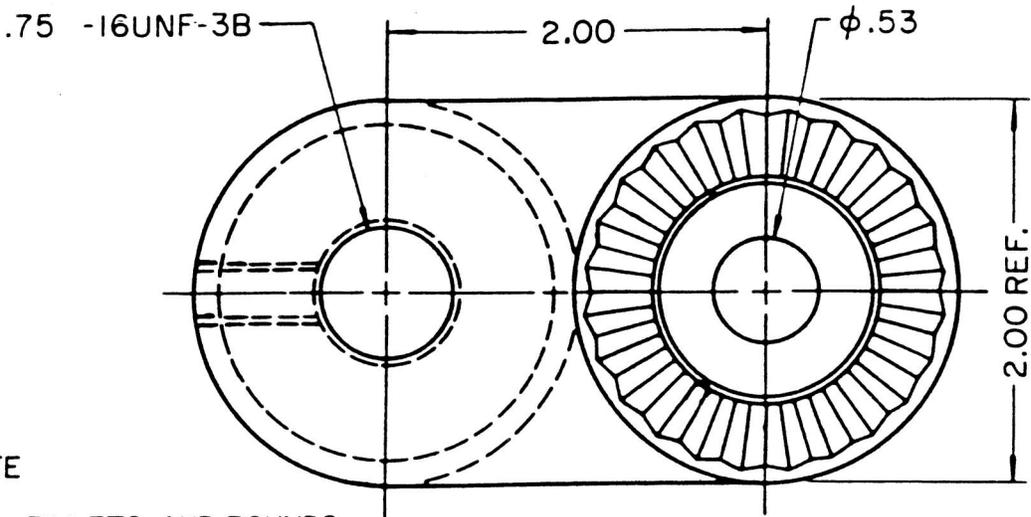


DWN	LIMITS, UNLESS OTHERWISE NOTED:			REVISION	DATE	CHANGE OR ADDITION		
	DECIMAL $\pm 0.01$ ANGULAR $\pm \frac{1}{2}^\circ$			MATERIAL	STOCK SIZE	HEAT TR	FINISH	
TCD	PART NO	RECD	NAME	SCALE	<b>BECKER MACHINE &amp; GEAR CO.</b> <small>MADE IN U.S.A.</small>			DRAWING NO.
CKD	ASSEMBLY			FULL				NO 1 OF 5
APPD	UNIT OR ASSEMBLY	UNIVERSAL DRIVE TENSIONER		ABSY DR NO	<small>321</small>			321
DATE			321					

ITEM NUMBER	PART NUMBER	DESCRIPTION	MATERIAL	QTY
1	100	BASE	CI	1
2	101	ARM	CI	1
3	53	.3125 - 18UNC - 2A X .50 LG. SOC. HD. SETSCREW, CUP PT.	STEEL	1
4	*	IDLER SHAFT	CH. STL	1
5	SC-100	BOSTON GEAR PART NO. SC-100	STEEL	1
6	5029	.25 ZERK FITTING	STEEL	1
7	54	WITH NO. 5	STEEL	1
8	65	.375 PLAIN WASHER, LIGHT	STEEL	1
9	66	.375 - 16UNC - 2A X 1.25 LG. HEX. HD. CAP SCR.	STEEL	1
10	67	.50 INT. LOCK WASHER	STEEL	1
11	68	.50 - 13UNC - 2A X 1.50 LG. HEX. HD. CAP SCR.	STEEL	1
12	55	.375 - 16UNC X 1.125 LG. HEX HD. CAP SCR.	STEEL	1

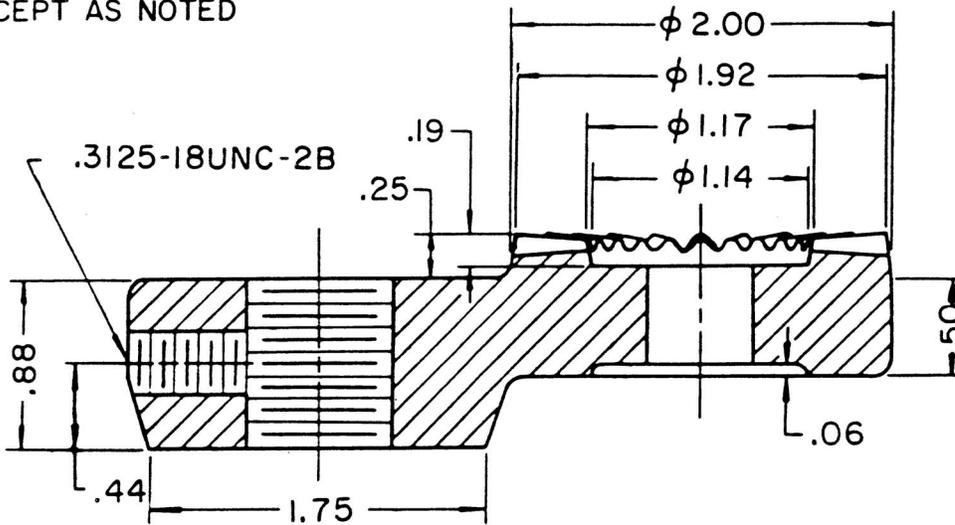
\* SEE DWG. 325 FOR PART NUMBERS

DWN	LIMITS, UNLESS OTHERWISE NOTED:			REVISION	DATE	CHANGE OR ADDITION			
	DECIMAL ±.01 ANGULAR ± $\frac{1}{2}$ °			MATERIAL	STOCK SIZE	HEAT TR	FINISH		
TCD	PART NO	REQD	NAME	SCALE	<b>BOEHRER MACHINE &amp; GEAR CO.</b> <small>MADE IN GERMANY</small>				DRAWING NO.
CKD	BILL OF MATERIALS			ASSY OR NO					NO. 2 OF 5
APPD	UNIT OR ASSEMBLY	UNIVERSAL DRIVE TENSIONER			321				322
DATE									

