ENGINEERING DESCRIPTIVE GEOMETRY PROBLEMS

A WORKBOOK FOR COURSES IN DESCRIPTIVE GEOMETRY USING THE DIRECT METHOD

BY

CHARLES ELMER ROWE, B.S. (C.E.), E.M.
Professor of Drawing
The University of Texas

and

JAMES DORR McFARLAND, M.S. IN E.E.
Professor of Drawing
The University of Texas
Registered Professional Engineer

SERIES D

D. VAN NOSTRAND COMPANY, INC.
PRINCETON, NEW JERSEY

TORONTO | NEW YORK | LONDON

D. VAN NOSTRAND COMPANY, INC.
120 Alexander St., Princeton, New Jersey (*Principal office*)
24 West 40th Street, New York 18, New York

D. Van Nostrand Company, Ltd.
358, Kensington High Street, London, W.14, England

D. Van Nostrand Company (Canada), Ltd.
25 Hollinger Road, Toronto 16, Canada

Published simultaneously in Canada by
D. Van Nostrand Company (Canada) Ltd.

PRINTED IN U.S.A.
PRESS OF
DEPENDABLE PRINTING COMPANY, INC.
NEW YORK, N. Y.

PREFACE

The gratifying results obtained through the use of Series A, Series B, and Series C, Engineering Descriptive Geometry Problems, have encouraged the authors to prepare this group designated as Series D. The advantages of using an entirely new set of problems are obvious to the experienced instructor.

These problems have been planned to give a good fundamental coverage of the subject and to save valuable time that is normally consumed by the student in laying out the data. An important consideration is that it has been possible to present interesting engineering data for many of them. The requirements for each problem are printed at the top of the sheet on which it is to be solved and can be seen throughout the progress of the solution without referring to any other source. By using these sheets, errors in plotting the data are avoided, and mistakes in reading the statement are minimized.

This is a new set of problems, planned and prepared especially for this workbook, and the data are placed on the sheet so that the space available for the solution is sufficient, without the overlapping of any views. Many of the problems in this book show applications to engineering and industry and will stimulate the interest of the student by showing him that *descriptive geometry is practical.*

This workbook may be used with any good text on the direct method, but it has been arranged to correlate with ENGINEERING DESCRIPTIVE GEOMETRY by the authors. The order in which the problems are given is the same as that followed in Chapters II to X inclusive. The authors believe the best results will be attained by assigning the problems in the sequence in which they are given, but an experienced instructor may be able to depart from it within reasonable limits. The complete workbook is planned for use in a three semester hour course.

The problems have been given dash numbers such as 2–5, 4–8, and 5–31. The first number in each case is the chapter number in ENGINEERING DESCRIPTIVE GEOMETRY. The number following the dash is the serial number of the problem for that chapter. The nature of each problem, however, is given in the table of contents from which the problems can be selected for a course in which this or some other textbook is being used. This table will be helpful to the instructor in planning the course.

The careful study of a good textbook, competent instruction, thorough analysis, and individual work in solving the problems, all are essential for acquiring a working knowledge of descriptive geometry.

C. E. ROWE

J. D. MCFARLAND

March, 1958

CONTENTS

PROBLEM SHEETS

DEVELOPMENT OF SURFACES

INTERSECTIONS OF SURFACES

GENERAL INSTRUCTIONS

It is necessary to place each problem sheet on the drawing board so that the sight-lines connecting the front and top views of points will be perpendicular to the T-square. Experience has shown that the sheet may not be squared up accurately by placing either the upper or lower border line in coincidence with the edge of the T-square.

To expedite and clarify the drawing board work required for a systematic solution of a problem, it is necessary to use notation on all points. In general, points are designated by letters, and each view of a point is identified by its letter and an appropriate subscript. The front view of the point B is marked B_F; the top view, B_H; the right-side view, B_R; the left-side view, B_L; any auxiliary view, B_A; and any oblique view, B_O. If desired, one base of a prism may be lettered and the other base numbered, in which case the sequence of the numbers should be the same as the sequence of the letters, and subscripts should be used. Incidental points used in the solution of a problem, such as points on a circle, should be marked with very small numbers without subscripts. Draw all sight-lines connecting adjacent views of points. Use a sharp, hard pencil and draw them accurately. Appropriately mark all reference planes and cutting planes used.

The solutions should be completed in accordance with the best pencil technique by using a hard pencil (4H or 6H) for construction work and sight-lines, and a softer pencil (H or 2H) for required lines, planes, and solids. In all problems on solids for which auxiliary views or oblique views are required, the orientation of each view should be determined and shown by placing its name in the proper position. The plumb-line method is most desirable. The instructor may wish to specify orientation for additional problems.

If the use of parallel lines is required, the parallel pairs should be indicated in all views as in Figure 1. This designation indicates that CD has been drawn parallel to AB.

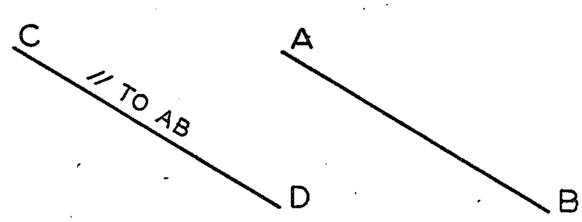


FIGURE 1

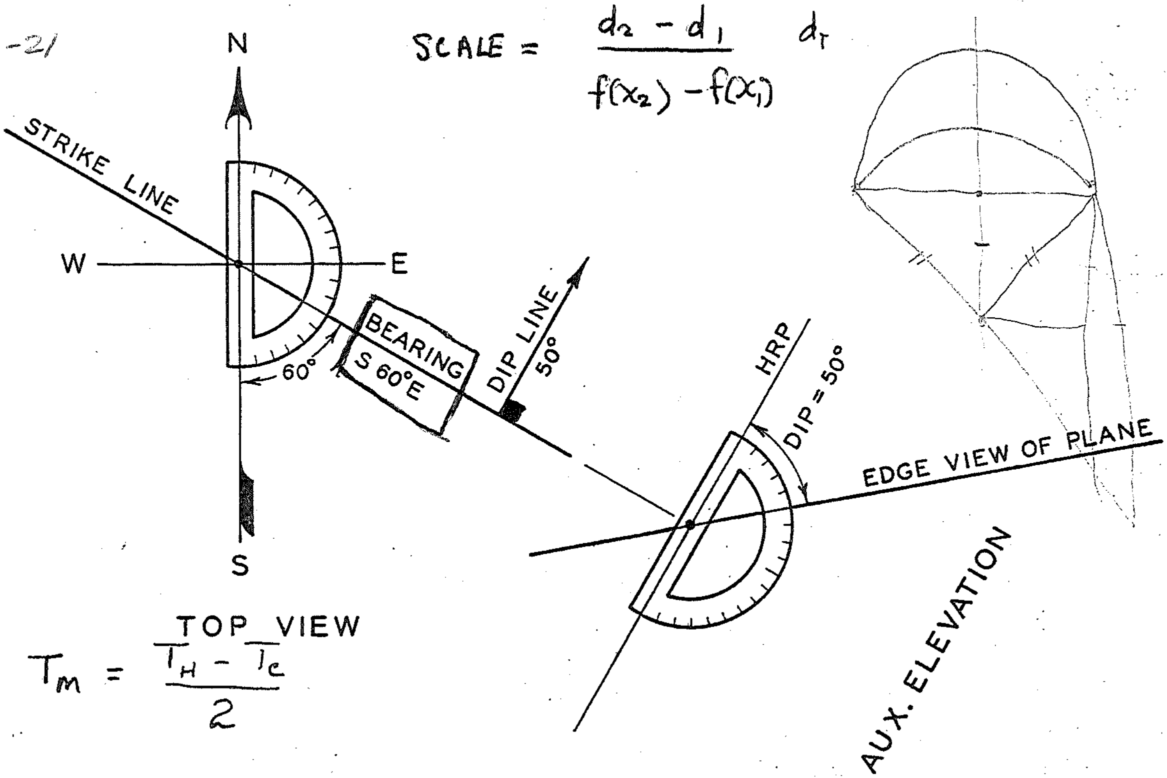
There are desirable and basically correct methods of using a protractor for measuring the bearing of a line and the dip of a plane. Every student should learn them thoroughly.

19: 1.7
20.1.5
20.1.9
20.1.11
20.1.12
P 597-8 609-21

Both are shown in Figure 2 which illustrates the use of a small transparent protractor. Notice that for measuring a bearing the straight side of the protractor should be placed along a north-south line, and the protractor should be to the right for a NE or SE bearing,

$$SCALE = \frac{d_2 - d_1}{f(x_2) - f(x_1)} \quad d_T$$

21.3.8
21.3.11
21.4.5
22.1.3
22.2.6
P 621-697



$$T_M = \frac{T_H - T_c}{2}$$ (TOP VIEW)

FIGURE 2

and to the left for NW or SW bearing. A bearing never exceeds 90°. For measuring dip always place the straight side of the protractor along HRP with the bow turned away from the top view; that is, the arc should be oriented downward. The dip never exceeds 90° and is always measured below HRP in space. The cardinal points of the compass and protractors for bearing and dip should be shown on the mining problems and others in which bearings and dip angles are given or required. Unless otherwise indicated the top of the paper is assumed to be north.

The students' interest can be aroused, and profitable experience gained, by making models in connection with the solution of problems on development. Most of the objects developed in problems 6–1 to 6–11 are suitable for models, and it is suggested that some models be required after the developments have been graded.

Should the instructor feel that additional problems on some parts of the course are desirable, blank problem sheets like the two included in this set can be made up by the instructor. These problems can be of the instructor's own devising, or can be assigned from the problems in ENGINEERING DESCRIPTIVE GEOMETRY, all of which can be solved on sheets of this size. The method of plotting by coordinates is fully explained on page 4 of this textbook.

Study the object shown on the next sheet, Problem 2-2. Identify each of the following planes, and letter the name of its "typical position" in the blank space indicated.

Plane DCJQ is VERTICAL

Plane FEHOG is PROFILE

Plane HNO is ORTHOPROFILE

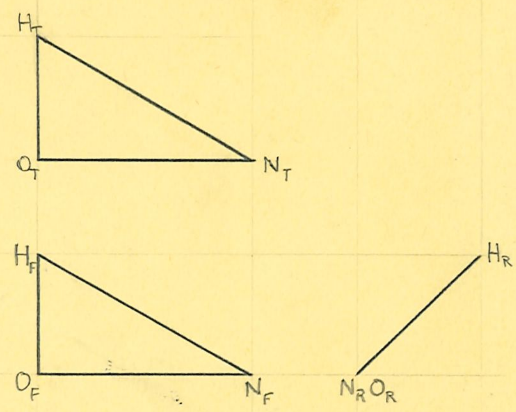
Plane AFG is OBLIQUE

Plane ABCDEF is HORIZONTAL

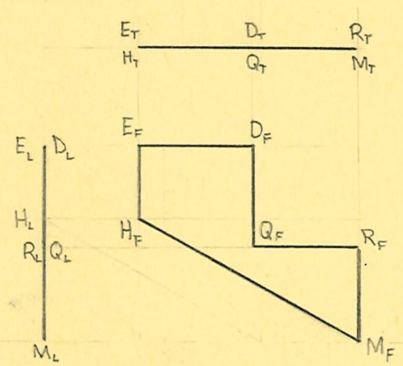
Plane EDQRMH is FRONTAL

Plane HMN is ORTHOFRONTAL

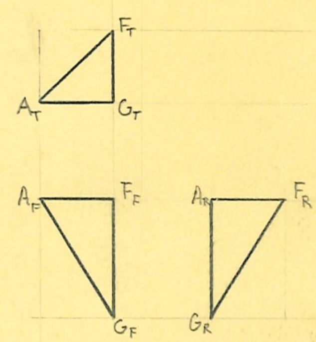
Draw the front, top, and right-side views of the plane HNO.



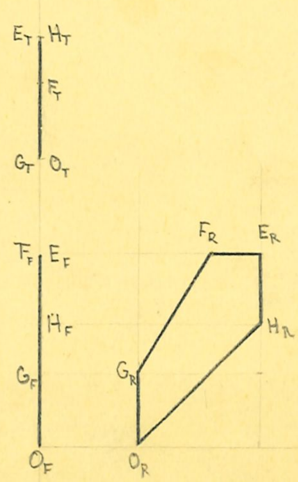
Draw the front, top, and left-side views of the plane EDQRMH.



Draw the front, top, and right-side views of the plane AFG.

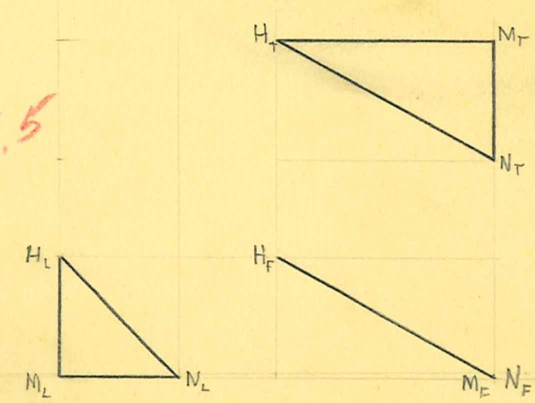


Draw the front, top, and right-side views of the plane FEHOG.



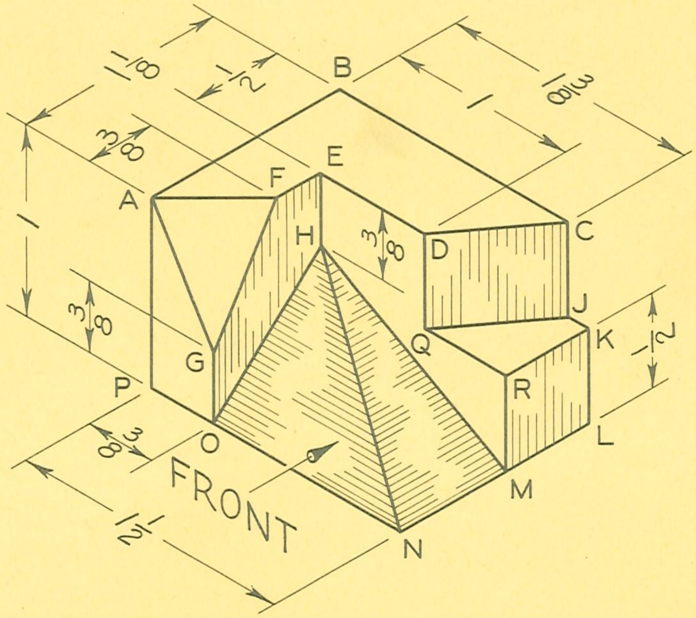
Draw the front, top, and left-side views of the plane HMN.

8.5



D

2-1	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION



Identify each of the following lines, and letter the name of its "typical direction" in the blank space indicated.

Line FG is PROFILE

Line BC is ORTHOPROFILE

Line HM is FRONTAL

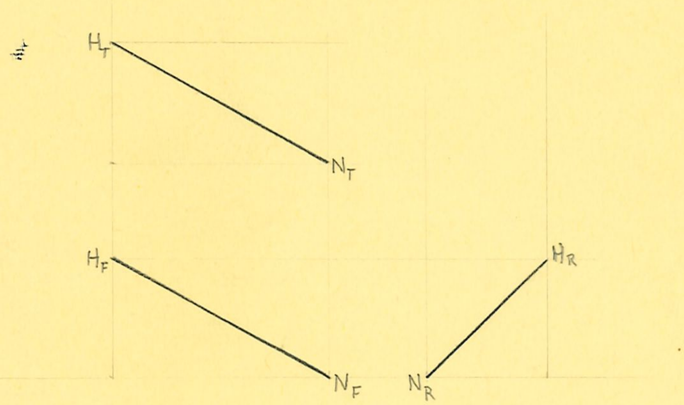
Line CJ is VERTICAL

Line HN is OBLIQUE

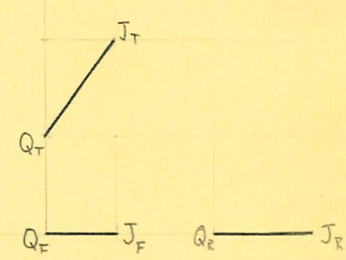
Line AF is HORIZONTAL

Line AB is ORTHOFRONTAL

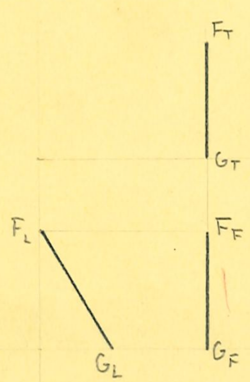
Draw the front, top, and right-side views of the line HN.



Draw the front, top, and right-side views of the line QJ.

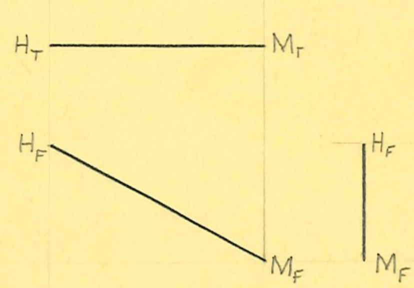


Draw the front, top, and left-side views of the line FG.



Draw the front, top and right-side views of the line HM.

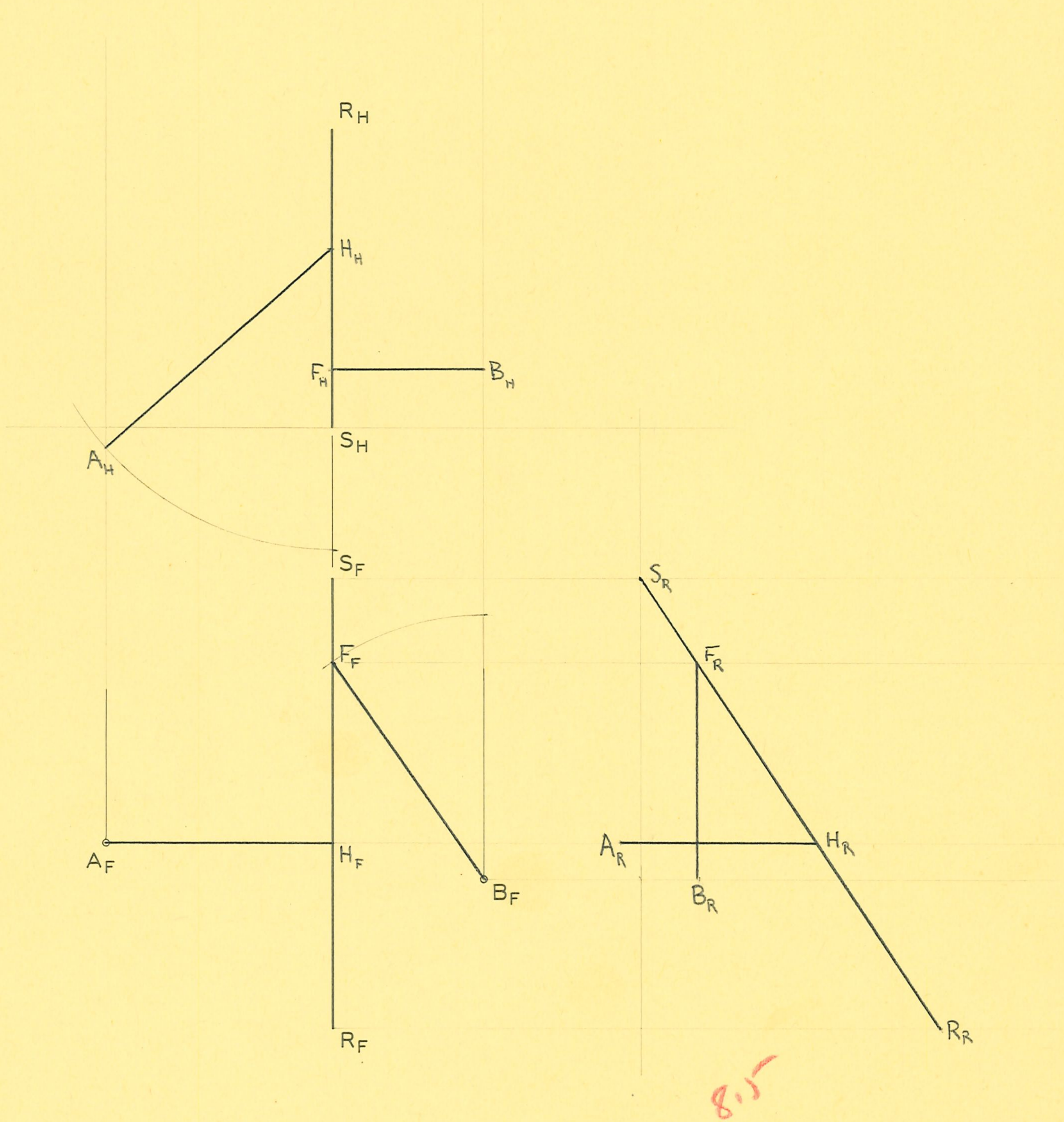
8.0



D

2-2	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

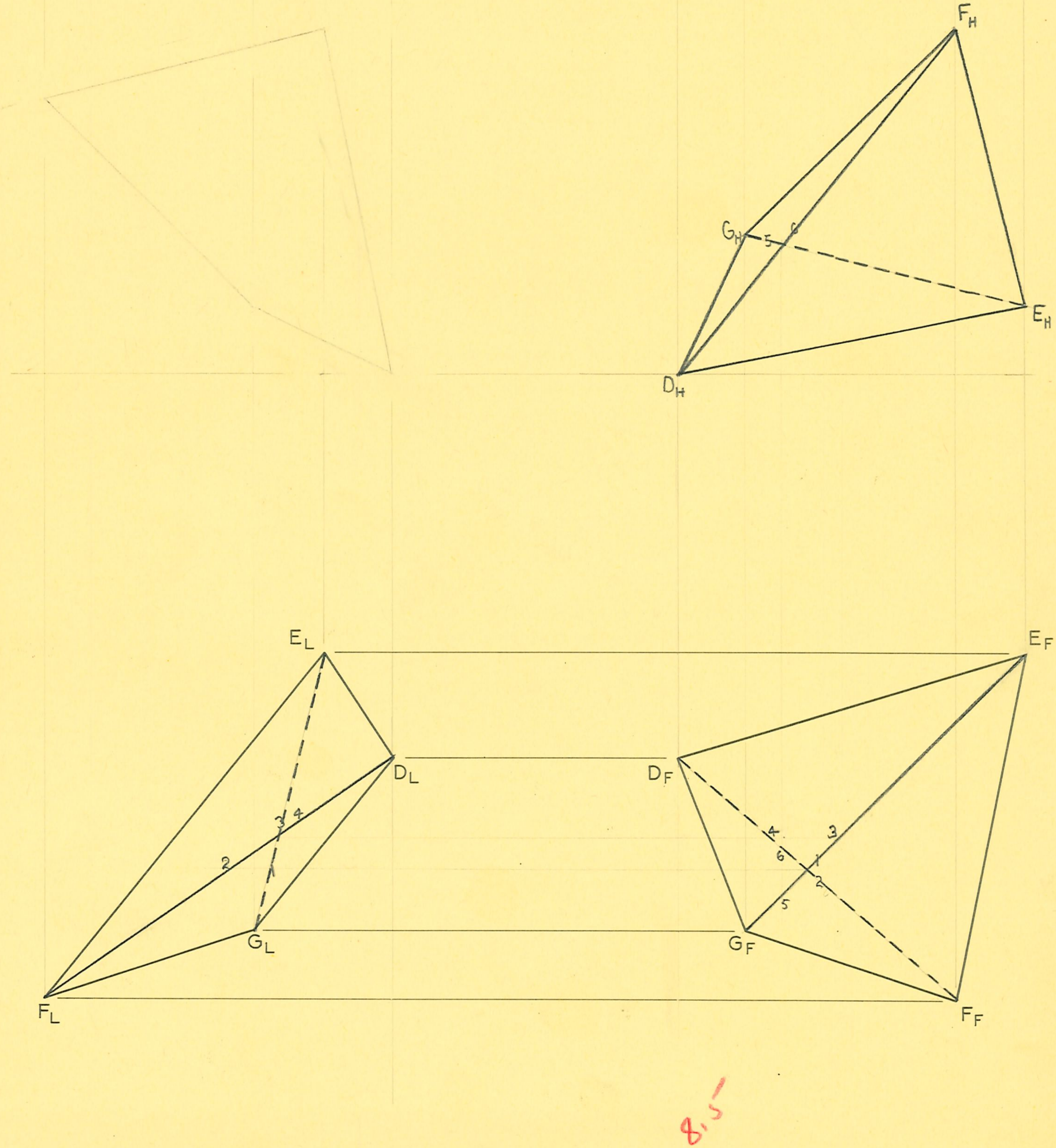
Draw a horizontal line AH, 2″ long, backward, and intersecting RS at H. Draw a frontal line BF, 1¾″ long, upward, and intersecting RS at F. Draw all three lines in the front, top, and right-side views.