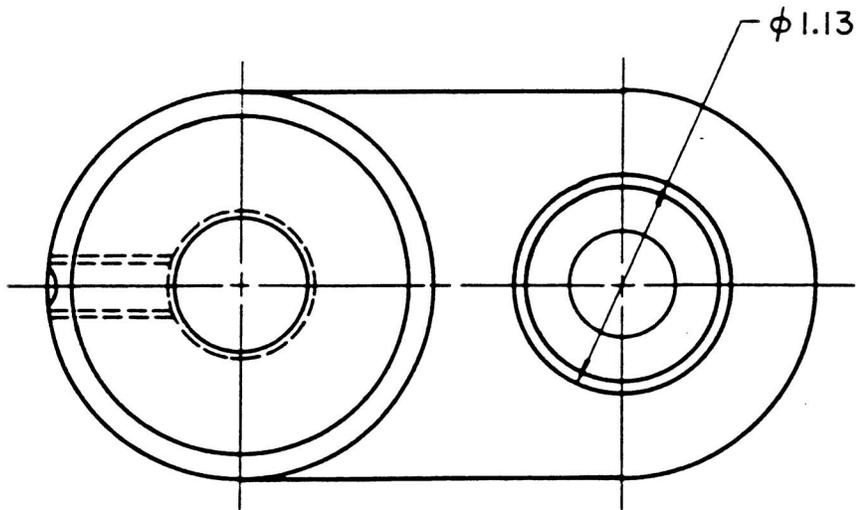


NOTE

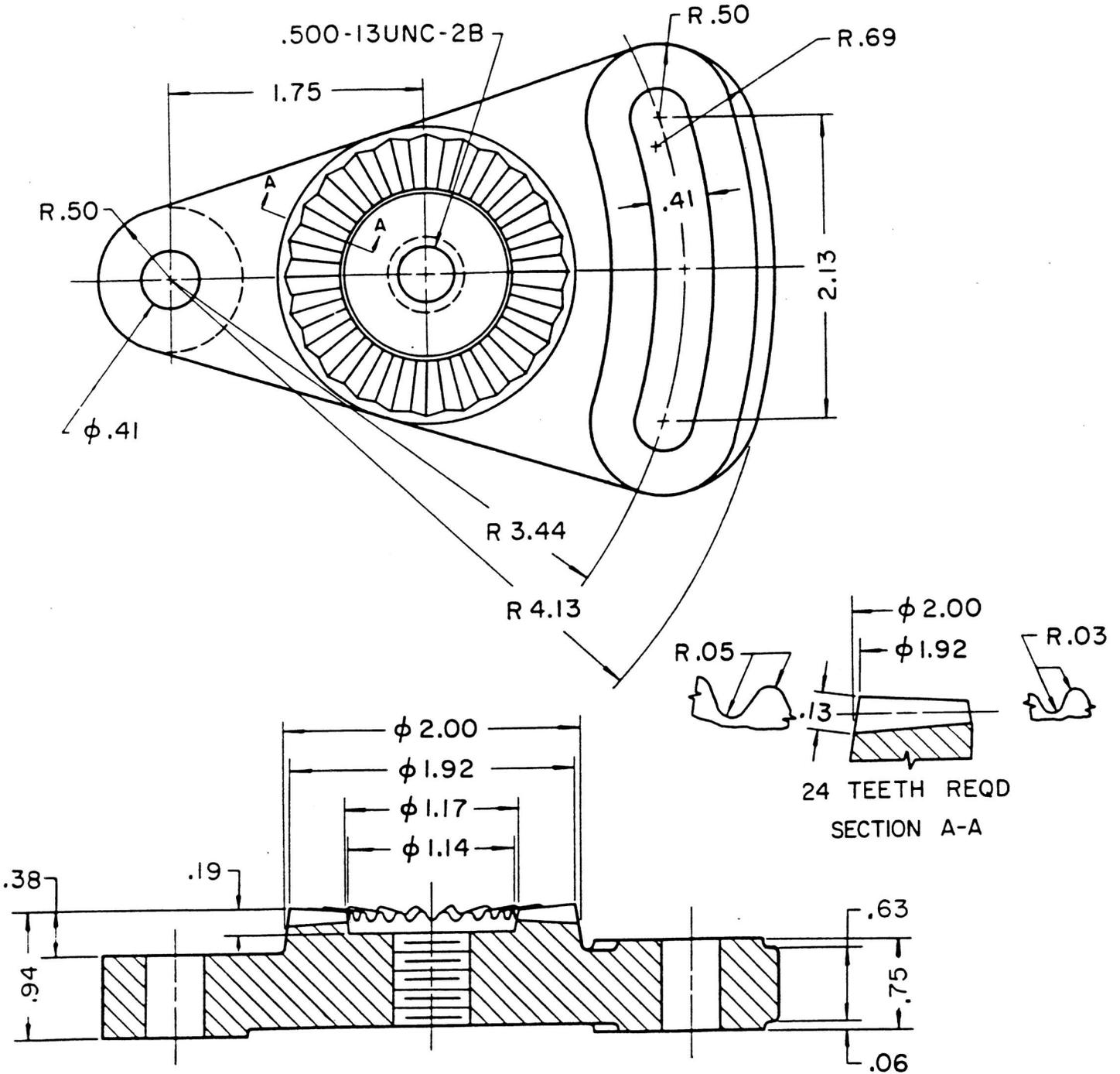
ALL FILLETS AND ROUNDS  
R.09, EXCEPT AS NOTED



NOTE  
FOR SERRATION  
DETAIL SEE DWG  
324



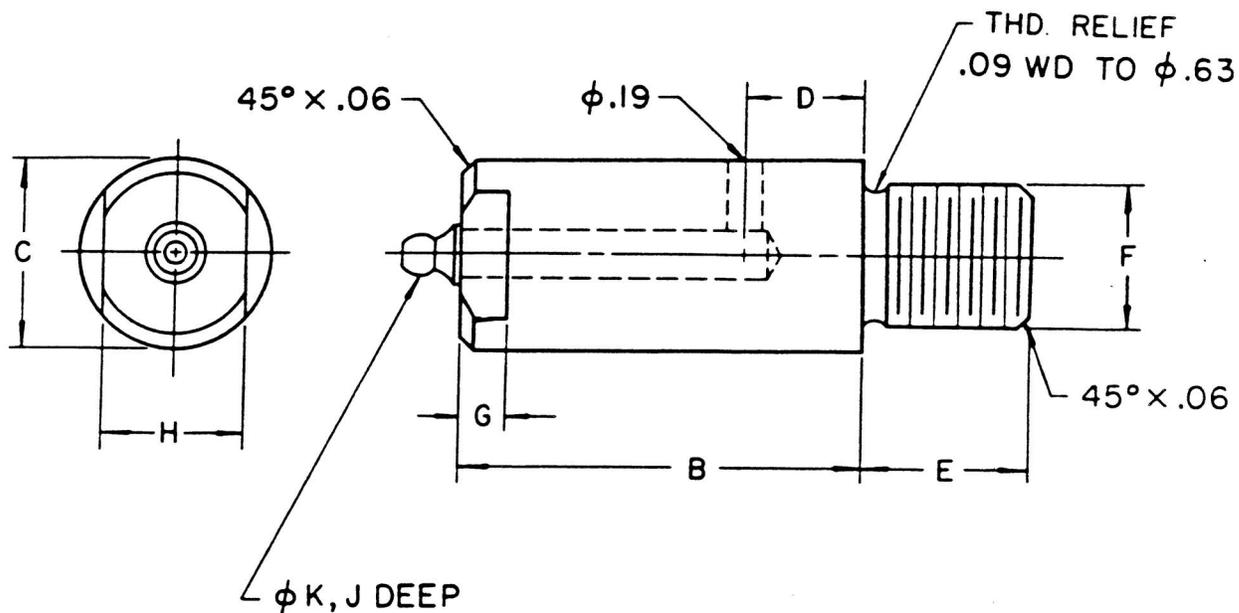
DWN	LIMITS UNLESS OTHERWISE NOTED:			REVISION	DATE	CHANGE OR ADDITION		
	DECIMAL ±.01		ANGULAR ±1°			MATERIAL	STOCK SIZE	HEAT TR
TCD	PART NO	RECD	NAME	C.I.				
CKD	IOI	I	ARM	SCALE				DRAWING NO.
APPD	UNIT OR ASSEMBLY	UNIVERSAL DRIVE TENSIONER		FULL	BREWER MACHINE & GEAR CO.			NO 3 OF 5
DATE				ASSY DR NO	321			323



NOTE

ALL FILLETS AND ROUNDS  
R.09, EXCEPT AS NOTED

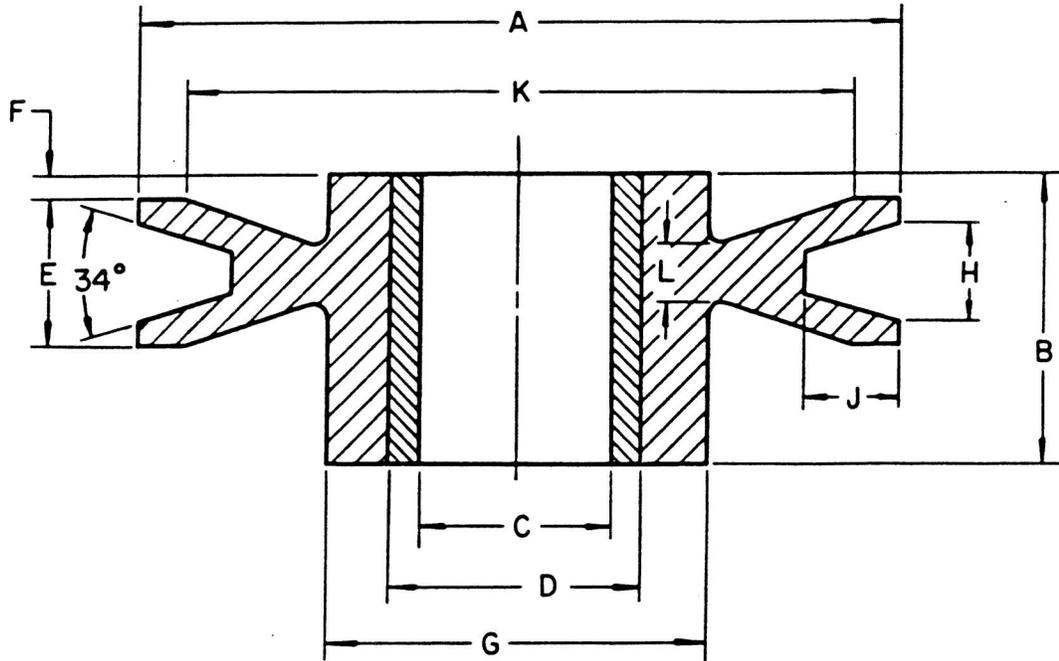
DWN	LIMITS, UNLESS OTHERWISE NOTED:			REVISION	DATE	CHANGE OR ADDITION		
	DECIMAL ±.01 ANGULAR ±½°			MATERIAL	STOCK SIZE		HEAT TR	FINISH
TCD	NAME			C.I.				
CKD	PART NO	REQD	NAME	SCALE	DRAWER MACHINE & GEAR CO.			DRAWING NO.
APPD	100	1	BASE	FULL	UNIVERSAL DRIVE TENSIONER			NO 4 OF 5
DATE	UNIT OR ASSEMBLY	UNIVERSAL DRIVE TENSIONER		ASSEY DR NO	321			324