D

2-3 | ENGINEERING DESCRIPTIVE GEOMETRY | STEVEN F. BELLENOT (NAME) | 90 (DESK-SECTION)

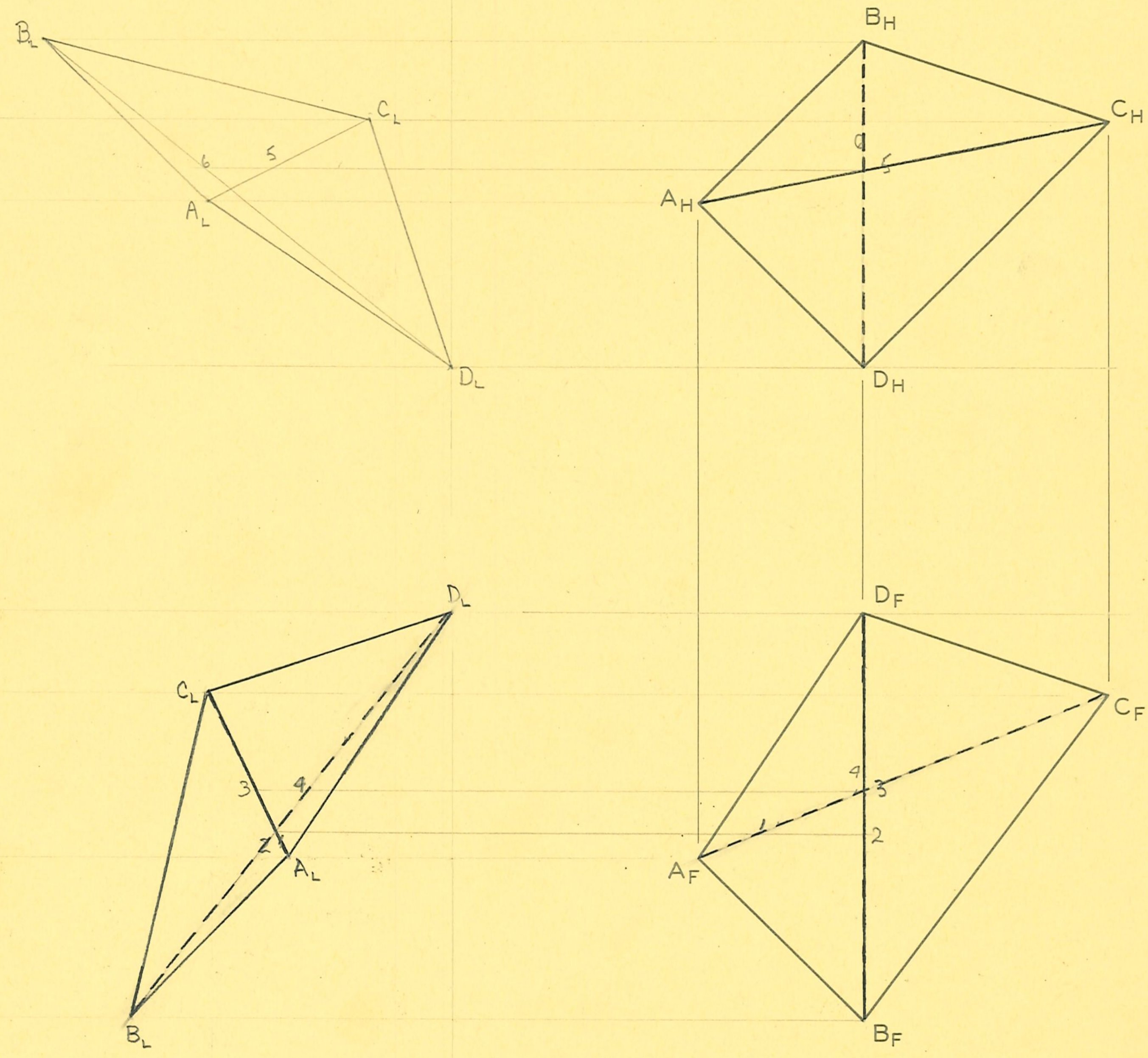
Complete the front and left-side views of the tetrahedron DEFG and draw the top view. Indicate the visibility of the edges and show how it was determined.



D

2–4	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

A, B, C, and D are the corners of a tetrahedron. Draw the front, top, and left-side views and indicate the method of determining the visibility of the edges.

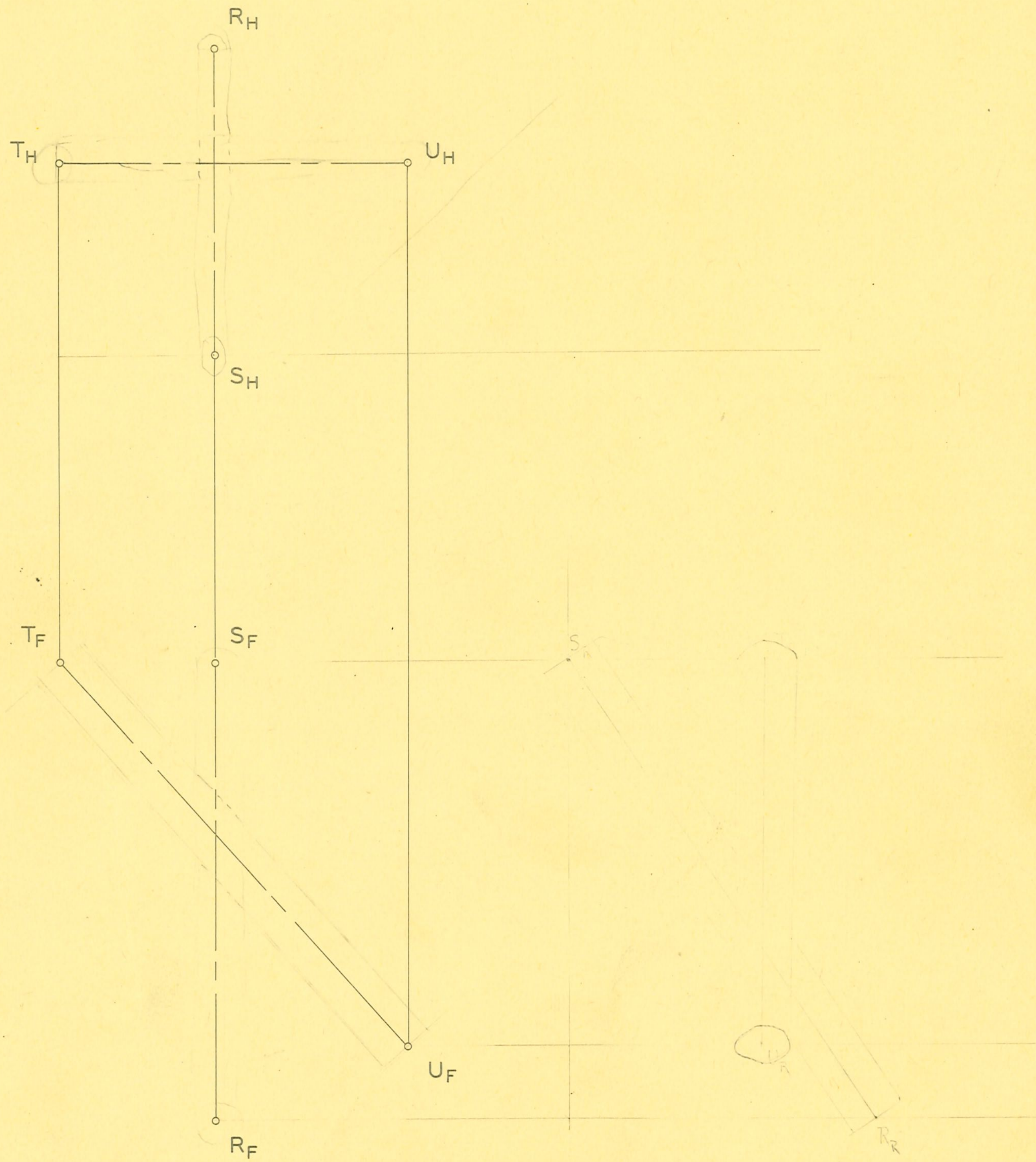


8.0

D

2-5	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

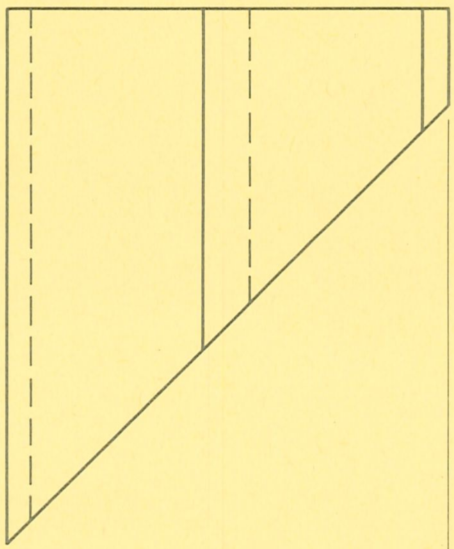
RS and TU are the center lines of two 3/8″ diameter rods. Draw front, top, and right-side views of the rods. Indicate the correct visibility of the rods and their ends and show how it was determined. Their ends are perpendicular to the center lines.



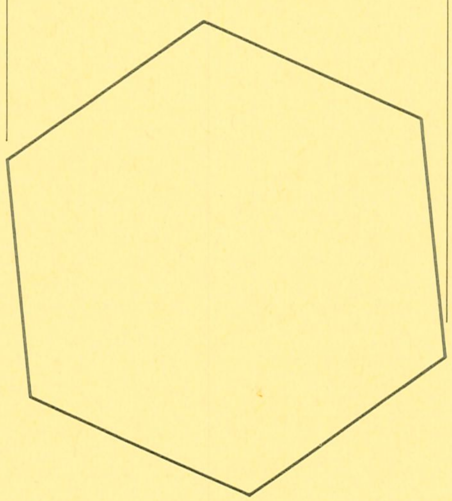
D

2 – 6	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

Draw an auxiliary view of the truncated prism for a direction of sight perpendicular to the cut surface. Use notation on all points, orientate and name the auxiliary view, and cross-hatch the cut surface.



TOP VIEW

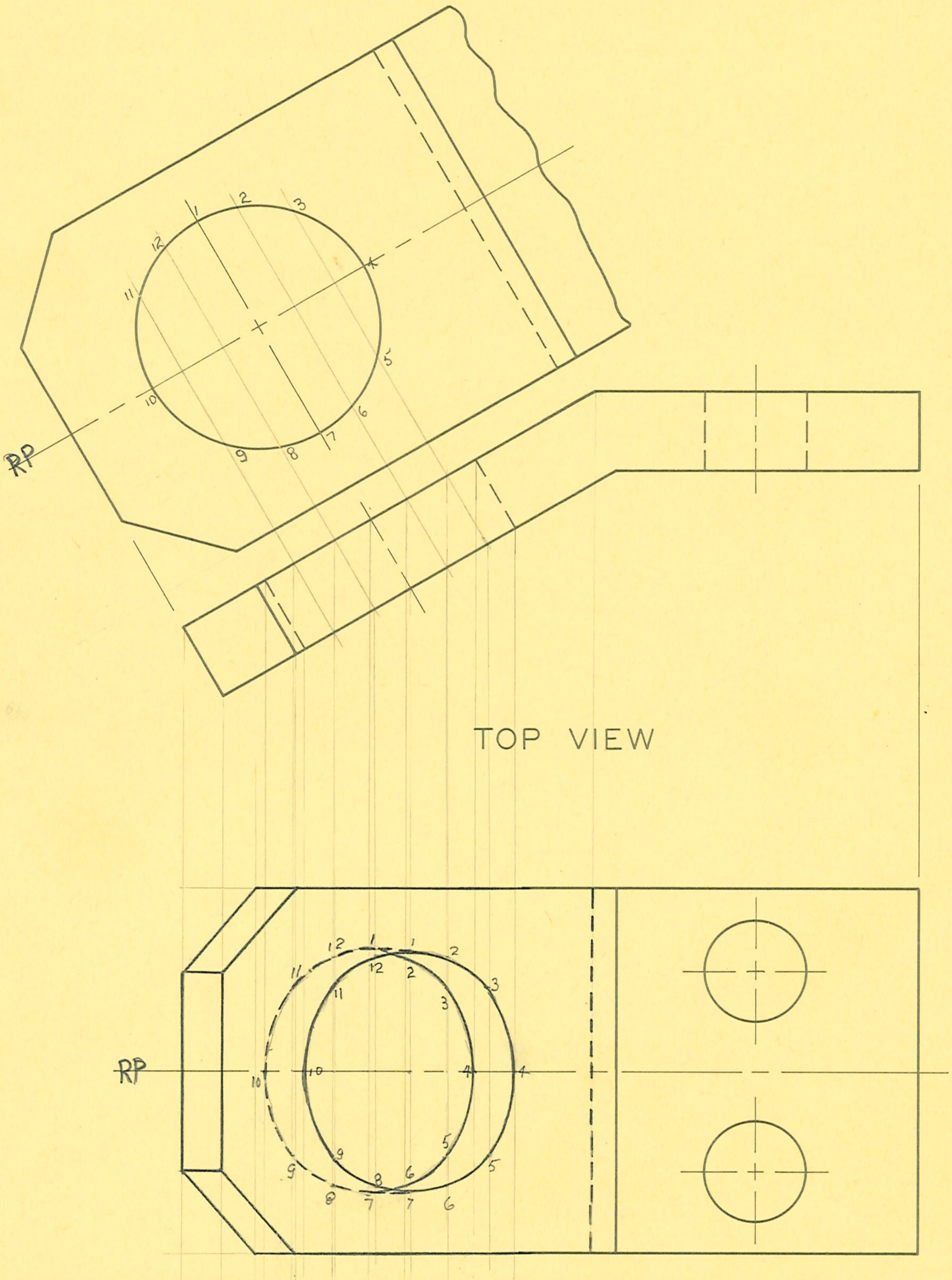


FRONT VIEW

D

3 – 1	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

Complete the front view of the bracket. Orientate and name the partial auxiliary view. Label the reference plane.

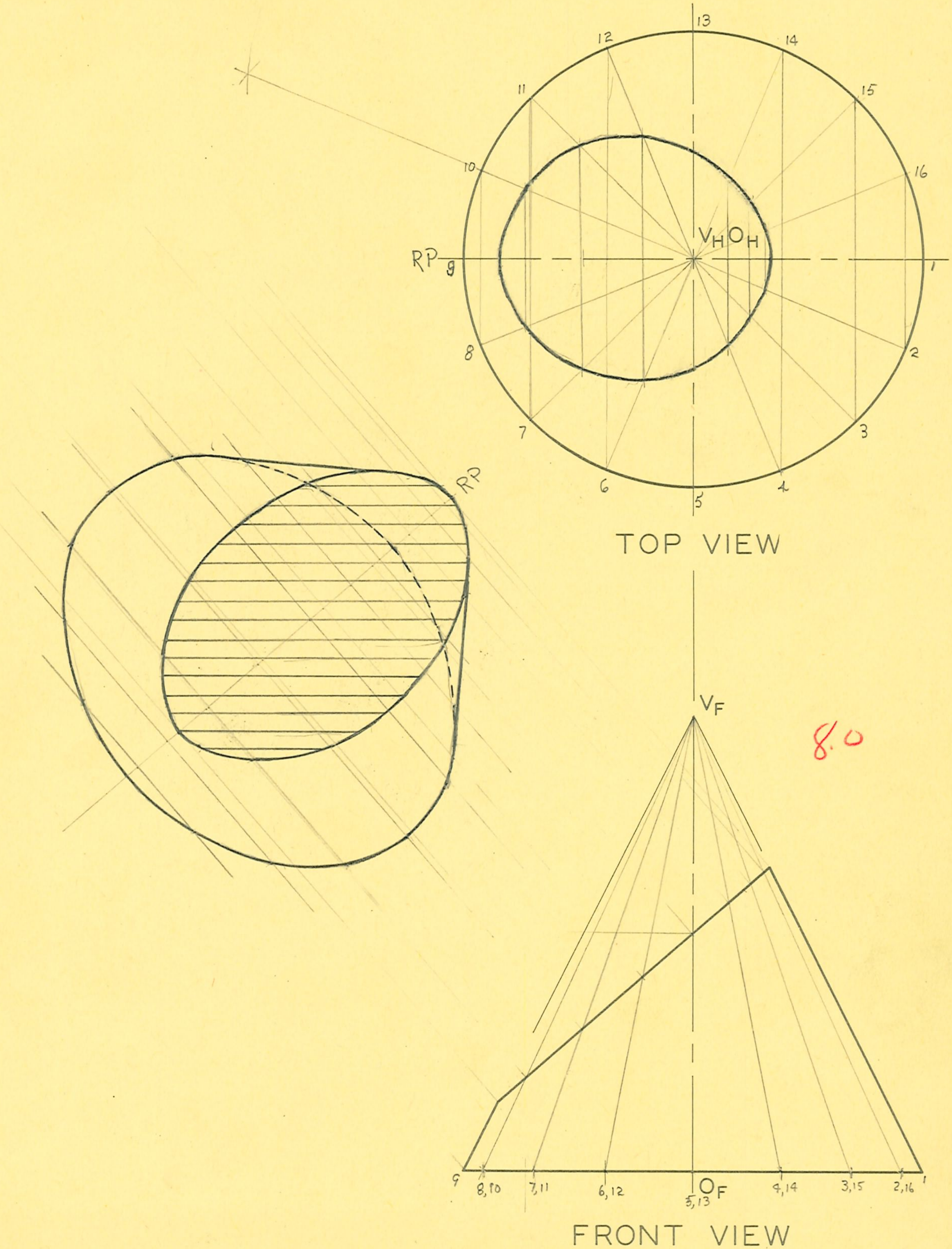


8.0

D

3-2	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

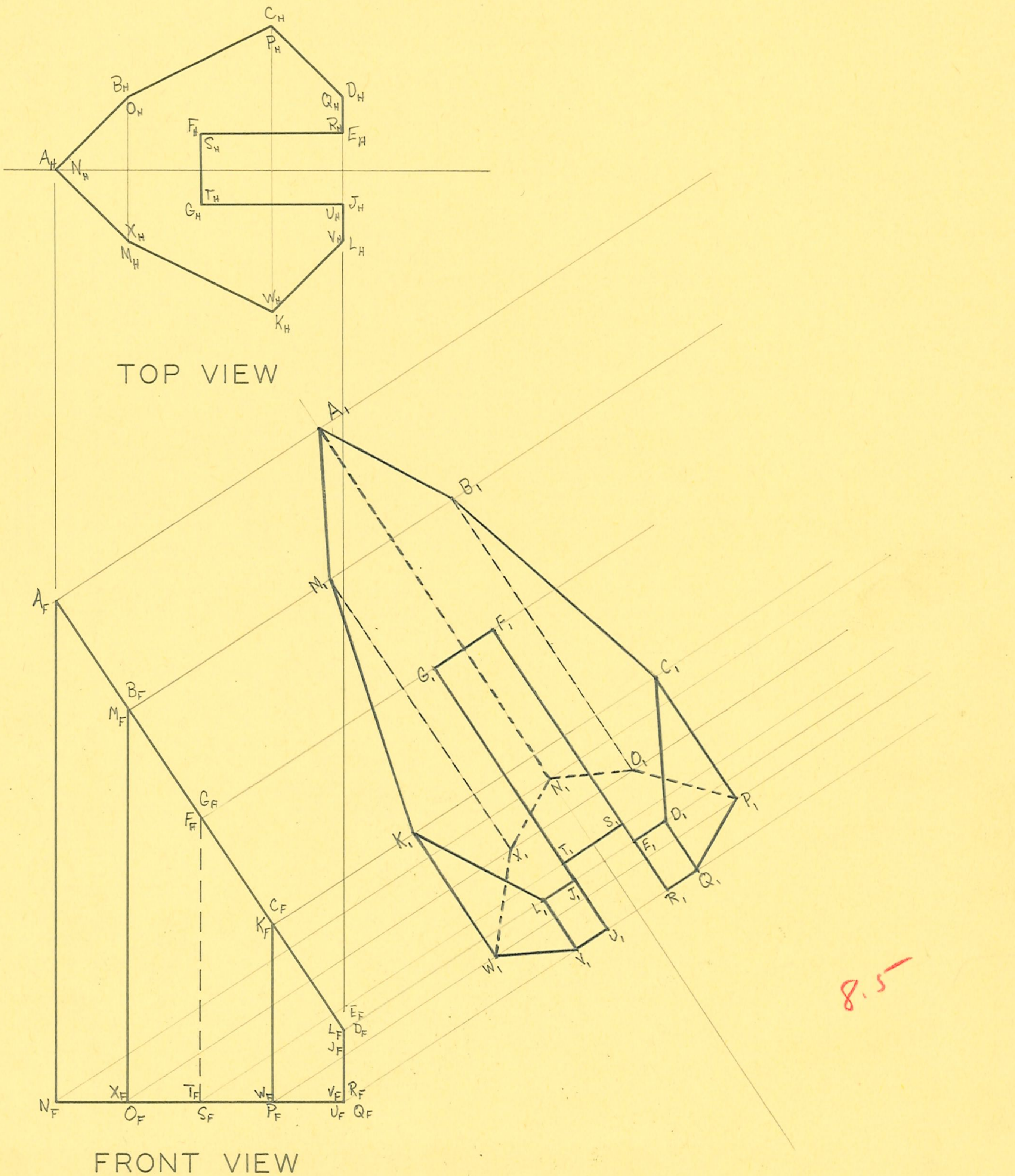
Complete the top view of the truncated cone and draw a view for a direction of sight perpendicular to the cut surface. Crosshatch the cut surface. Orientate and name the auxiliary view.



D

3-3	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

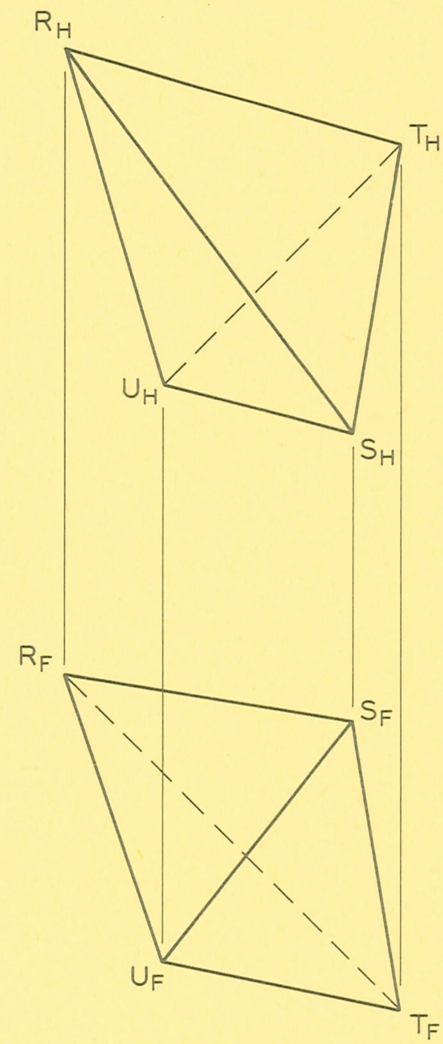
Draw a view of the truncated prism for a direction of sight perpendicular to the inclined surface. Use notation on all the points. Orientate and name the auxiliary view.



D

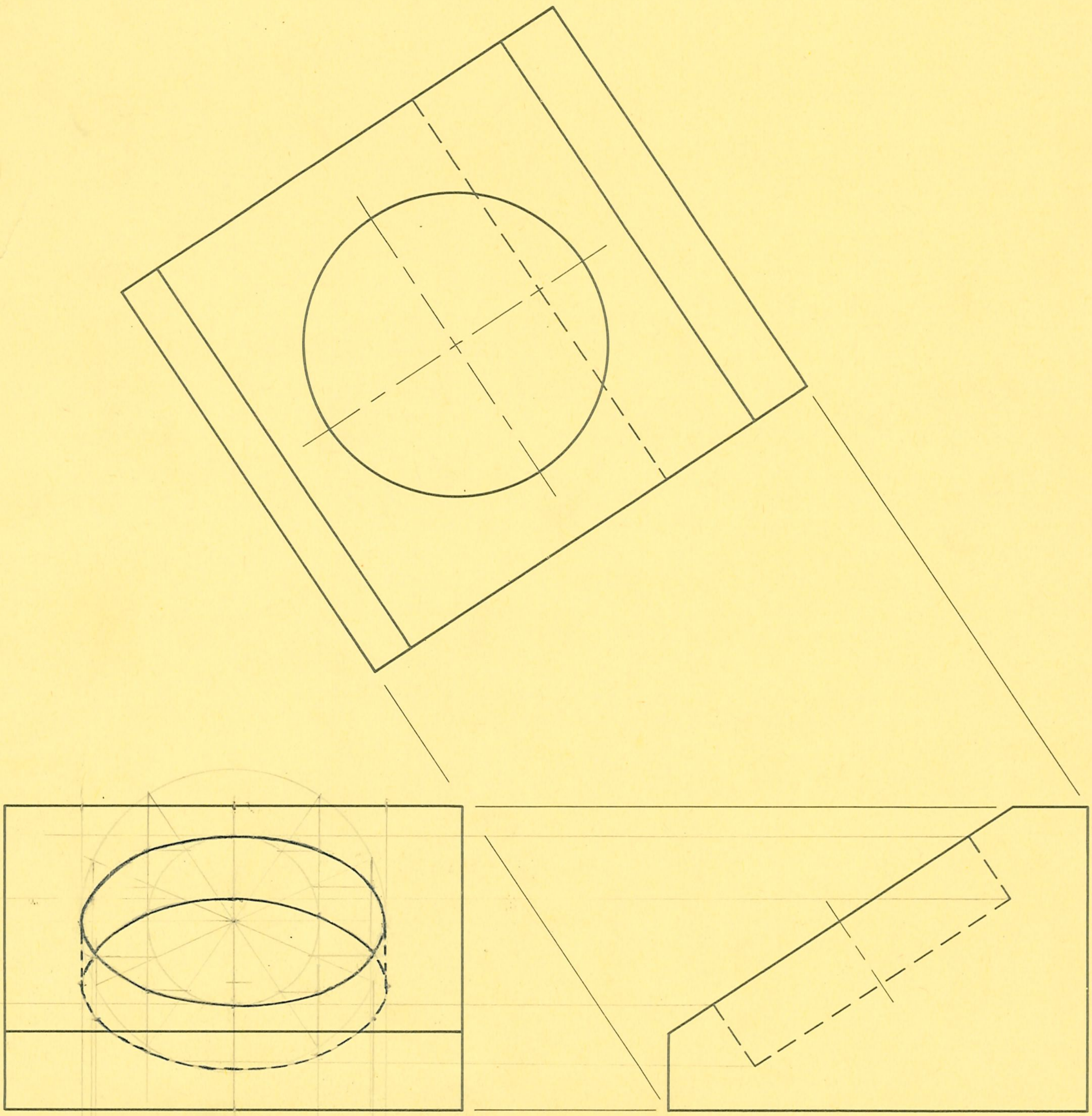
3-4	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Given the tetrahedron RSTU. Draw a rear-auxiliary view 60° below the horizontal. Orientate and name the auxiliary view.



D

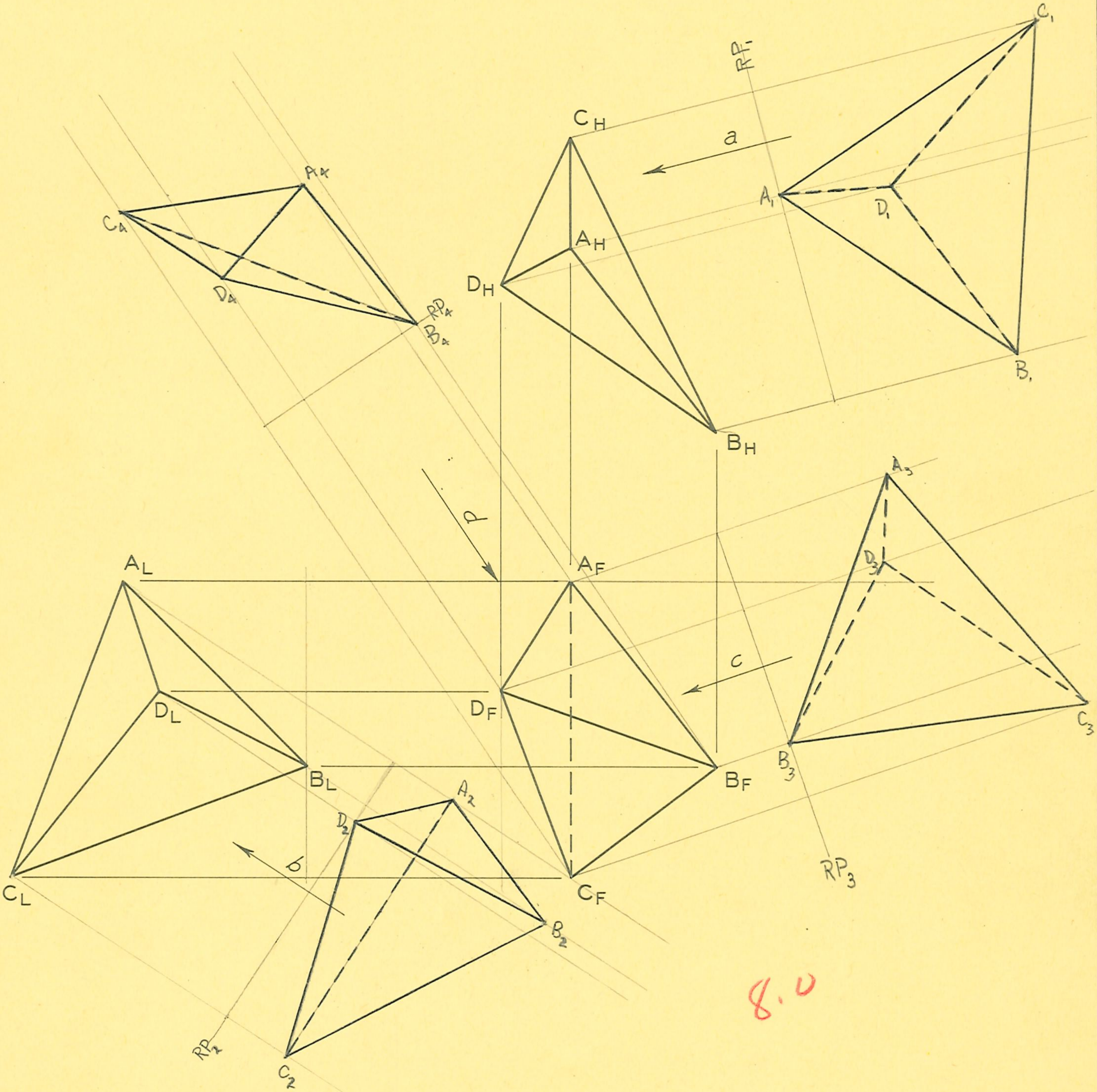
Complete the front view of the block. Orientate and name the auxiliary view.



D

3–6	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

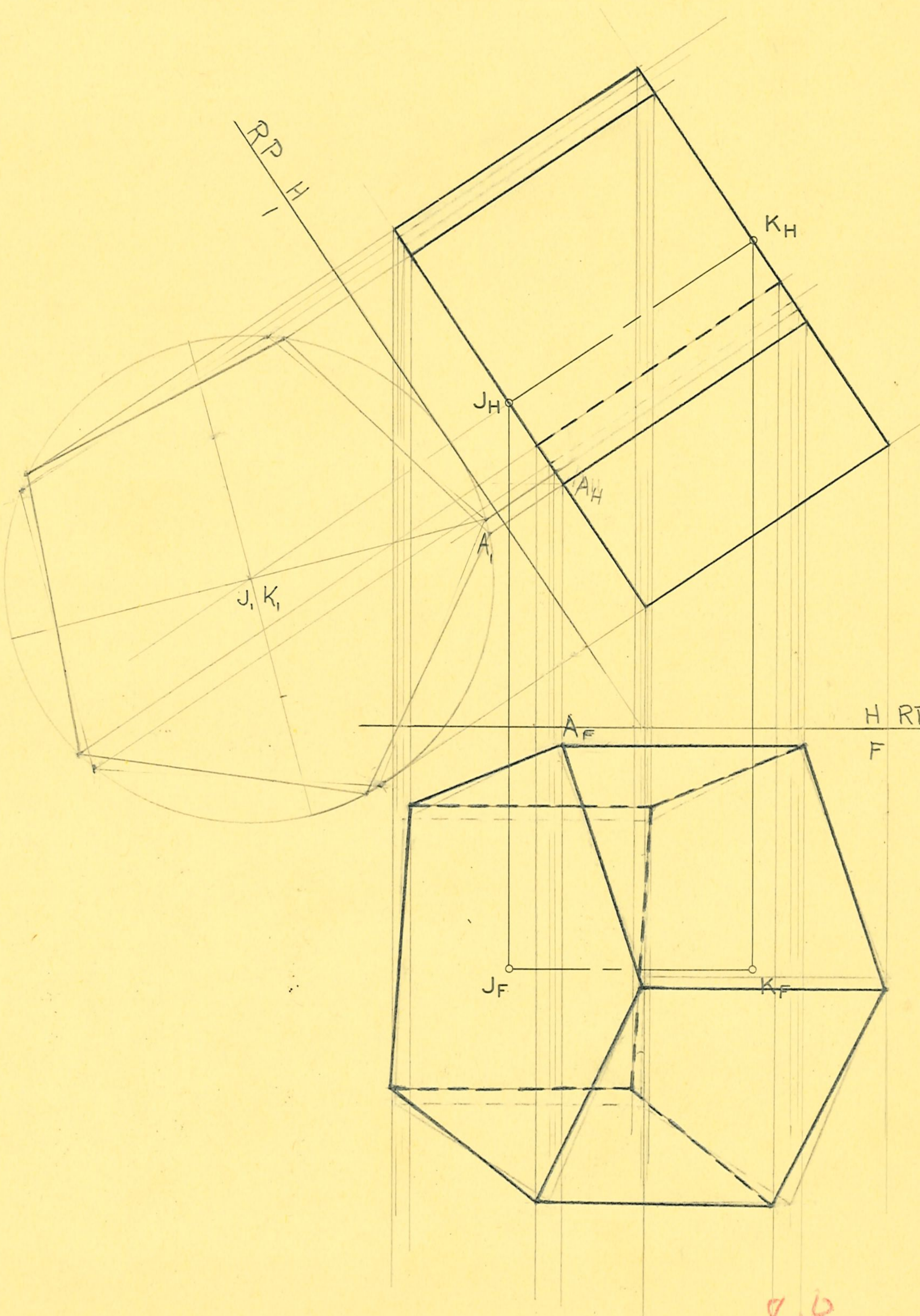
Given the front, top, and left-side views of a tetrahedron ABCD. Draw auxiliary views as seen when looking along the horizontal arrow "a", the profile arrow "b", and the frontal arrows "c" and "d". Name and orientate the auxiliary views.



D

3-7	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

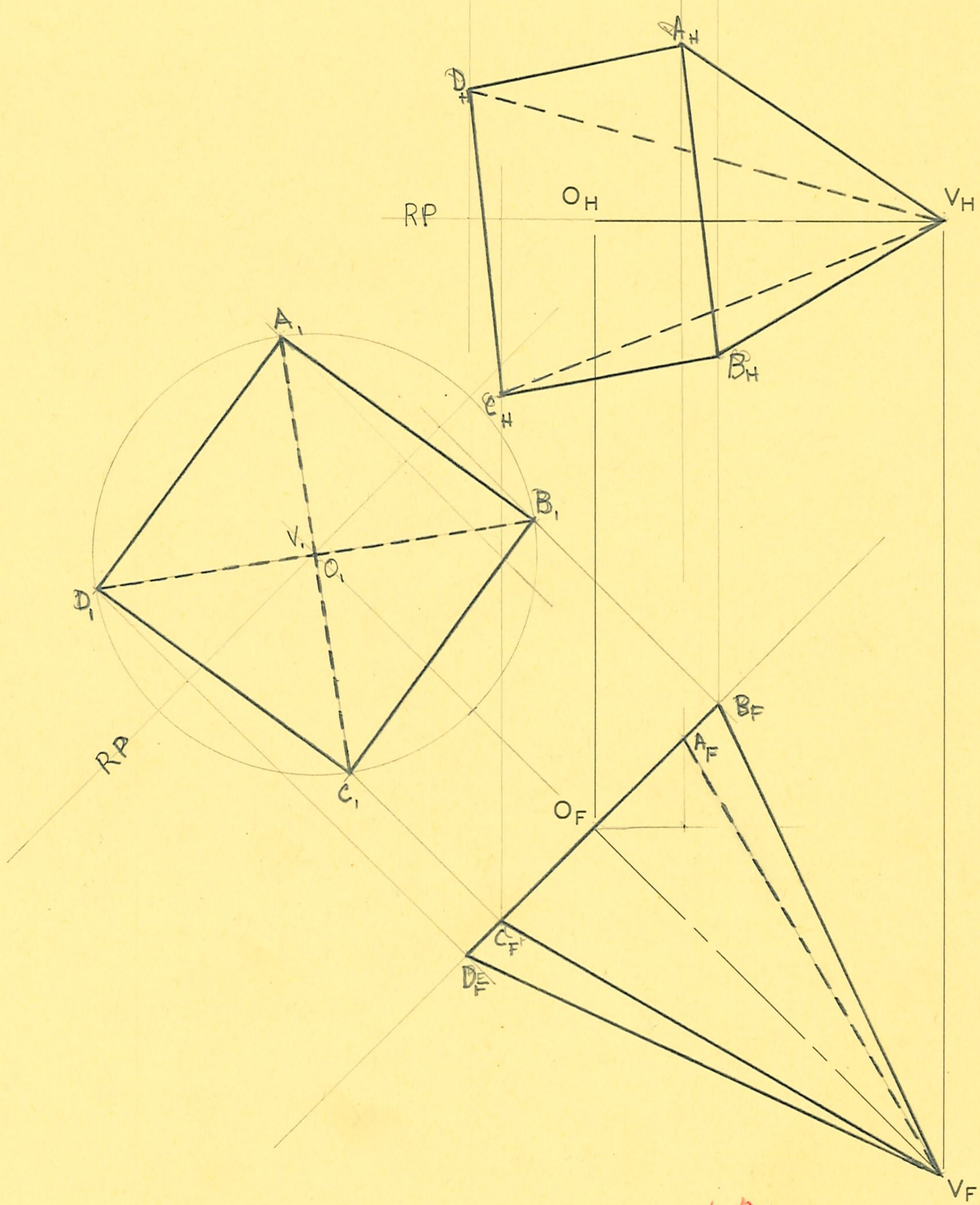
JK is the axis of a right prism. The bases are regular pentagons that may be inscribed in 3" diameter circles. Corner "A" of the base with center J is above J and ½" in front of J. Draw top and front views of the prism and any other views needed. Orientate and name all views drawn.



D

3-8	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

V is the vertex and O is the center of the base of a right pyramid. The base is a square with diagonals 2½″ long. Corner "A" of the base is behind O and ½″ to the right of O. Draw front and top views of the pyramid and any other views needed. Orientate and name the views.