NOTE  
SURFACE TO BE CASE HARDENED .015 DEEP  
ROCKWELL C-58 MIN., CARBO-NITRIDE

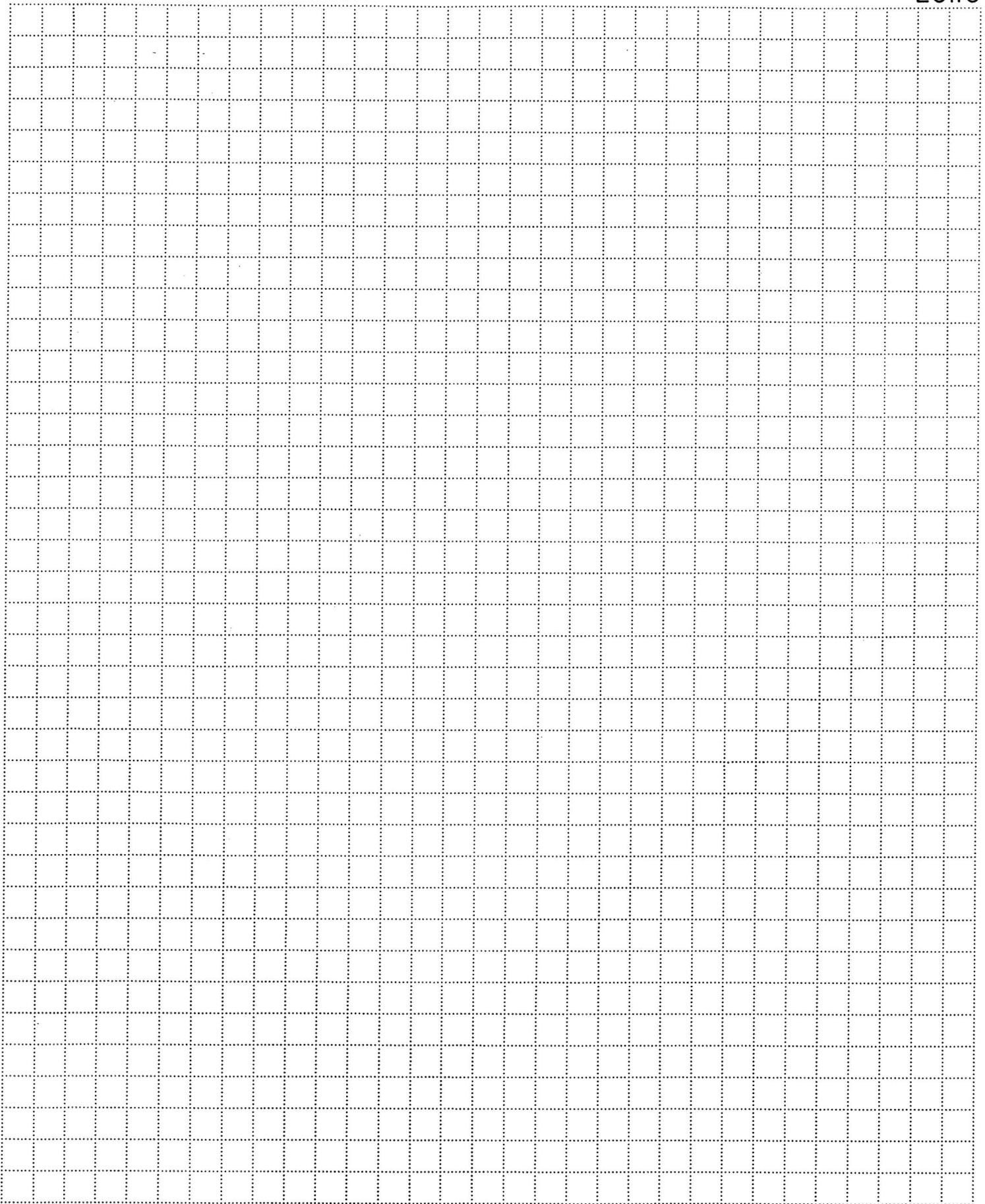
PART NUMBER	B	C	D	E	F	G	H	J	K	WT
S02	2.13	1.00	.63	.88	.750-16UNF-3A	.25	.75	1.63	.251 .252	.53
S03	3.13	1.00	1.13	.88	.750-16UNF-3A	.25	.75	2.13	.251 .252	.75
S04	4.13	1.00	1.63	.88	.750-16UNF-3A	.25	.75	2.63	.251 .252	.97

DWN	LIMITS, UNLESS OTHERWISE NOTED: DECIMAL ±.01 ANGULAR ±½°			REVISION	DATE	CHANGE OR ADDITION	
TCD				MATERIAL	STOCK SIZE		HEAT TR
CKD	PART NO	RECD	NAME	CH. STL.			FINISH
APPD	SEE ABOVE	1	IDLER SHAFT	SCALE			DRAWING NO.
DATE	UNIT OR ASSEMBLY	UNIVERSAL DRIVE TENSIONER		FULL	BROWER MACHINE & GEAR CO.		NO 5 OF 5
				ASBY DR NO	321		325