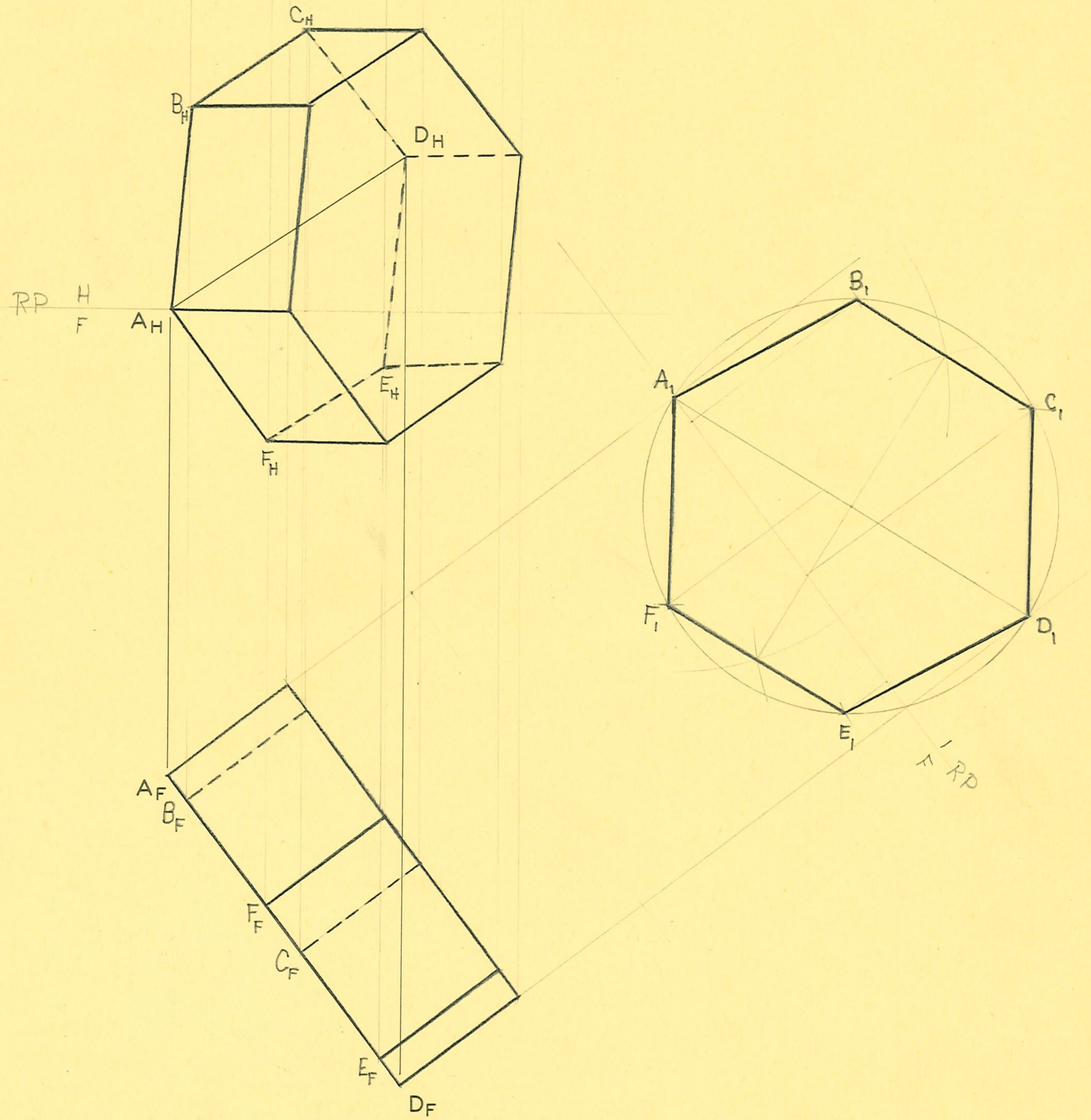


8.0

D

3 – 9	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

AD is a diagonal of an ortho-frontal hexagon which is the lower base of a right prism of 1" altitude. Draw the front and top views of the prism and any other views needed. Orientate and name the views.

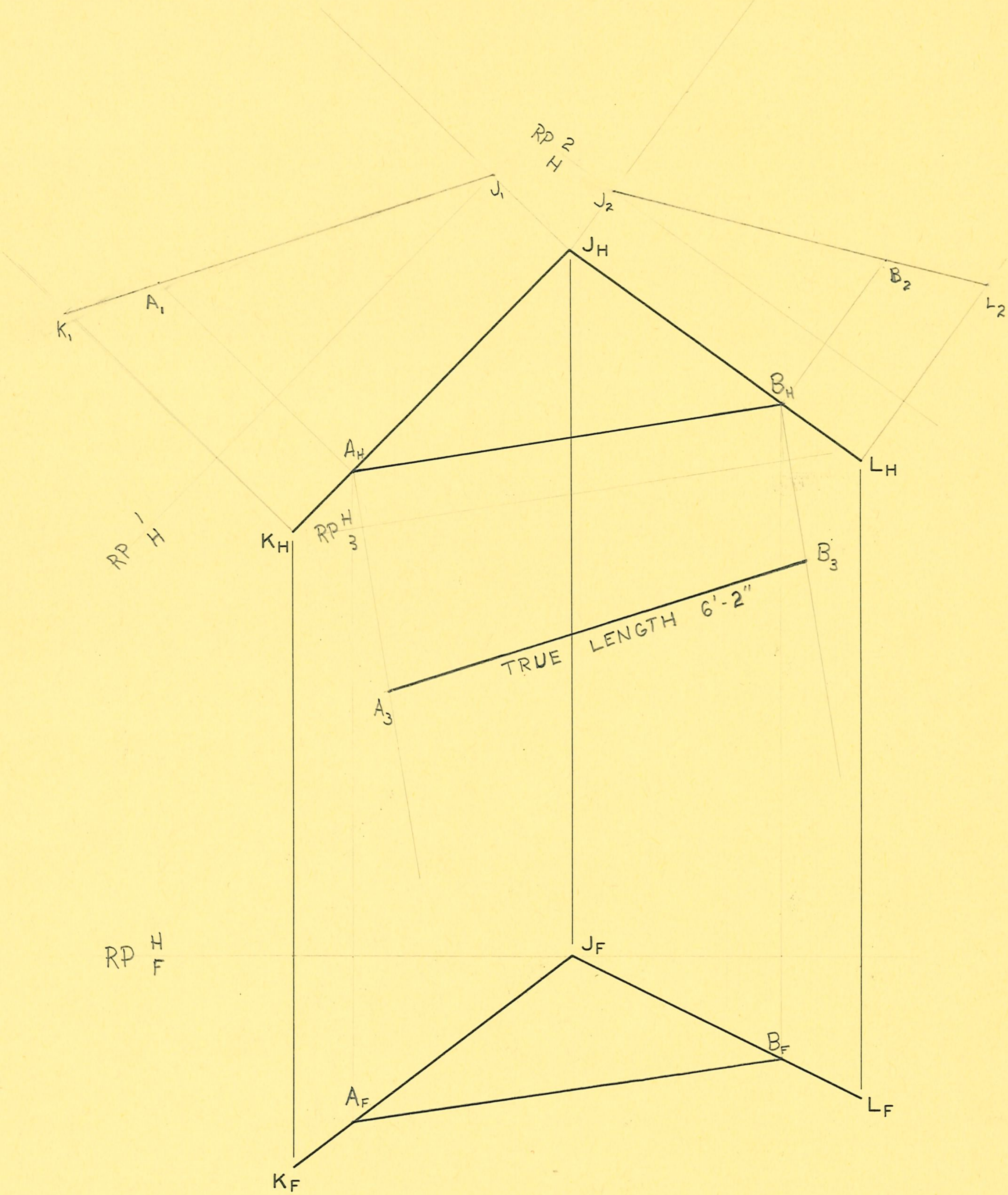


8.0

D

3-10	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

In a structure made of steel tubing, a member is to be welded to JK at A, 5 feet from J, and to JL at B, 4 feet from J. Draw the front and top views of the member AB and find its true length. Scale: ½" = 1'-0". Neglect size of tubing.



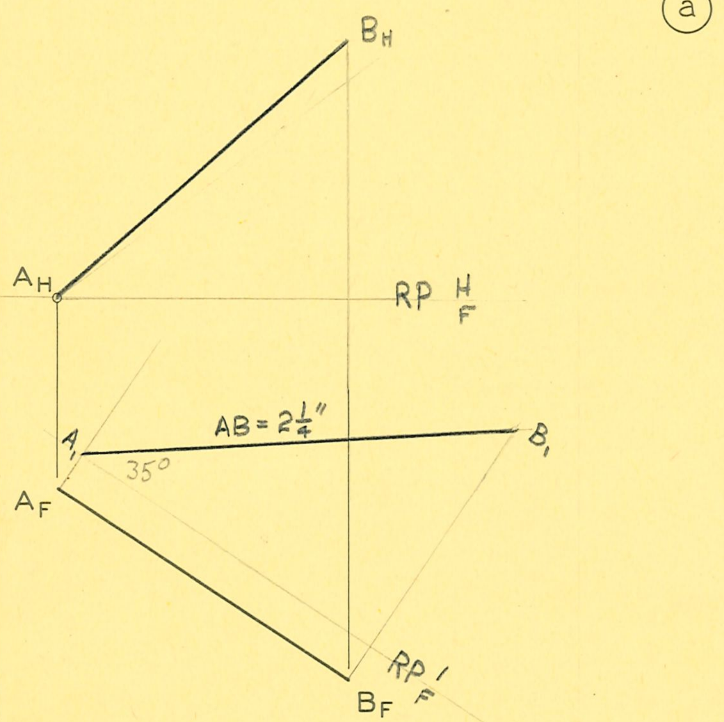
8.0

D

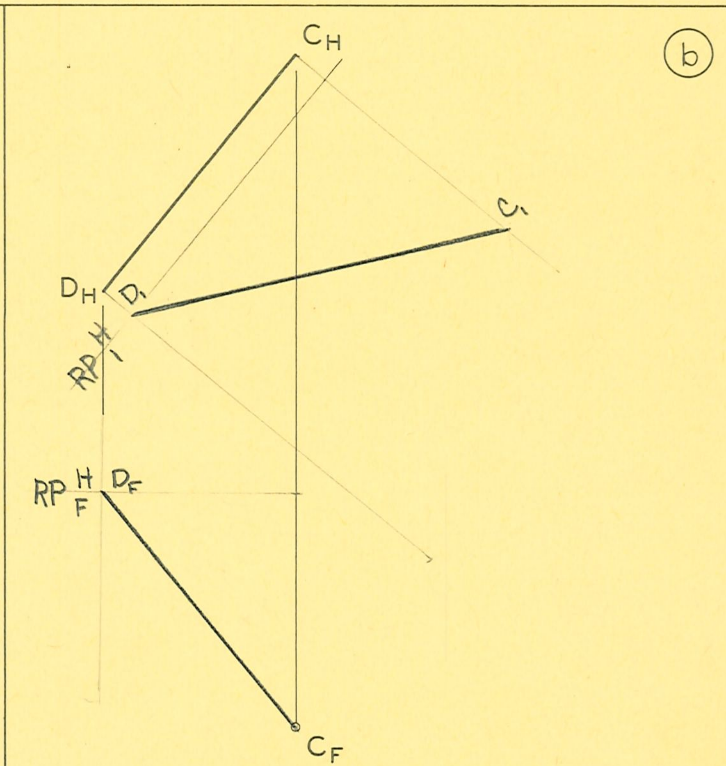
4 – 1	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

(a) AB makes 37° with a frontal plane and extends backward. Find its true length and draw the top view.
(b) CD is 2″ long and extends upward. Draw the front view.
(c) Find true length of EF and measure the angles it makes with horizontal, frontal, and profile planes.
(d) GH extends upward and makes 30° with horizontal planes. Draw the front view.

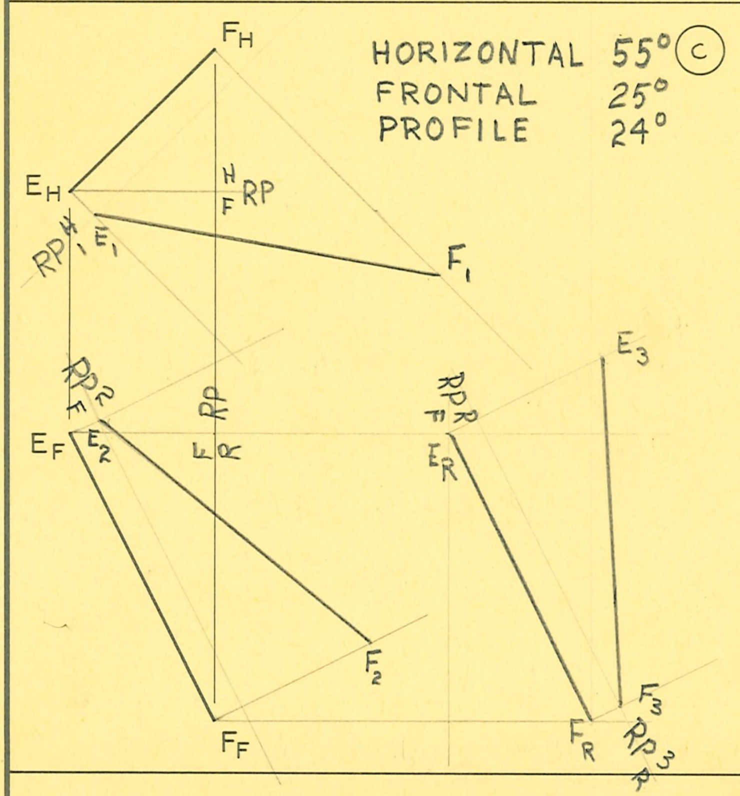
(a)



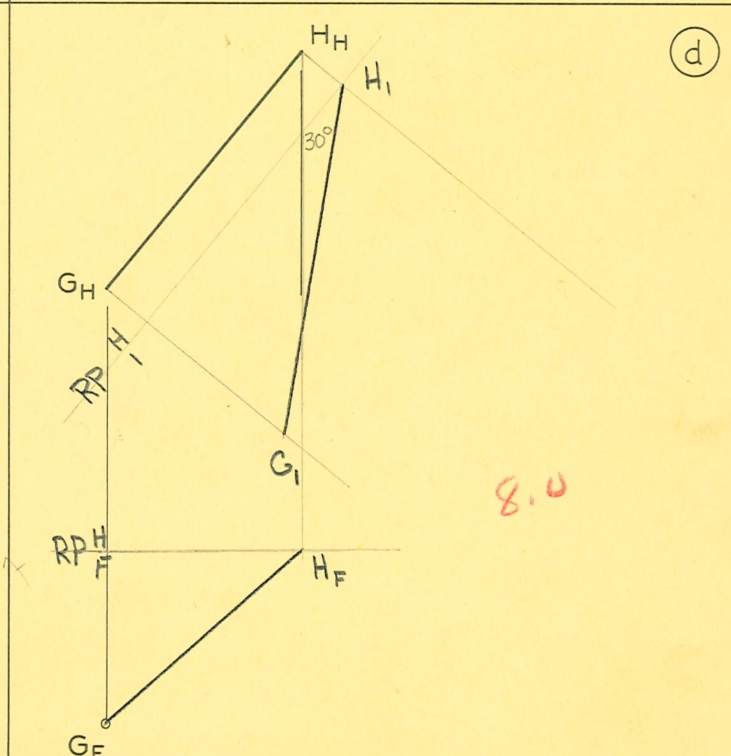
(b)



(c)



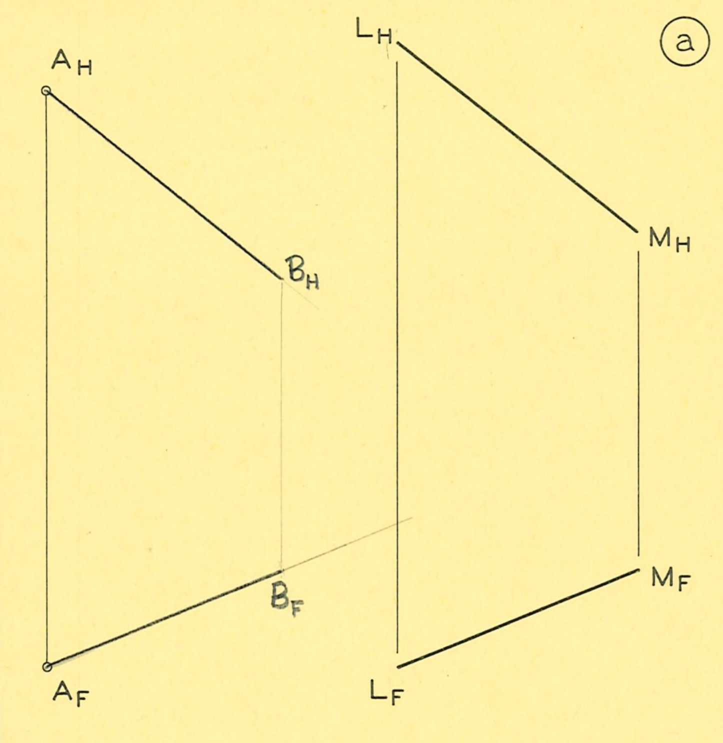
(d)

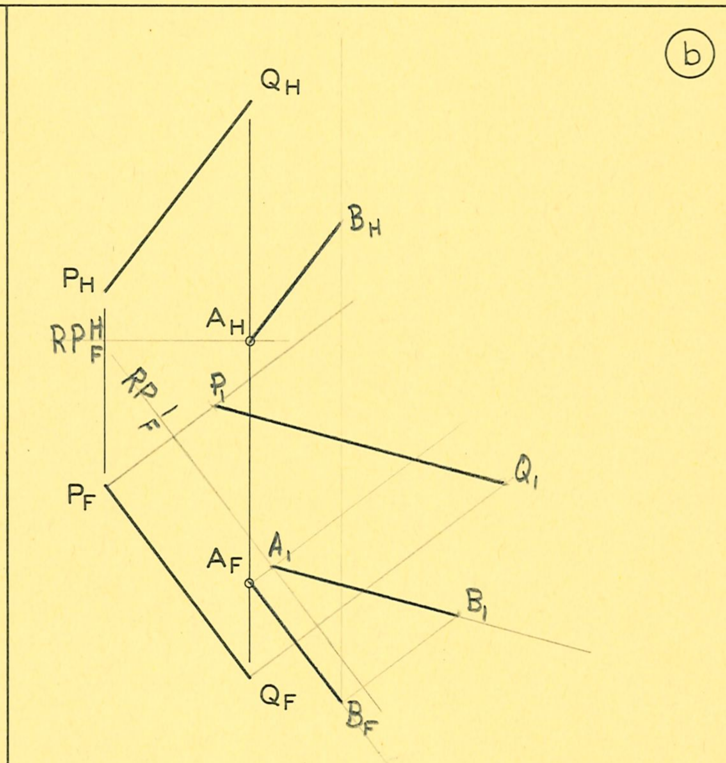


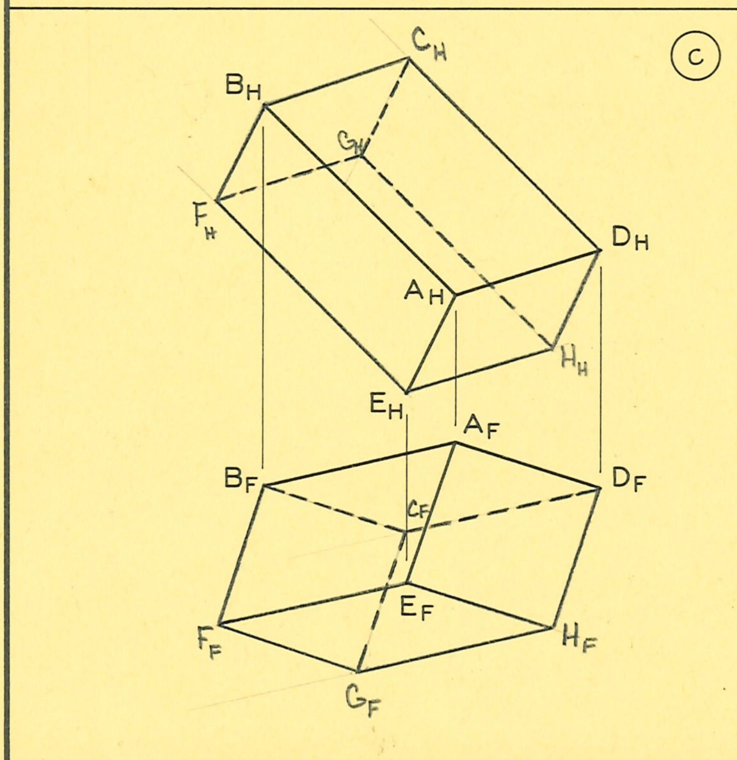
D

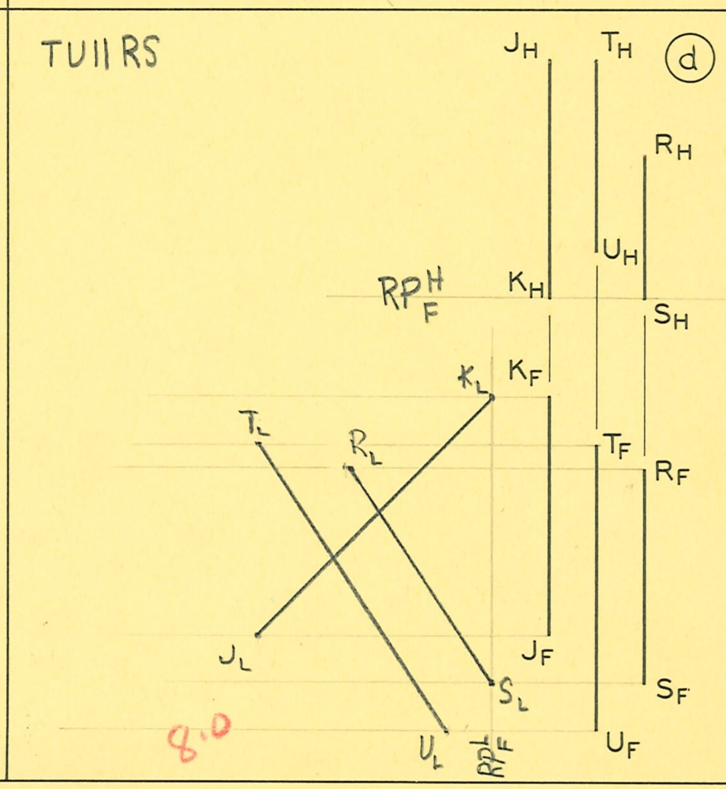
4-2 | ENGINEERING DESCRIPTIVE GEOMETRY | STEVEN F. BELLENOT
NAME | 90
DESK-SECTION

(a) Draw AB upward, parallel, and equal to LM.
(b) Draw AB downward, 1" long, and parallel to PQ.
(c) Draw the parallelepiped having adjacent sides AB, AD, and AE.
(d) Are any of the lines parallel? Show how the answer is determined.





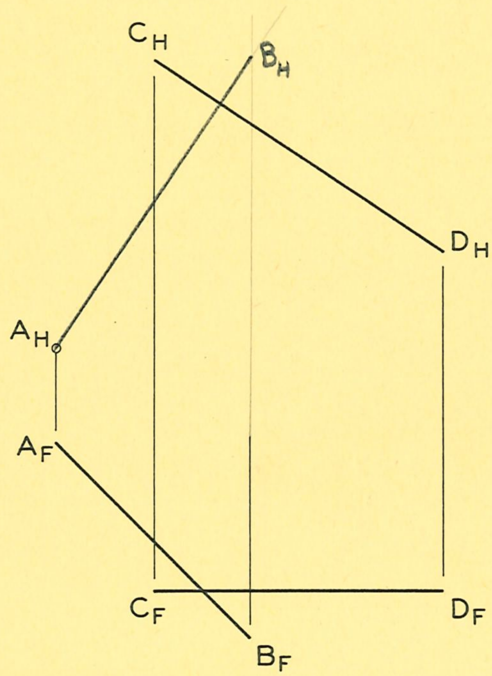


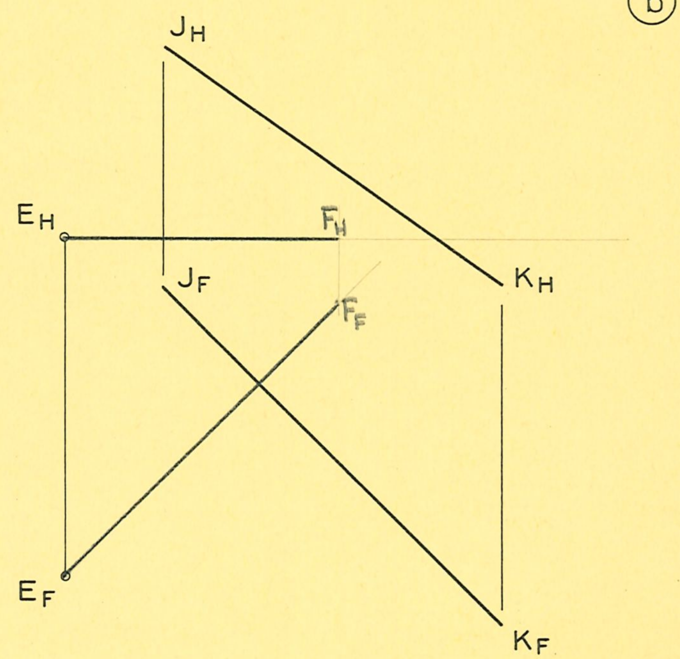


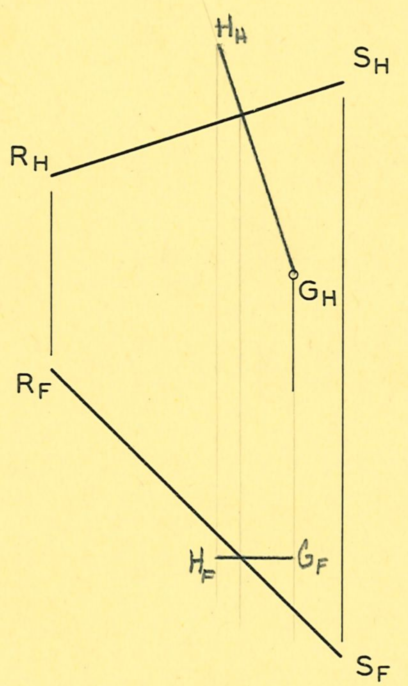
D

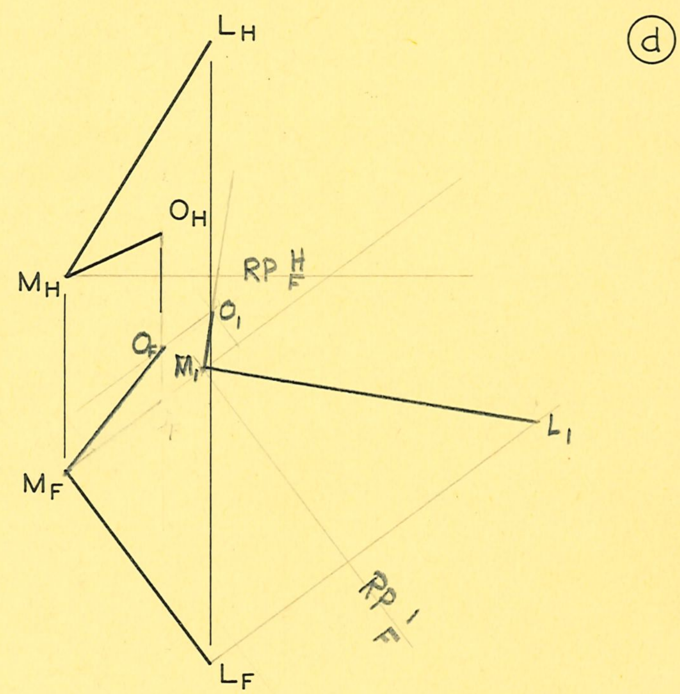
4–3 | ENGINEERING DESCRIPTIVE GEOMETRY | STEVEN F. BELLENOT NAME | 90 DESK-SECTION

Draw front and top views of the following lines:
(a) AB perpendicular to CD.
(b) A frontal line EF, 2″ long, perpendicular to JK.
(c) A horizontal line GH, 1¼″ long, perpendicular to and intersecting RS.
(d) MO perpendicular to LM.







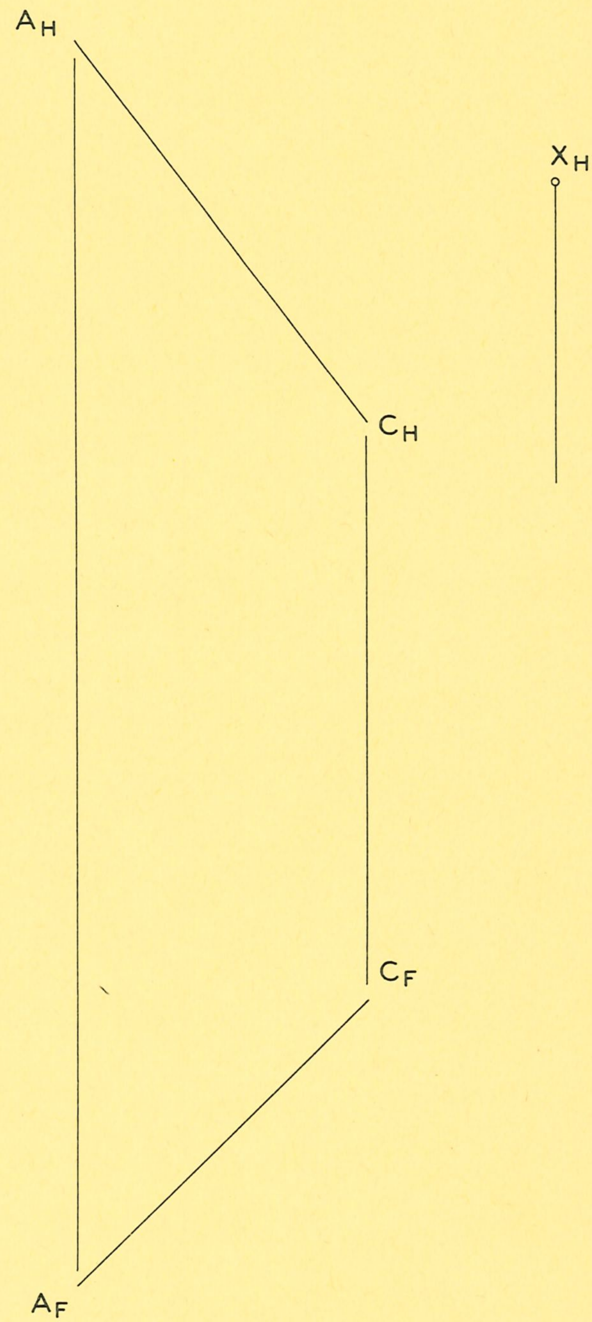


8.0

D

4-4	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

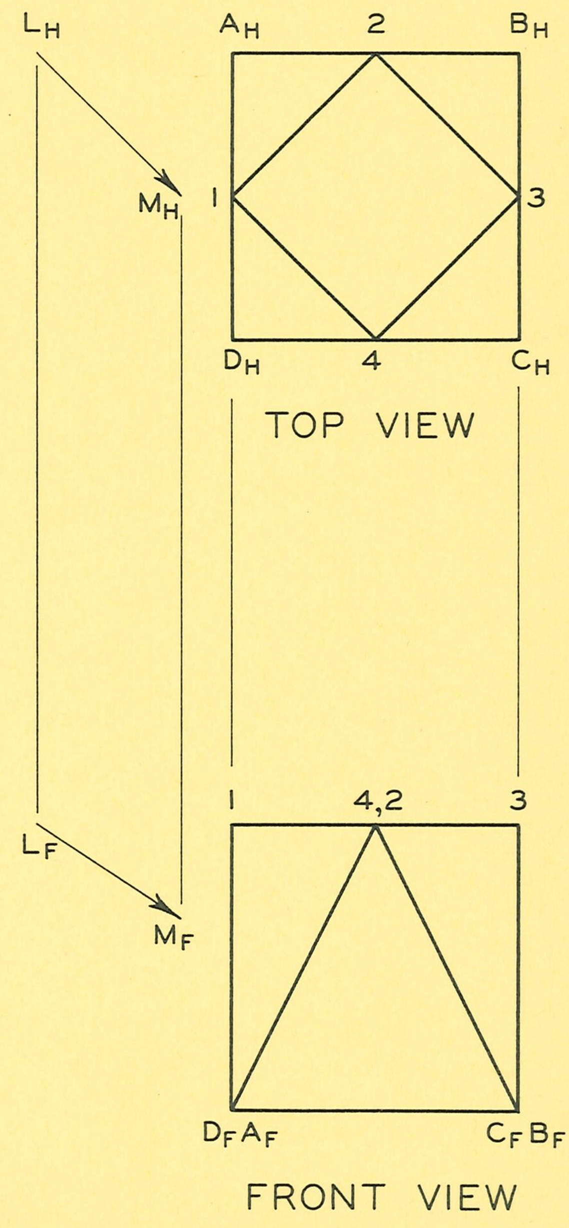
AC is one diagonal of a square. X is a point on the other diagonal. Draw front and top views of the square.



D

4–5	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

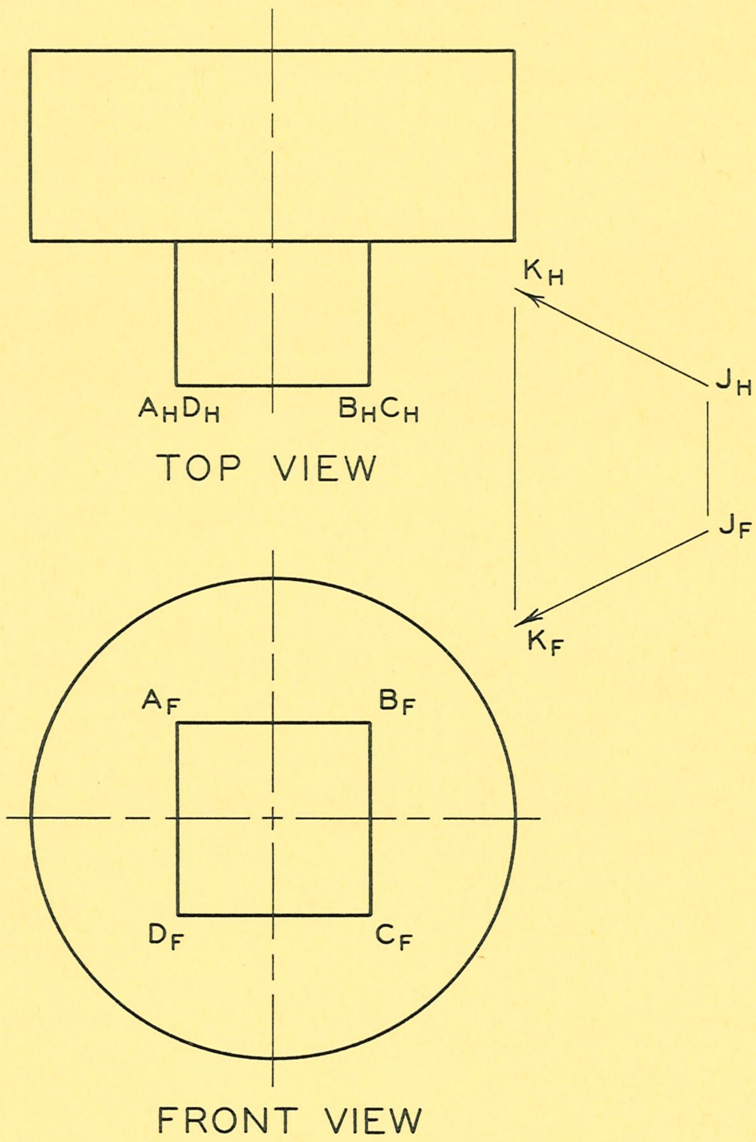
Draw a view of the sheet metal transition piece as seen when looking in the direction LM. Orientate and name the views.



D

 | ENGINEERING DESCRIPTIVE GEOMETRY | NAME | DESK-SECTION

Draw a view of the pipe plug blank as seen when looking in the direction JK. Orientate and name the views.

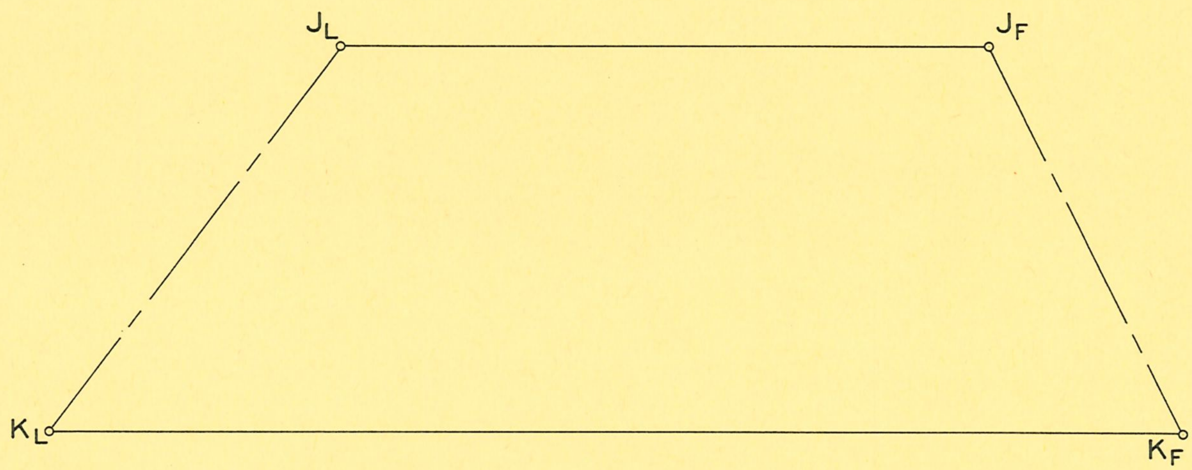


D

NAME

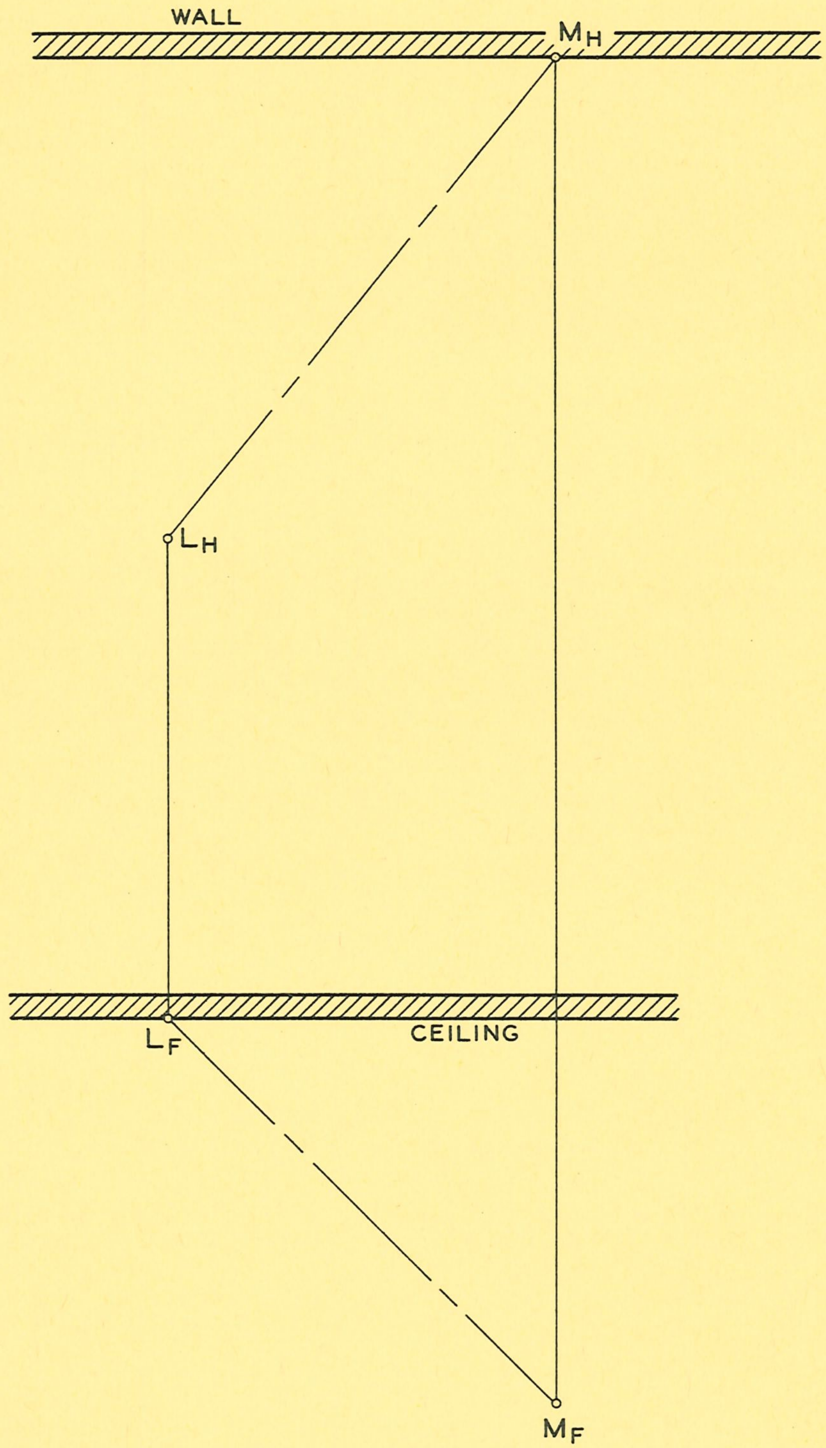
DESK-SECTION

JK is the axis of a right prism. The bases are equilateral triangles that may be inscribed in 2" diameter circles. The rear side of each base is frontal. Draw front and left-side views of the prism and any other views that are needed. Orientate and name the views.



D

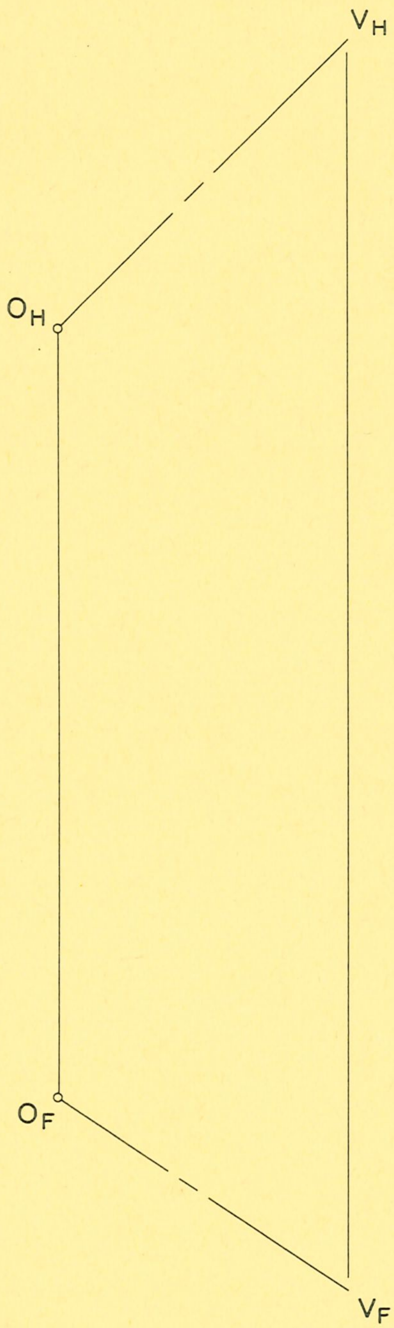
LM is the axis of a 4″x6″ timber cut to fit the wall of a room at M and the ceiling at L. The timber is turned on LM so that the 6″ sides of a right section are profile. Draw the front and top views of the cut timber and any other views that are needed. Orientate and name the views. Scale: 1½″ = 1′-0″.



D

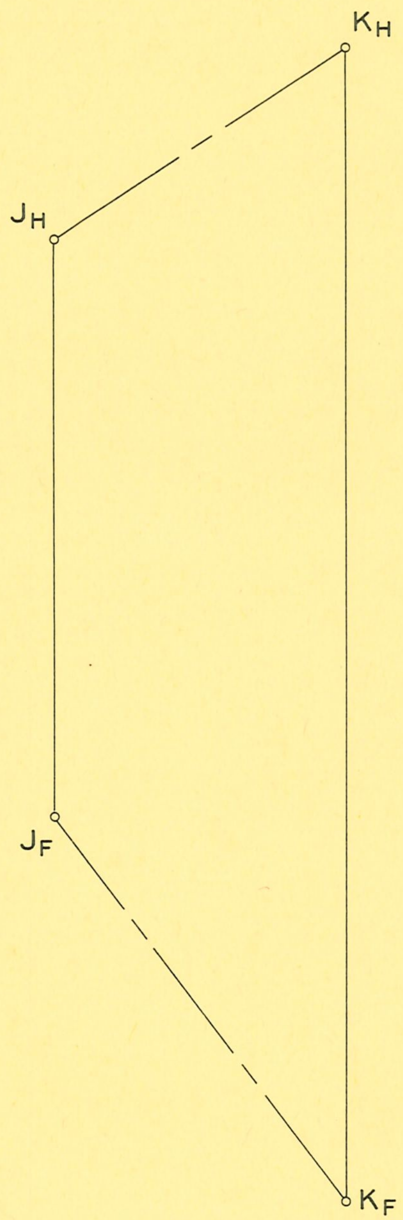
4–9	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

V is the vertex and O is the center of the square base of a right pyramid. The diagonals of the square are 2" long. Corner "A" of the base is in front of O and ½" above O. Draw front and top views of the pyramid and any other views that are needed. Orientate and name the views.