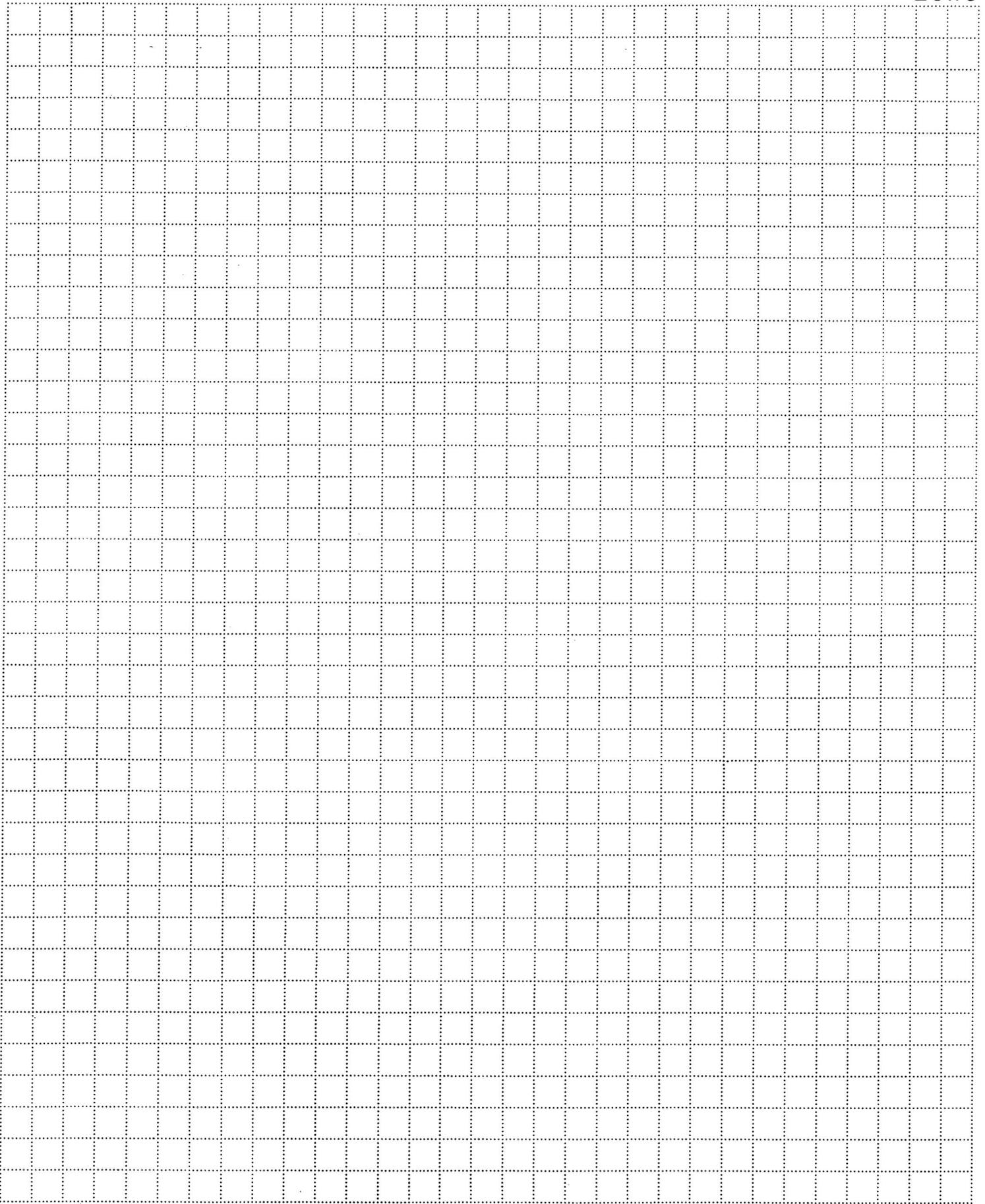
PART NUMBER		A	B	C	D	E	F	G	H	J	K	L	BELT	WT.(1)	WT.(2)
BRONZE (1) BEARING	NEEDLE (2) BEARING														
IAU3	IAU3F	3.00	1.50	1.00	1.31	.75	.13	2.00	.494	.490	2.50	.25	A	1.31	1.25
IAU4	IAU4F	4.00	1.50	1.00	1.31	.75	.13	2.00	.494	.490	3.50	.25	A	1.83	1.72
IBU4	IBU4F	4.00	1.50	1.00	1.31	.88	.13	2.00	.637	.580	3.38	.38	B	1.87	1.81
IBU5	IBU5F	5.00	1.50	1.00	1.31	.88	.13	2.00	.637	.580	4.38	.38	B	1.95	2.03

DWN	LIMITS. UNLESS OTHERWISE NOTED: DECIMAL ±.01 ANGULAR ±1°			REVISION	DATE	CHANGE OR ADDITION		
	TCD	PART NO	RECD	NAME	MATERIAL	STOCK SIZE	HEAT TR	FINISH
CKD	SEE ABOVE	1	SHEAVE	C.I.				DRAWING NO.
APPD	UNIT OR ASSEMBLY	UNIVERSAL DRIVE TENSIONER		SCALE	BREWSTER MACHINE & GEAR CO.			NO. OF
DATE				ABBY. DR. NO.	1038			