D

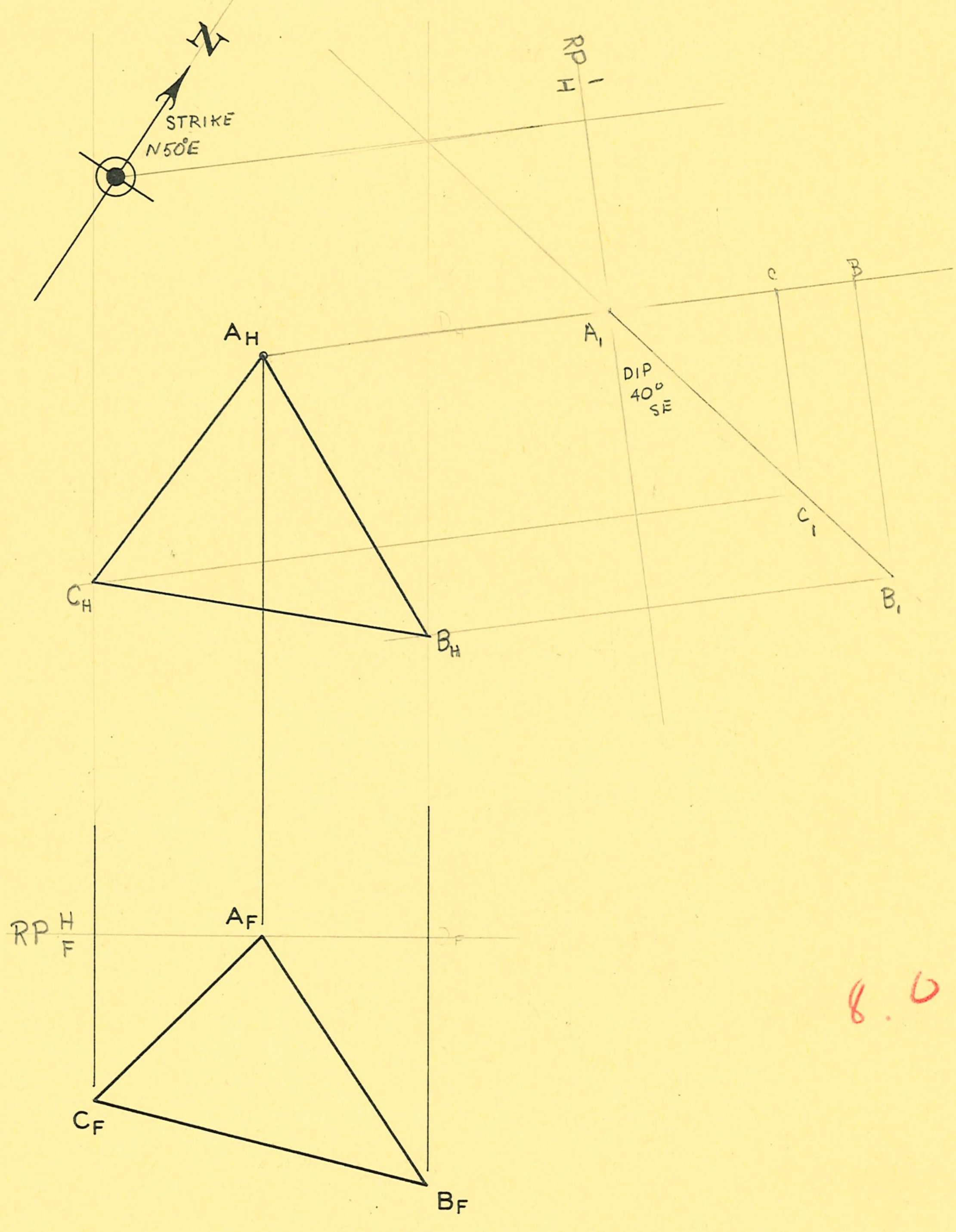
JK is the axis of a right pentagonal base prism. The pentagons can be inscribed in 2" diameter circles. Corner "A" of the pentagon with center K is to the left of K and 5/8" in front of K. Draw front and top views of the prism and any other views that are needed. Orientate and name the views.



D

4-11	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

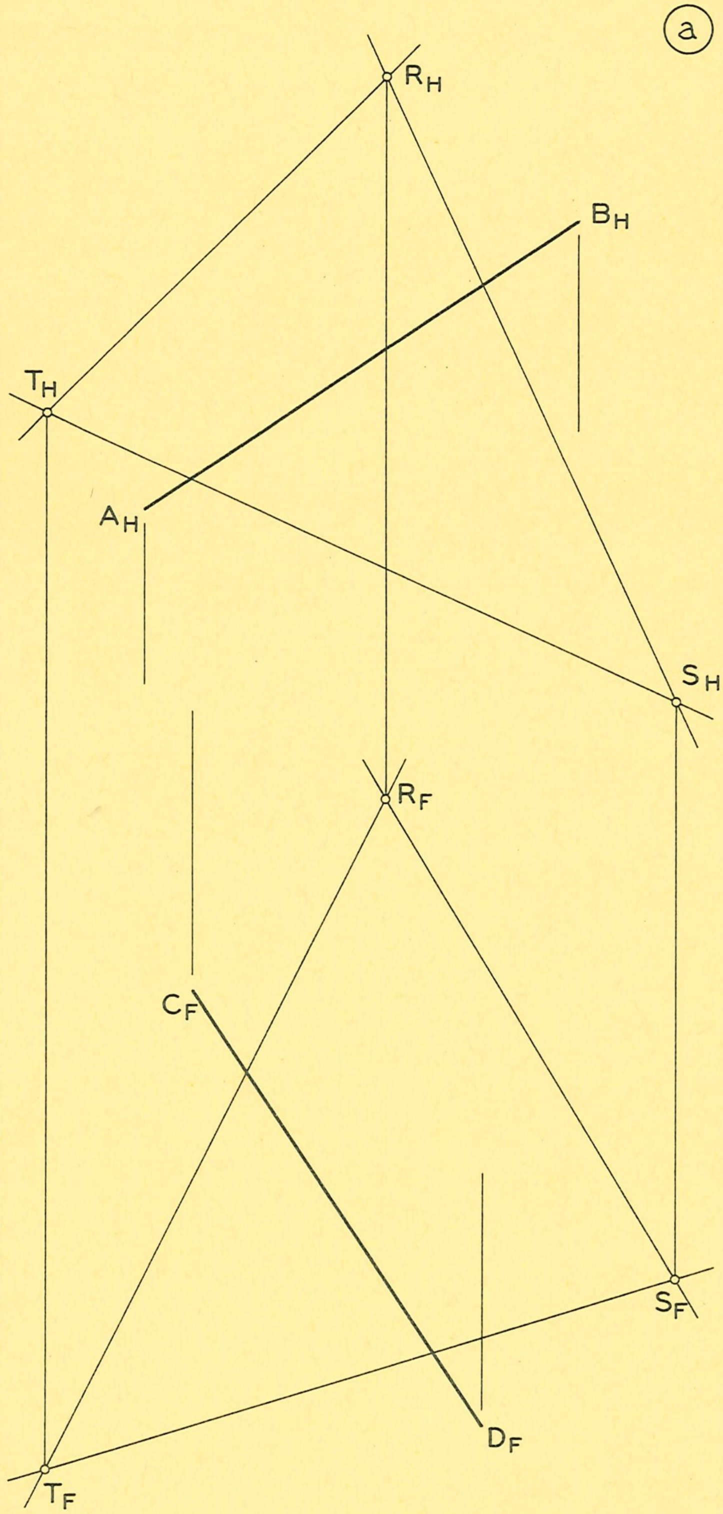
The strike of triangle ABC is N 50° E and the dip is 40° southeasterly. Draw the top view of the triangle.

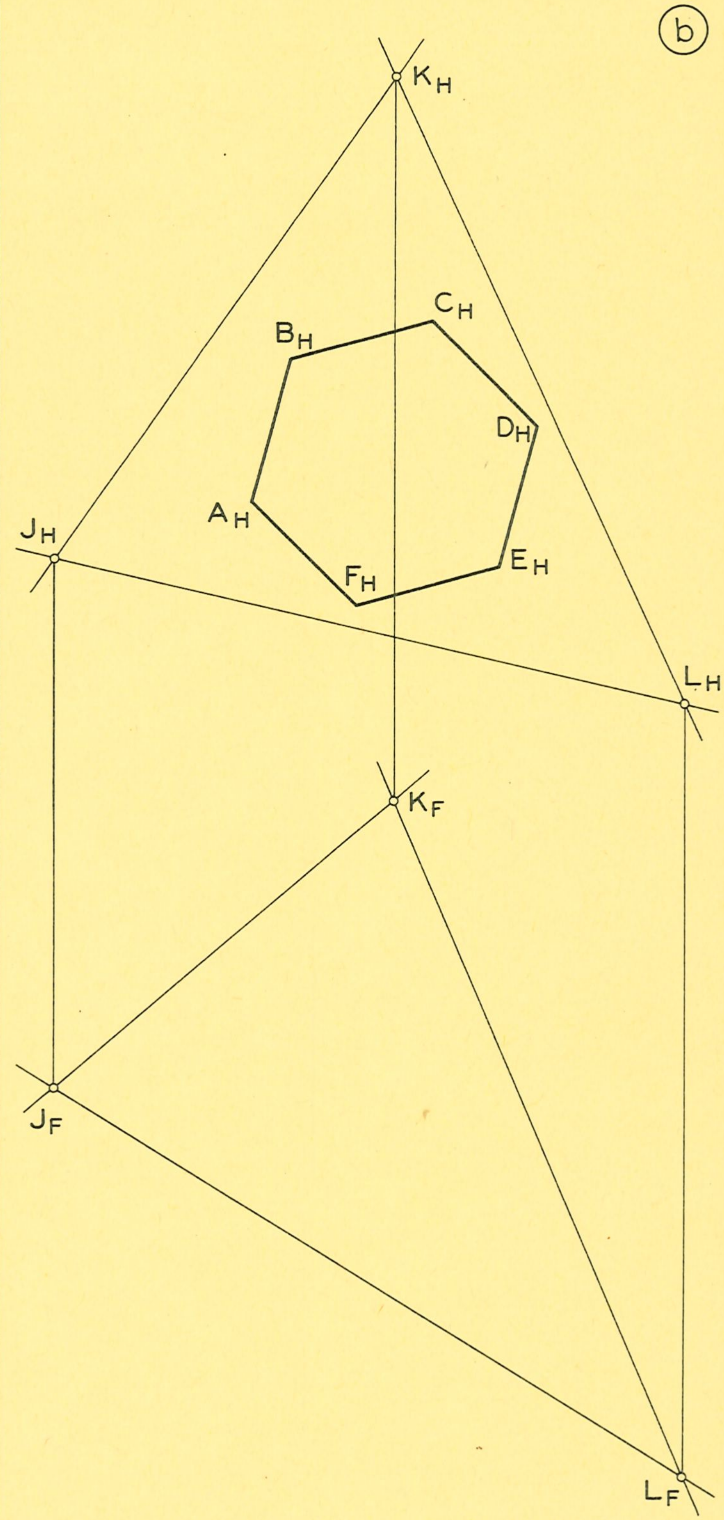


D

5 - 1	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

(a) Draw the lines AB and CD in the plane RST. Check the solution.
(b) Draw the front view of the hexagon ABCDEF in the plane JKL.





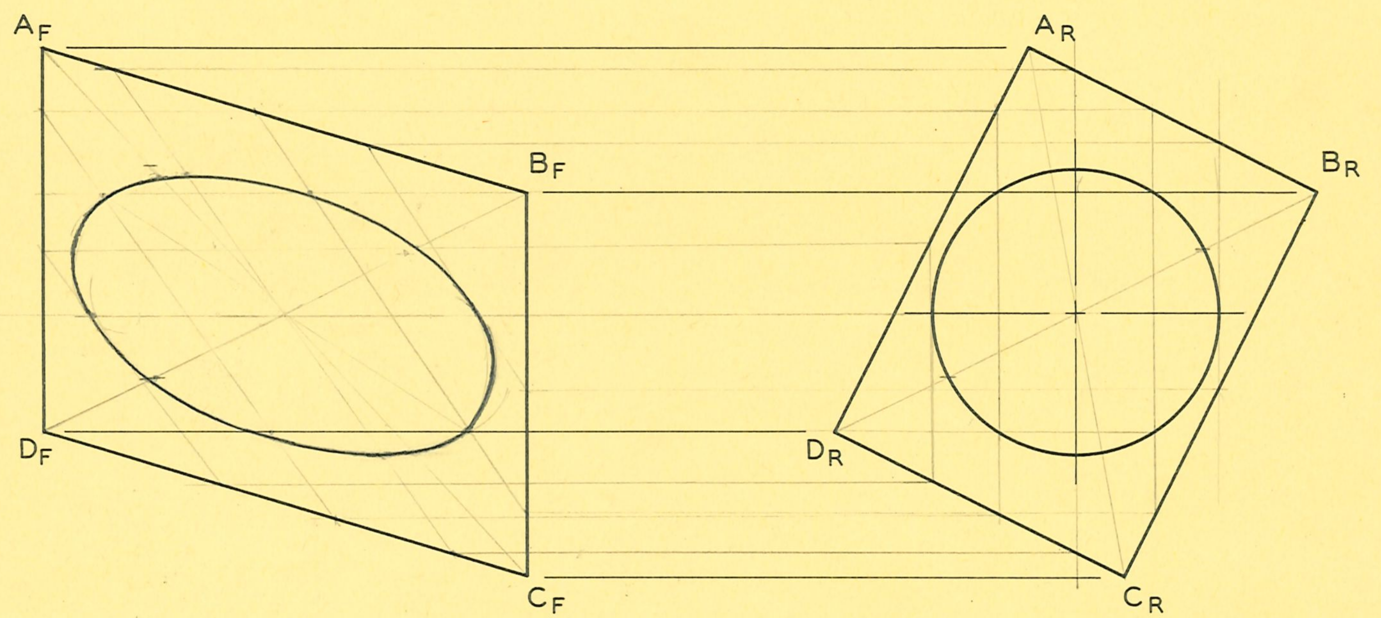
D

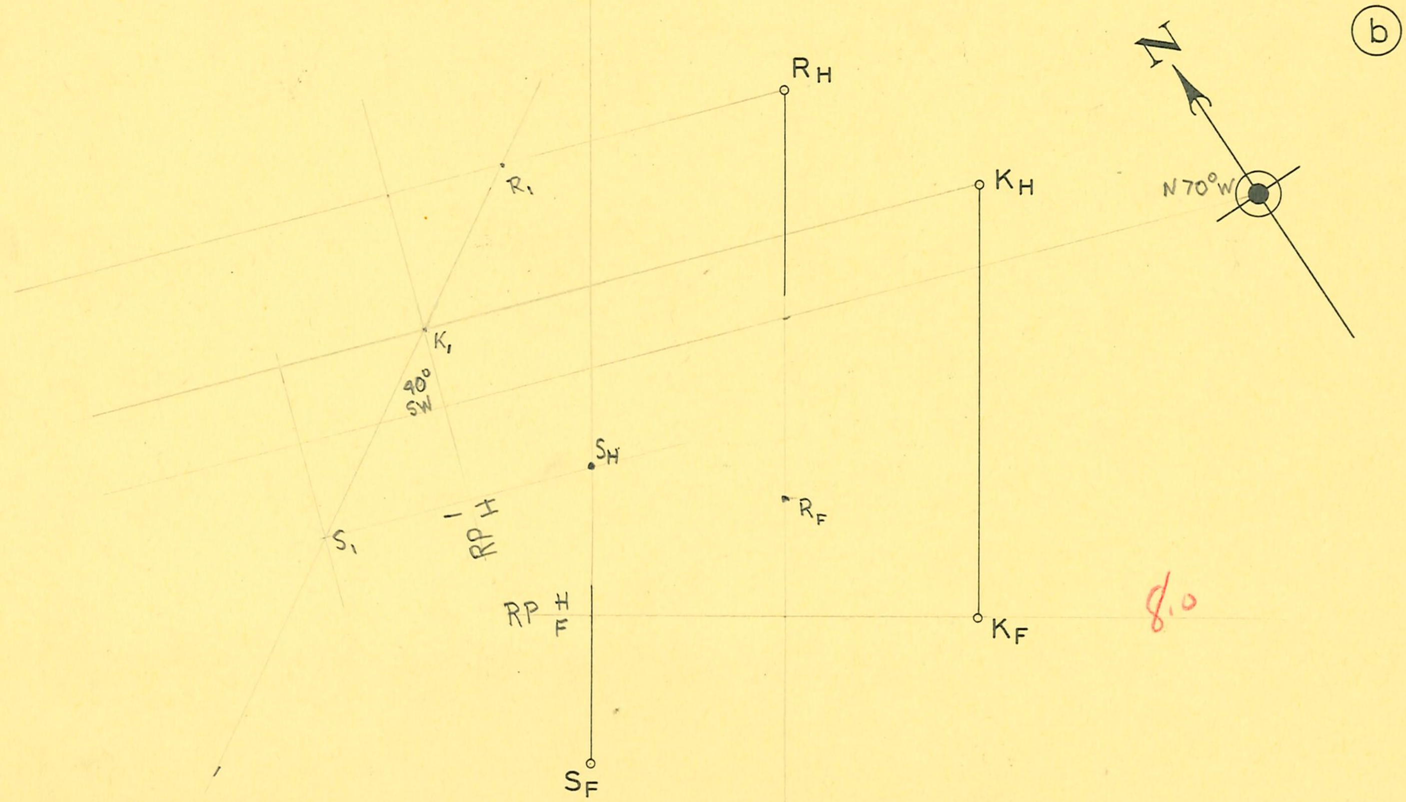
NAME

DESK-SECTION

(a) An ellipse in the plane ABCD appears as a circle in the right-side view. Draw the front view.

(b) Locate the front and top views of points R and S in a plane through K which strikes N 70° W and dips 40° southwesterly.

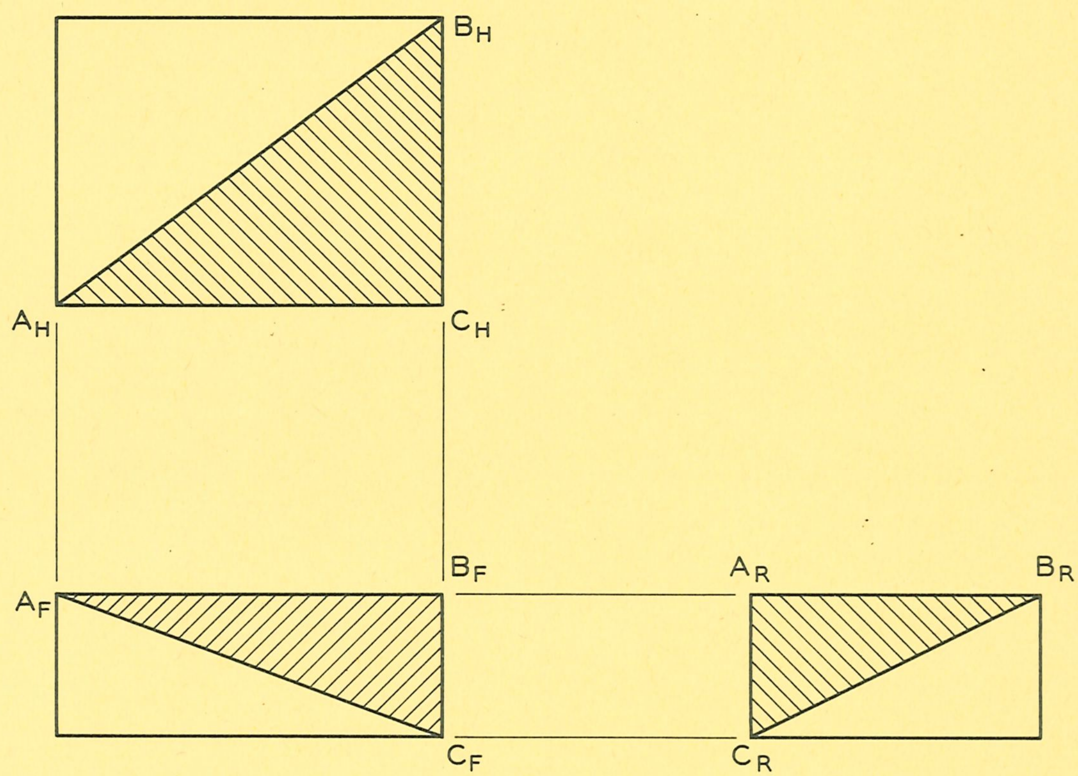




D

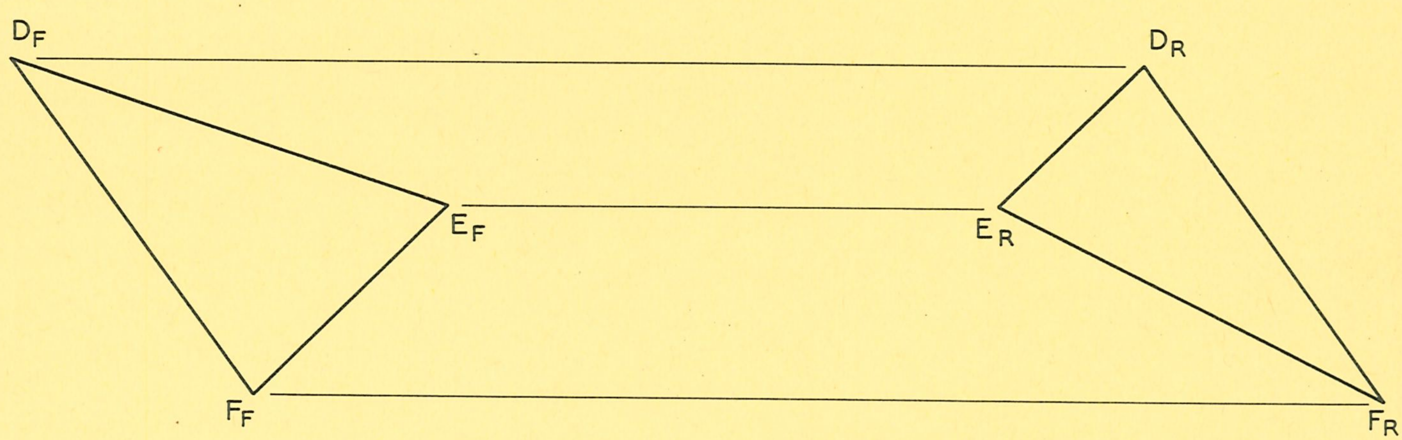
5-3	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Given a rectangular block with one corner cut off as shown below. Measure the angles between the cut surface and the top, front, and right-side faces of the block. Show the entire block in all views drawn.



D

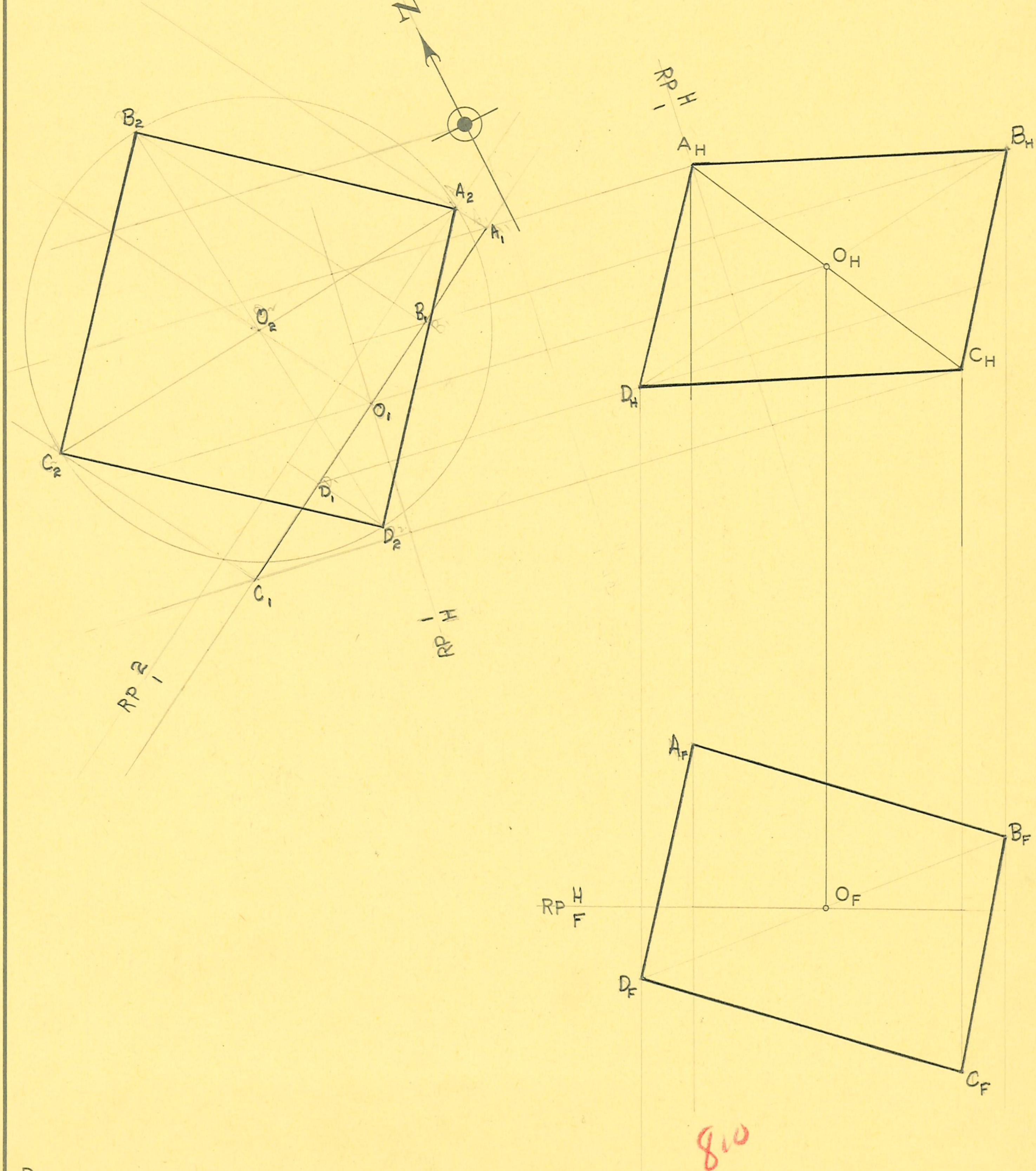
Measure the angles the plane DEF makes with horizontal, frontal, and profile planes.



D

5 – 5	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

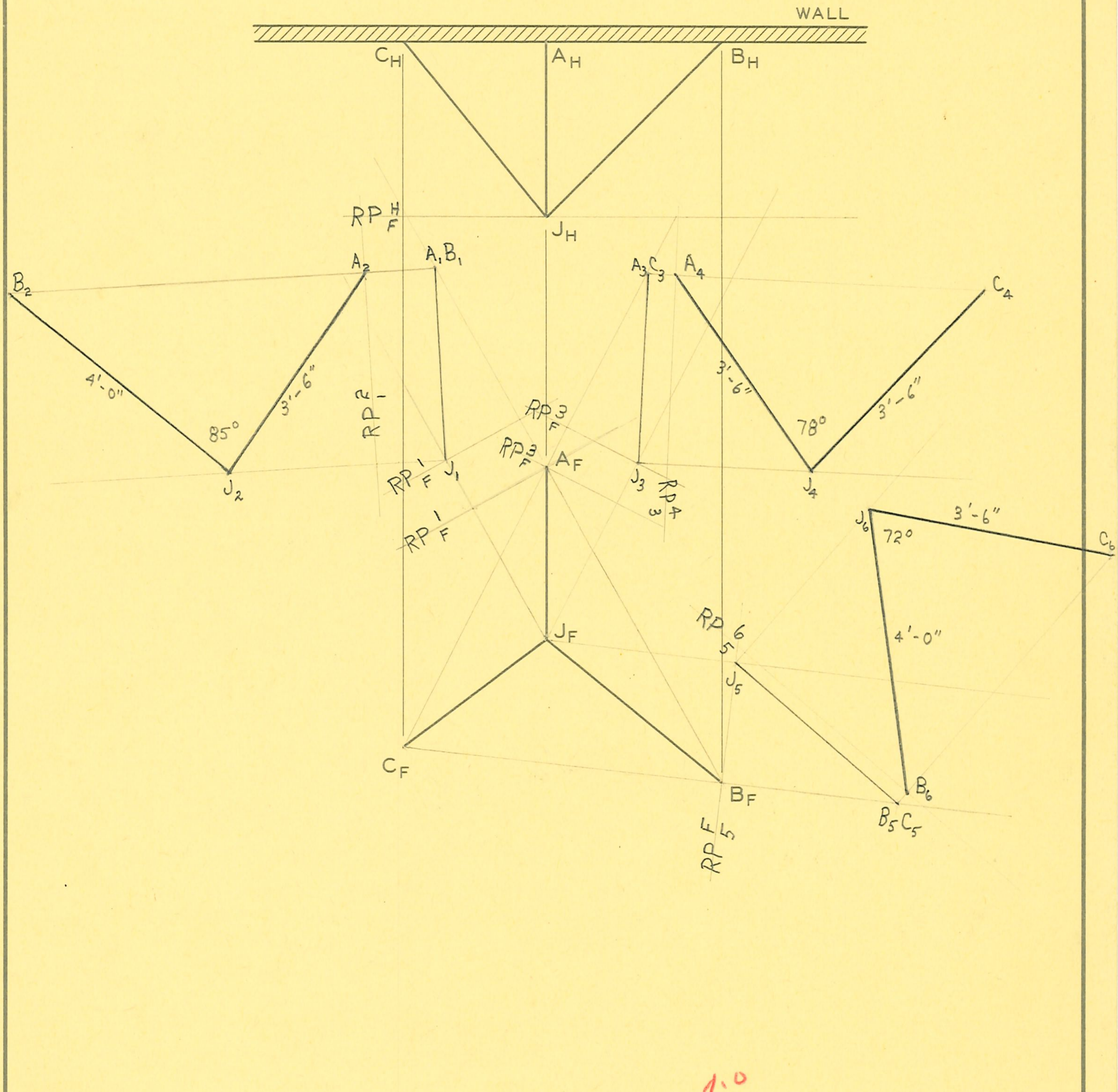
The strike of a square with center O is N 80° W. The dip is 50° southwesterly. AC is one diagonal of the square. Find the true size of the square and draw its front and top views.



D

5 – 6	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 D DESK-SECTION

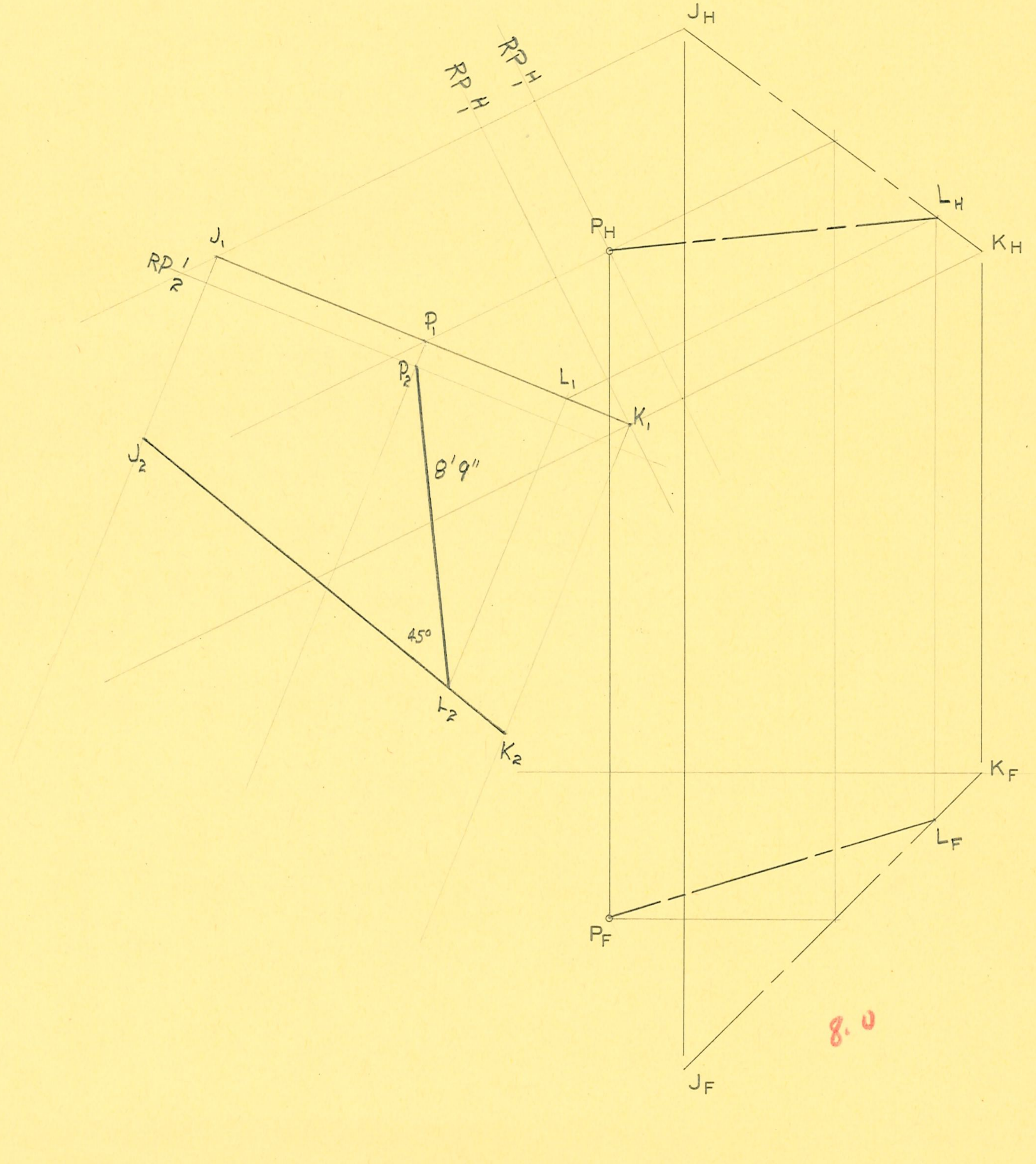
A structure made of three pieces of steel tubing is fastened to a wall as shown. Find the length of each piece and measure the angles between them. Scale: ½″ = 1′-0″.



D

5-7 | ENGINEERING DESCRIPTIVE GEOMETRY | STEVEN F. BELLENOT (NAME) | 90 (DESK-SECTION)

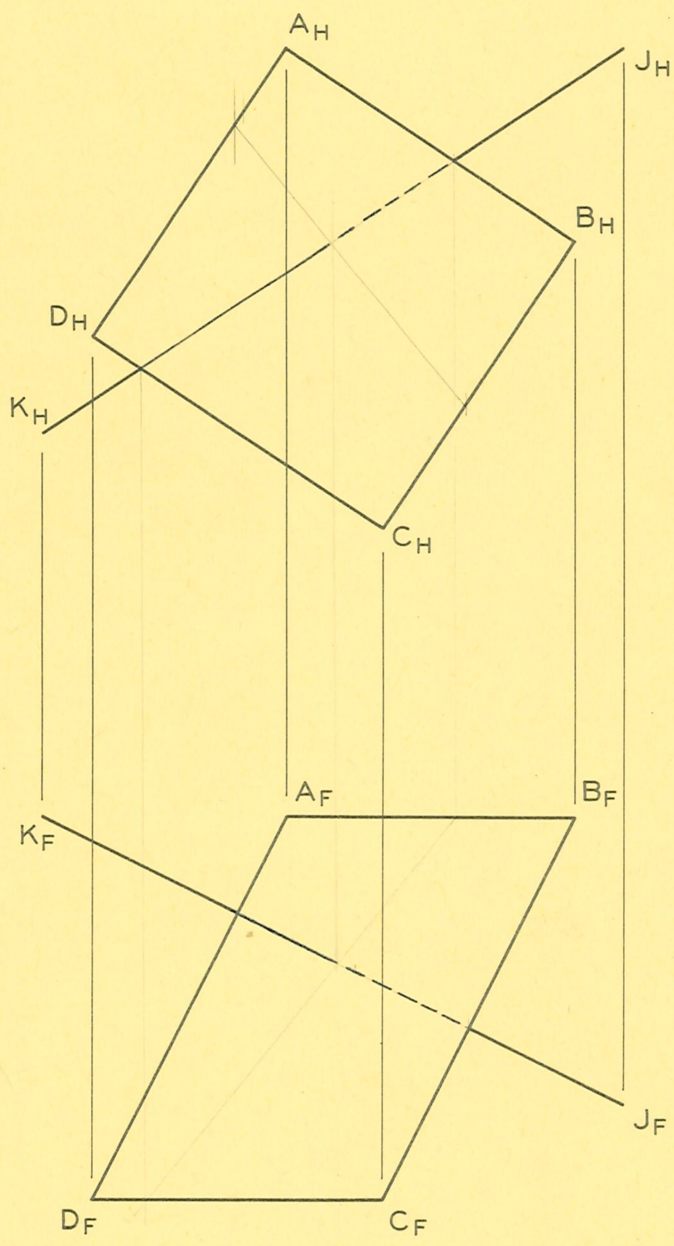
JK is the center line of a pipe. Draw front and top views of the center line of another pipe connecting point P to JK with a 45° fitting. Find the length of the connecting pipe. Scale: 1/4" = 1'-0".

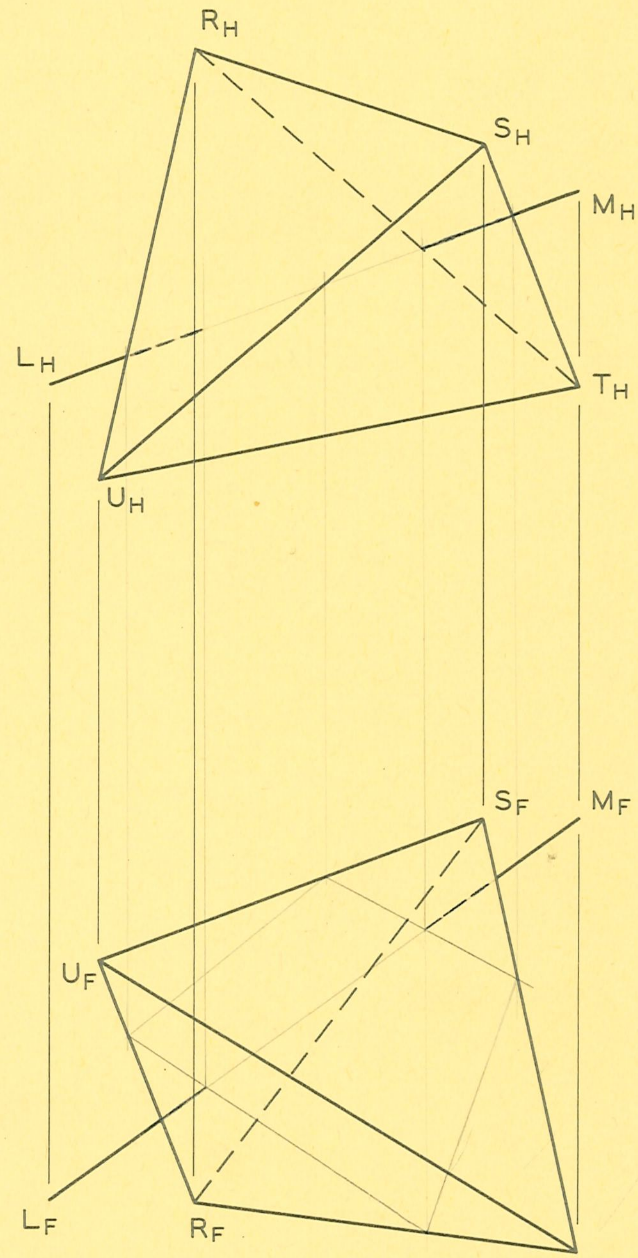


D

5-8	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

(a) Find the intersection of JK and the plane ABCD. Show the proper visibility of JK.
(b) Find the intersection of LM and the tetrahedron RSTU. Omit the portion of LM inside the tetrahedron and indicate the visibility of the portion outside.