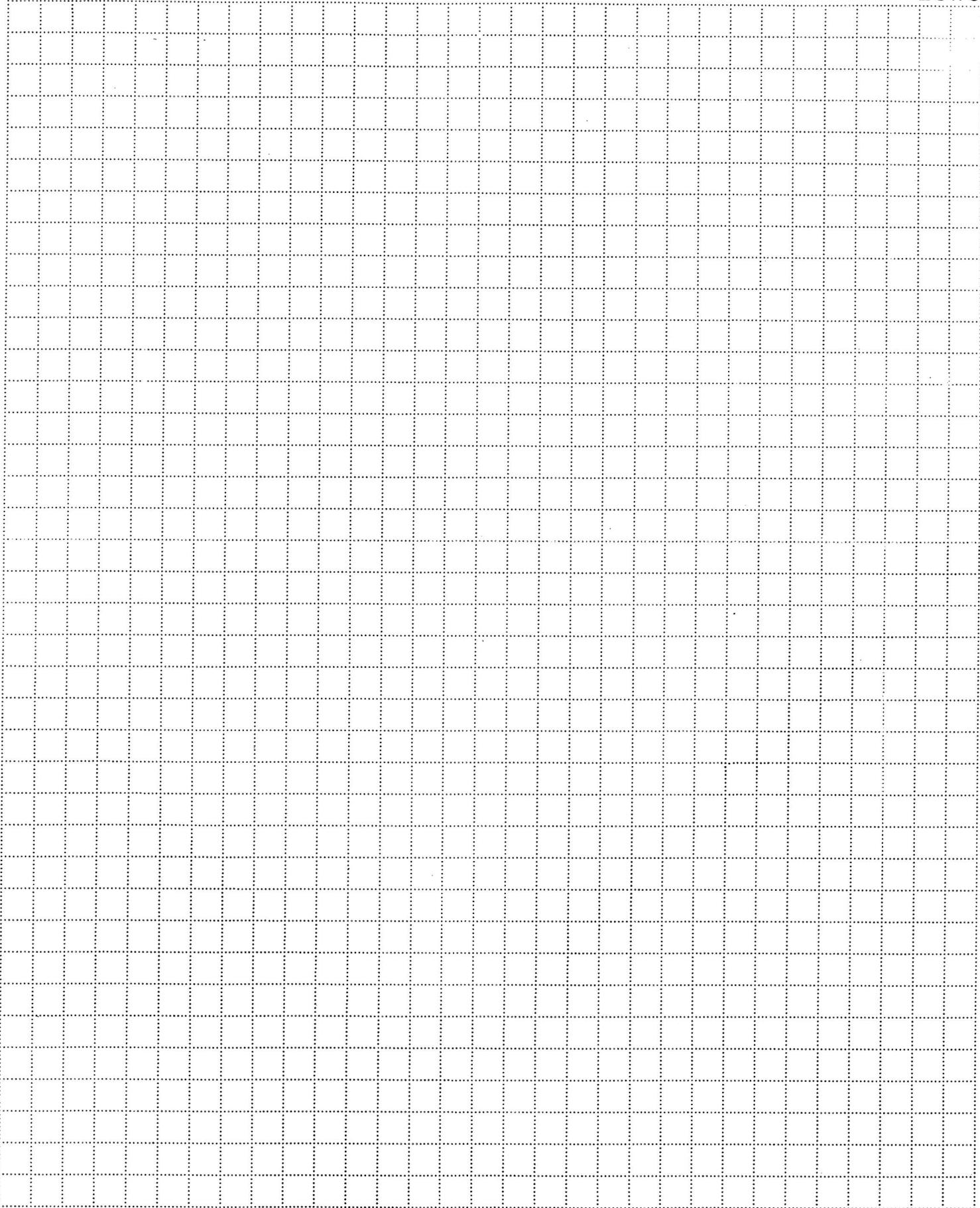


C&R

	SCALE	NAME		DWG	1
		INSTR	TABLE	HOUR	$\frac{1}{2}$
					0

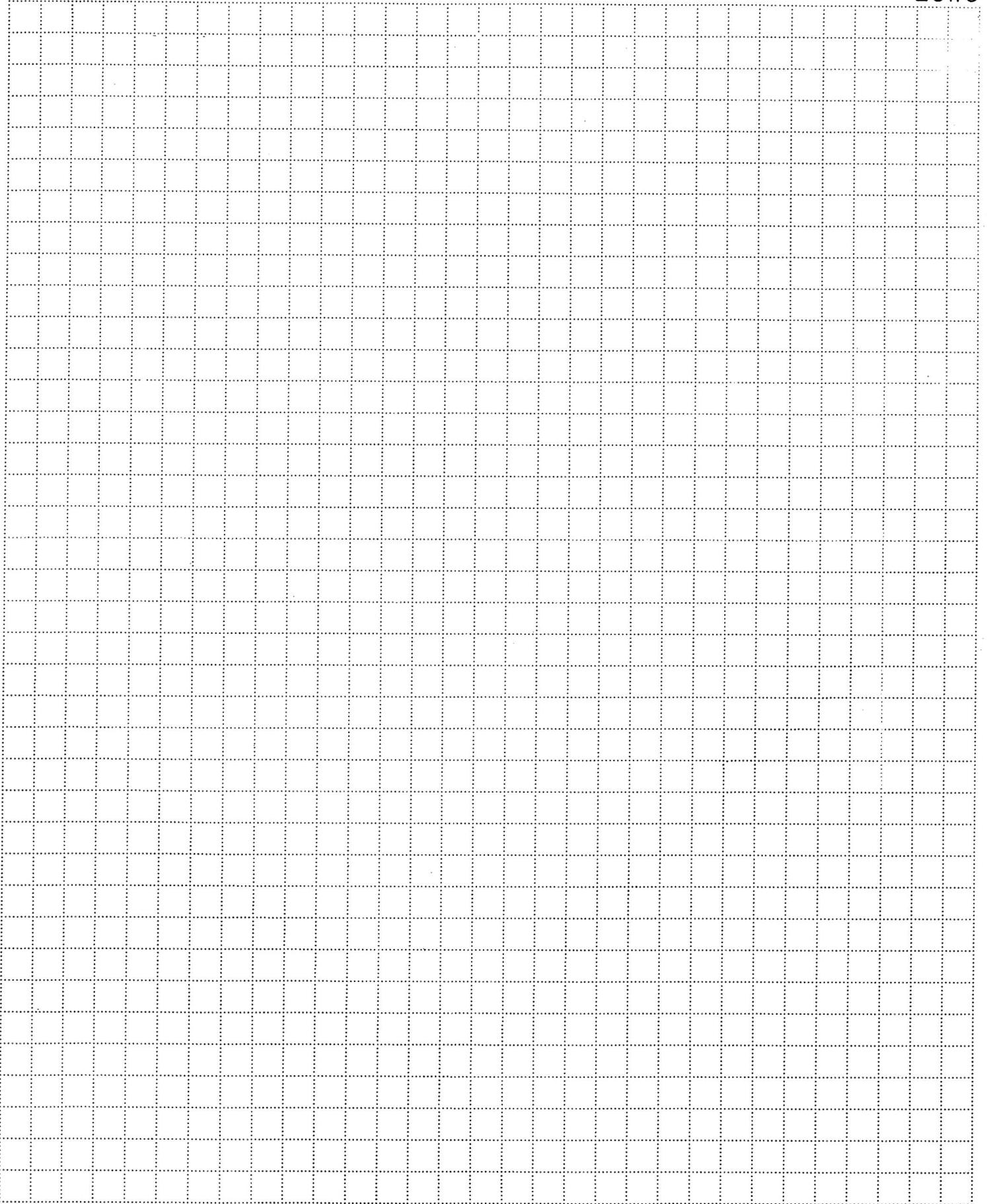


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		INSTR			DWG	1/2
						0



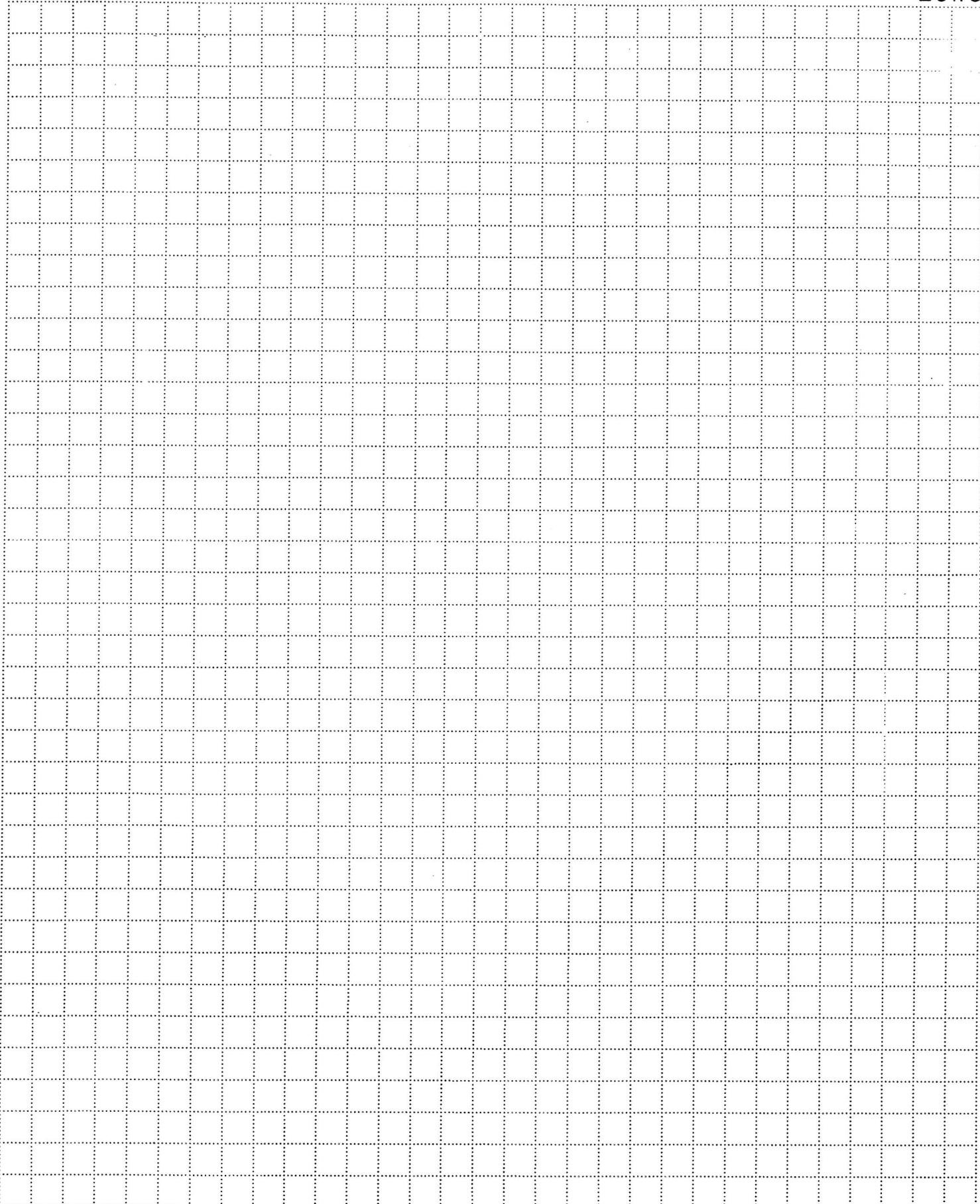
C&R

	SCALE	NAME	TABLE	HOUR	DWG	1
		INSTR				1/2
						0



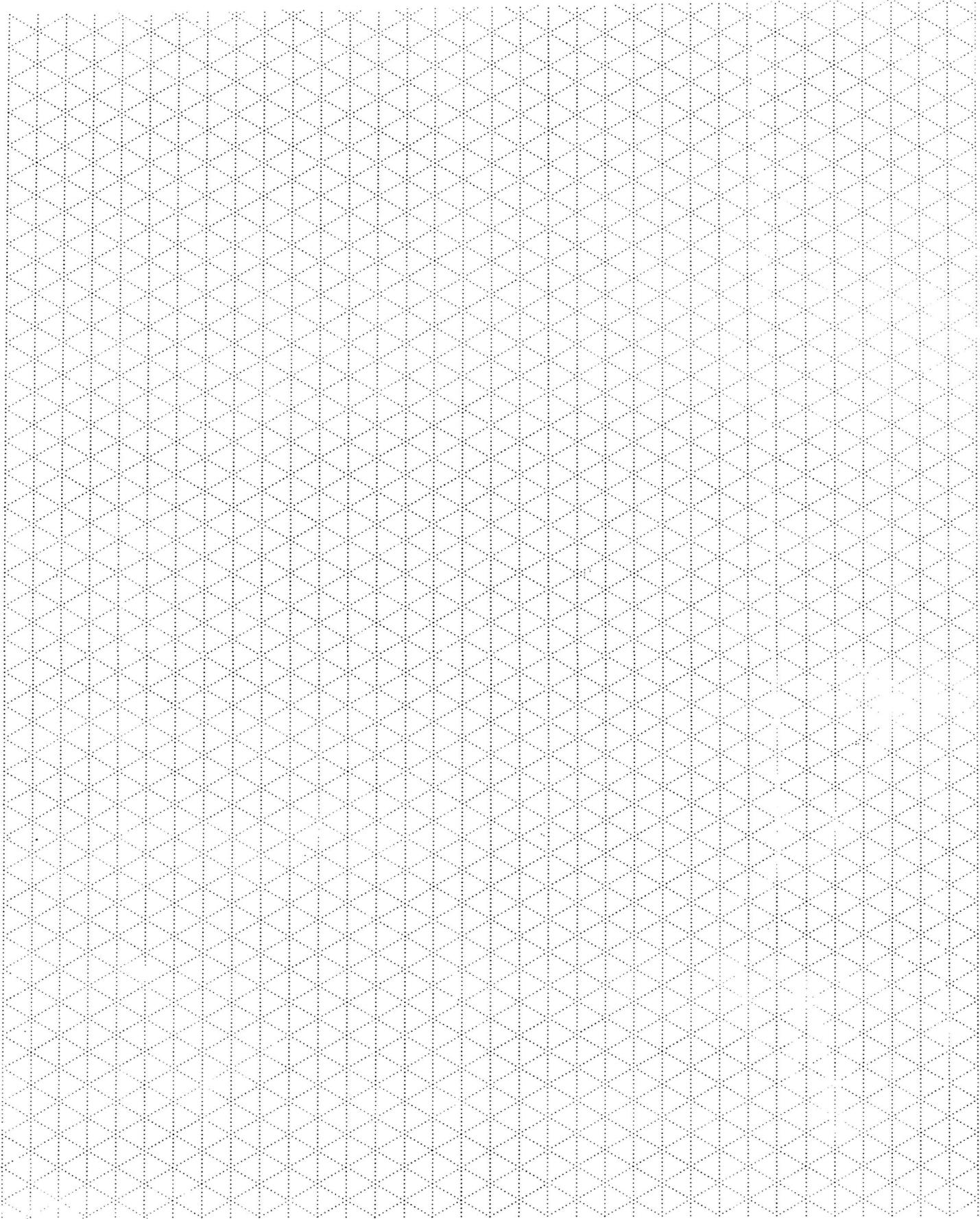
C&R

	SCALE	NAME	TABLE	HOUR	DWG	1
		INSTR				$\frac{1}{2}$
						0



C&R

	SCALE	NAME	TABLE	HOUR	DWG	1
		INSTR				$\frac{1}{2}$
						0



C&R

SCALE

NAME

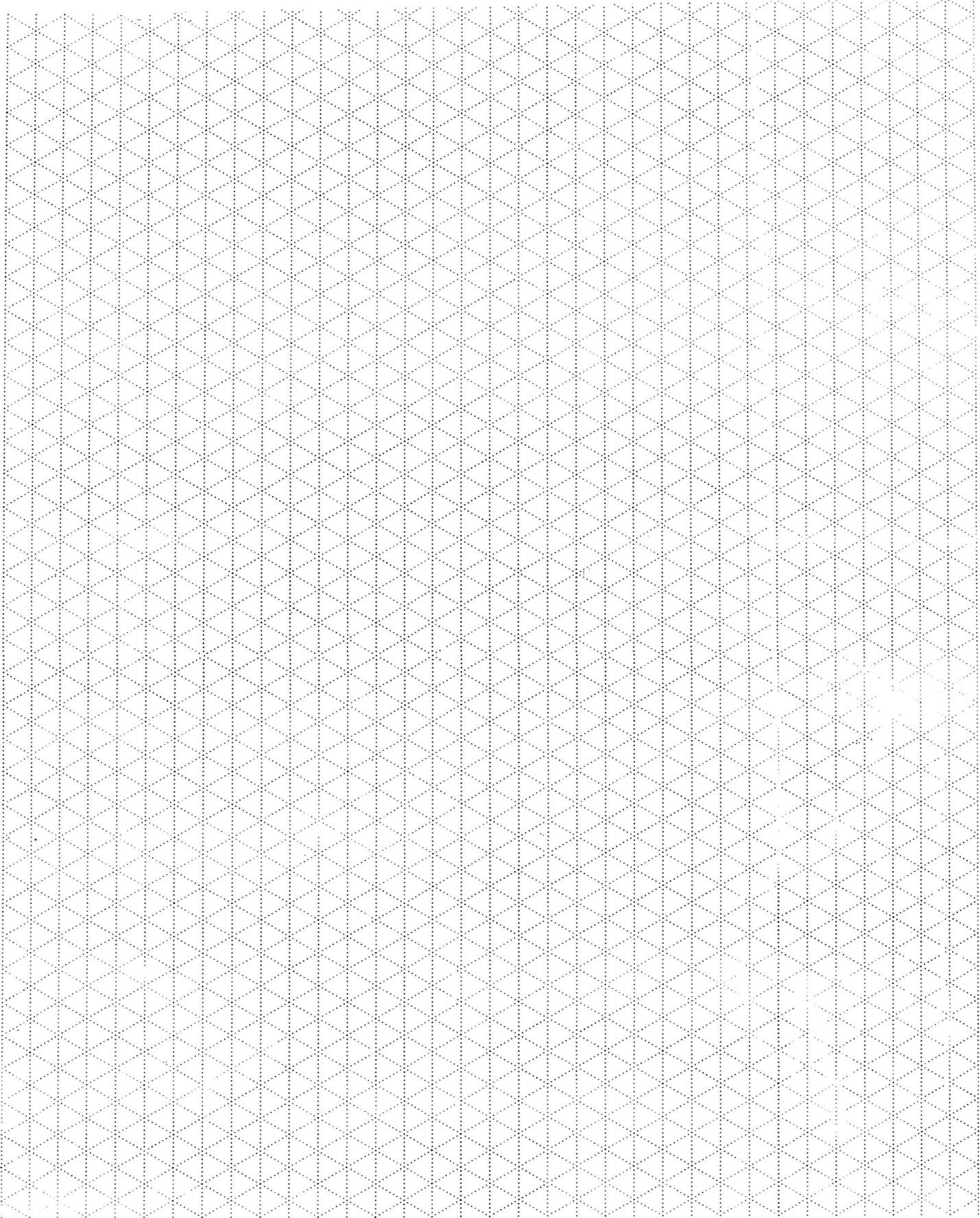
INSTR

TABLE

HOUR

DWG

1  
1/2  
0



	SCALE	NAME	TABLE	C&R <input type="checkbox"/>	DWG	1 1/2 0
		INSTR				