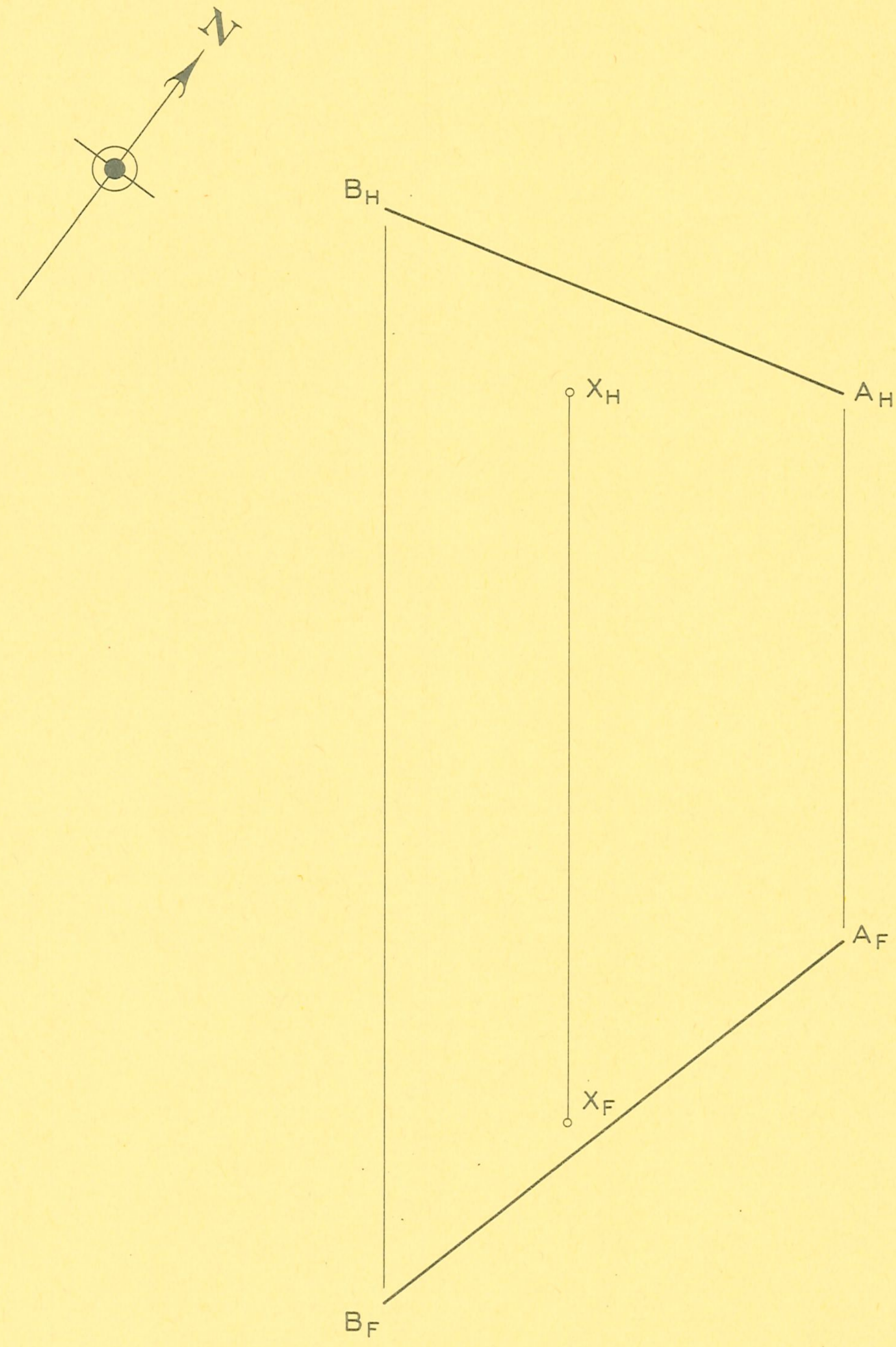


8.5

D

5 – 9	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

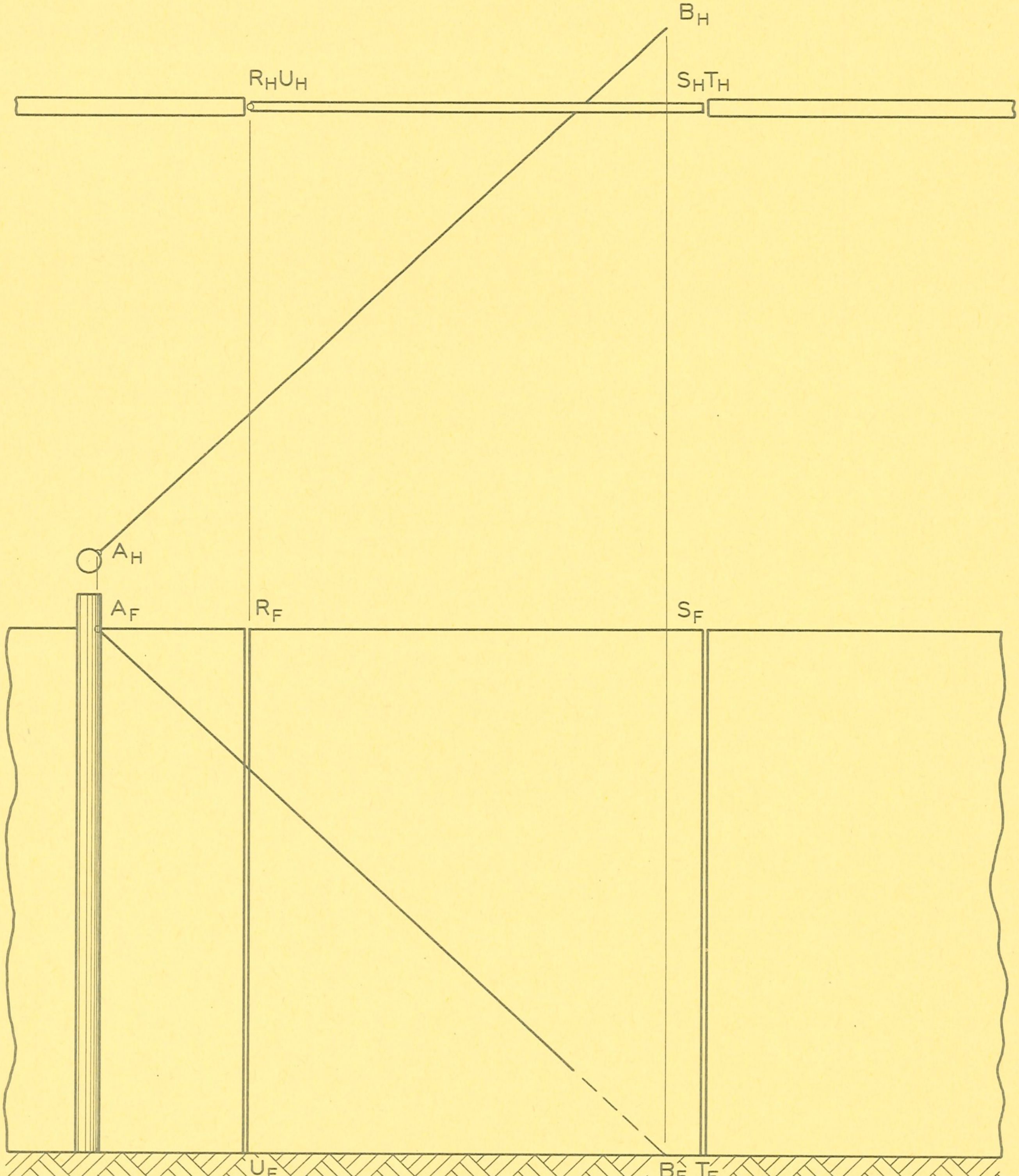
Show in the front and top views the point O where the line AB intersects a plane through X which strikes S 35° W and dips 40° southeasterly.



D

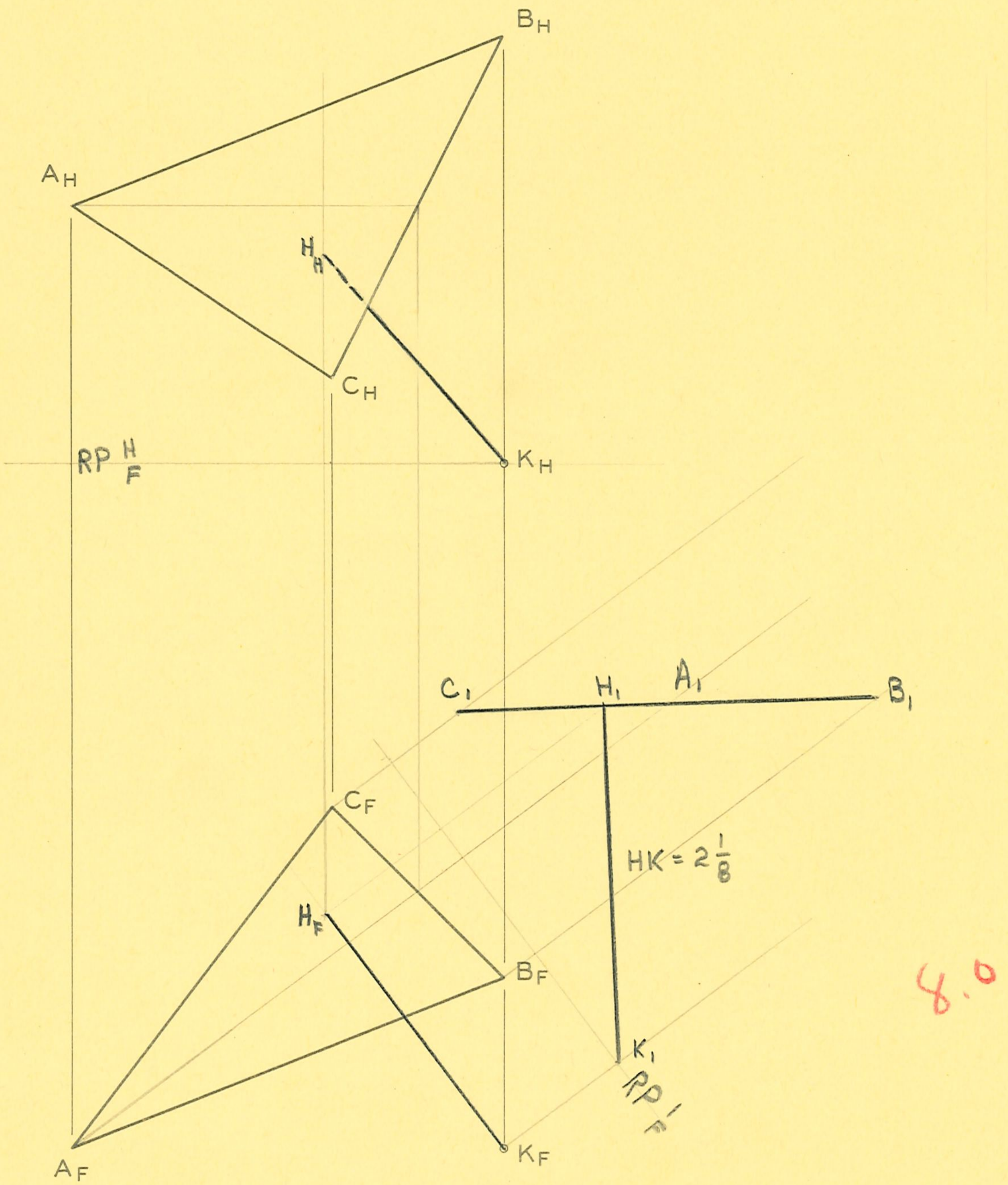
5-10	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

RSTU is a solid plank gate in a fence. AB is a wire extending from a pole, through the gate, and to an anchor in the ground. Neglecting the size of the wire, find the shape of the slot necessary to be cut in the gate to allow it to be opened forward 90° if hinged on RU.



D

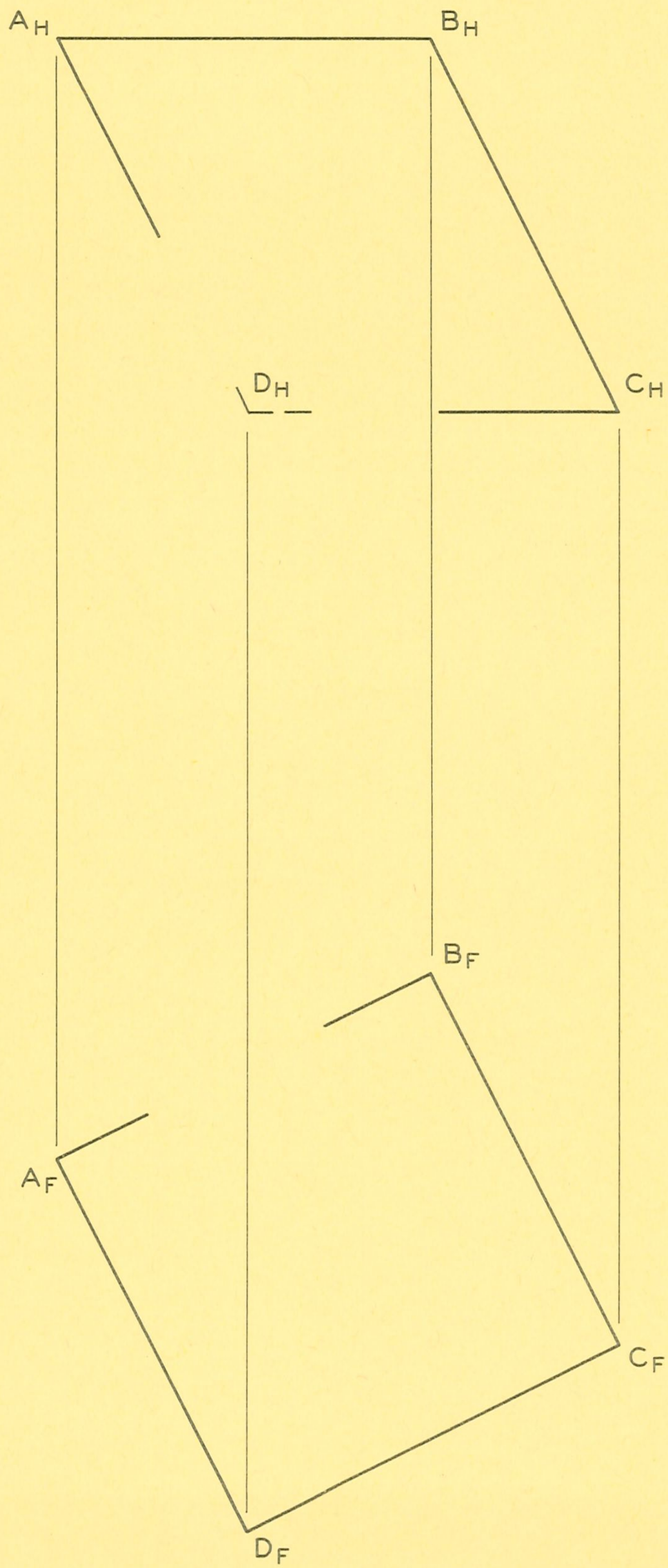
Draw the shortest possible line from point K to the triangle ABC. Measure its length and indicate proper visibility.



D

5-12	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

An equilateral triangle that can be inscribed in a 2″ diameter circle has its center at the intersection of the diagonals of the rectangle ABCD, and its left side is profile. This triangle is the lower base of a right prism of 1″ altitude and resting on the rectangle. Draw the front and top views of the prism.



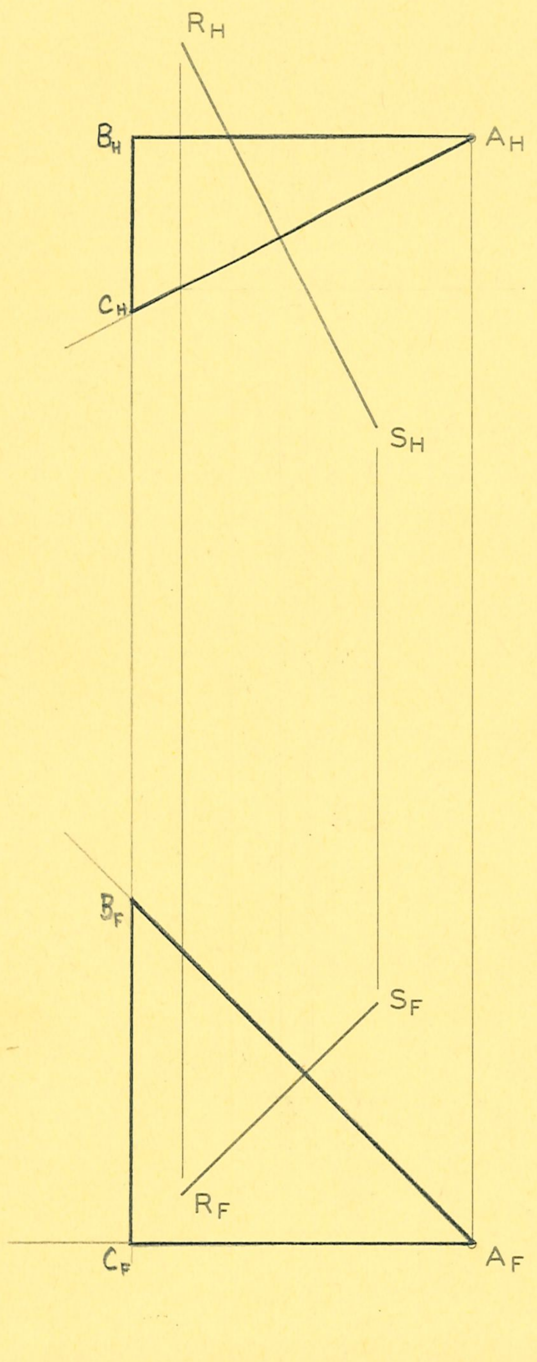
D

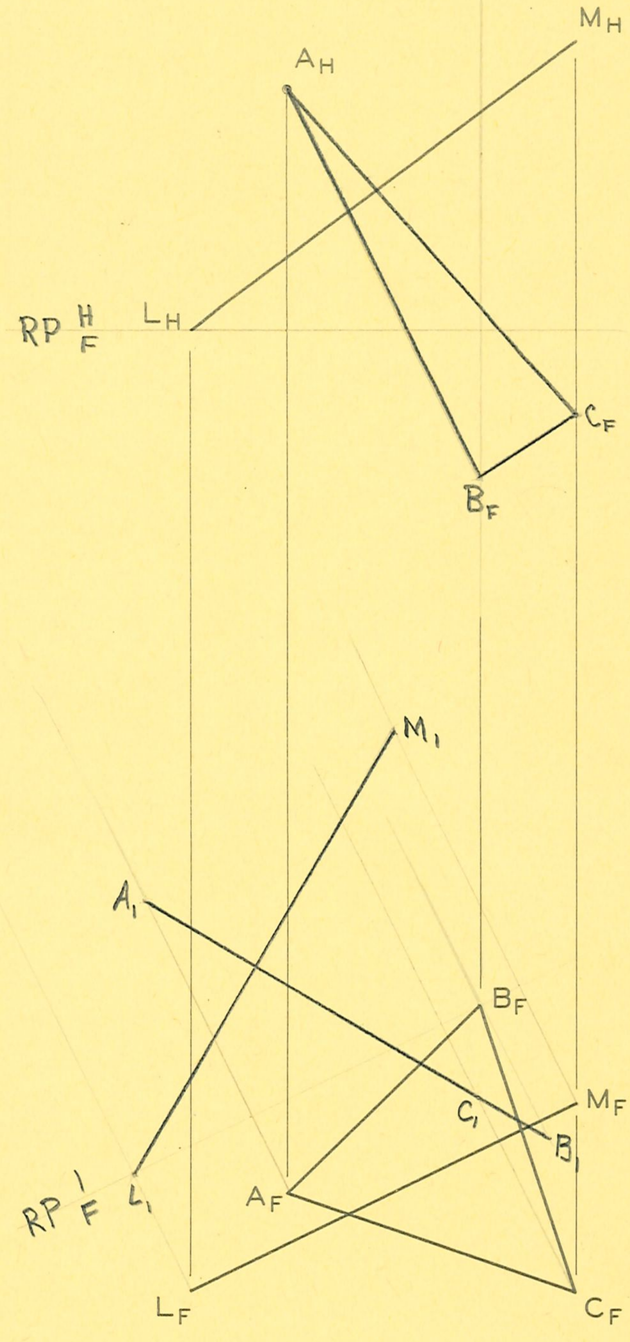
ENGINEERING DESCRIPTIVE GEOMETRY

NAME

DESK-SECTION

(a) Without using auxiliary views draw the front and top views of a plane through "A" and perpendicular to RS.
(b) Triangle ABC is perpendicular to LM. Draw its top view.



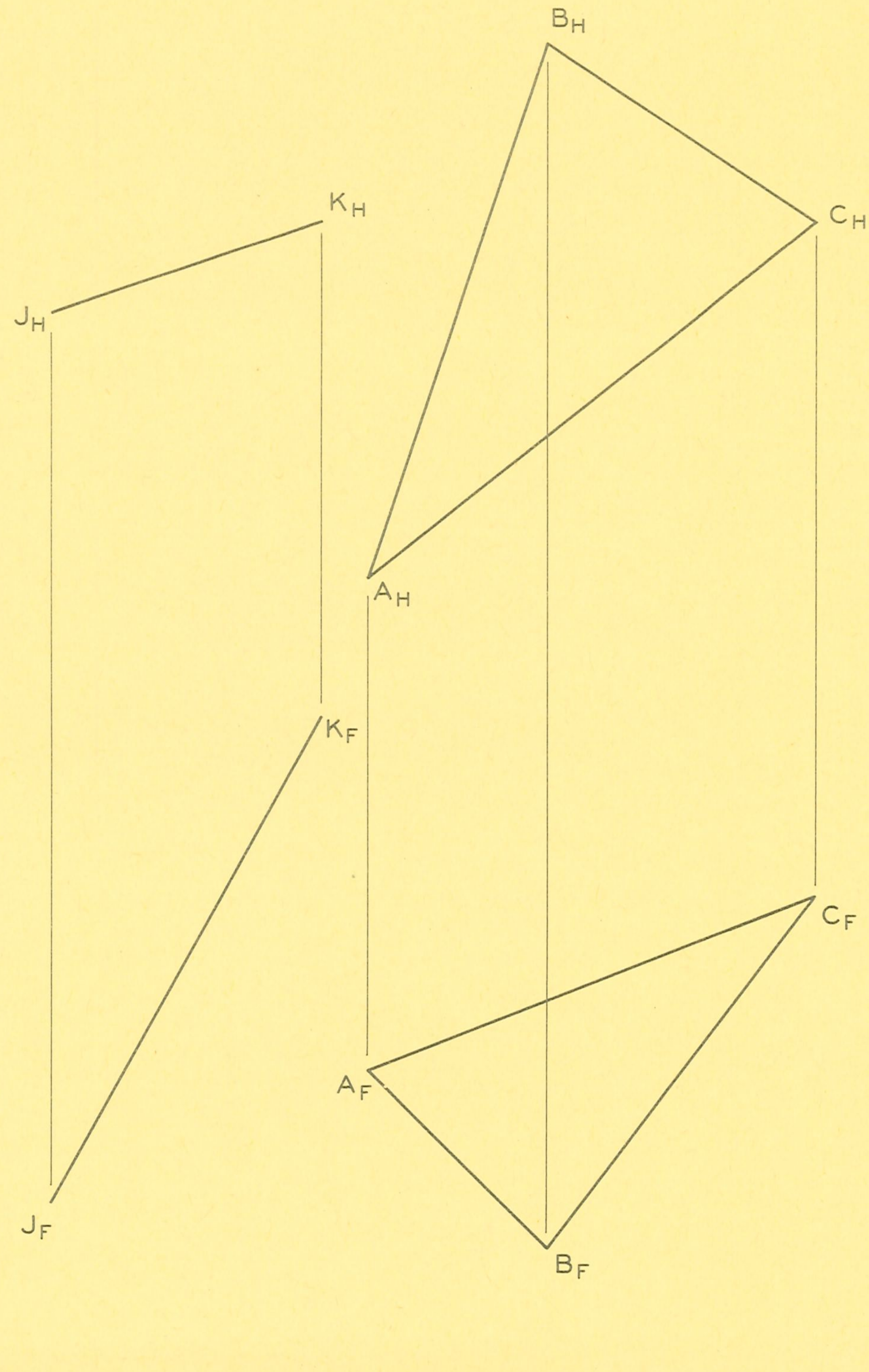


8.0

D

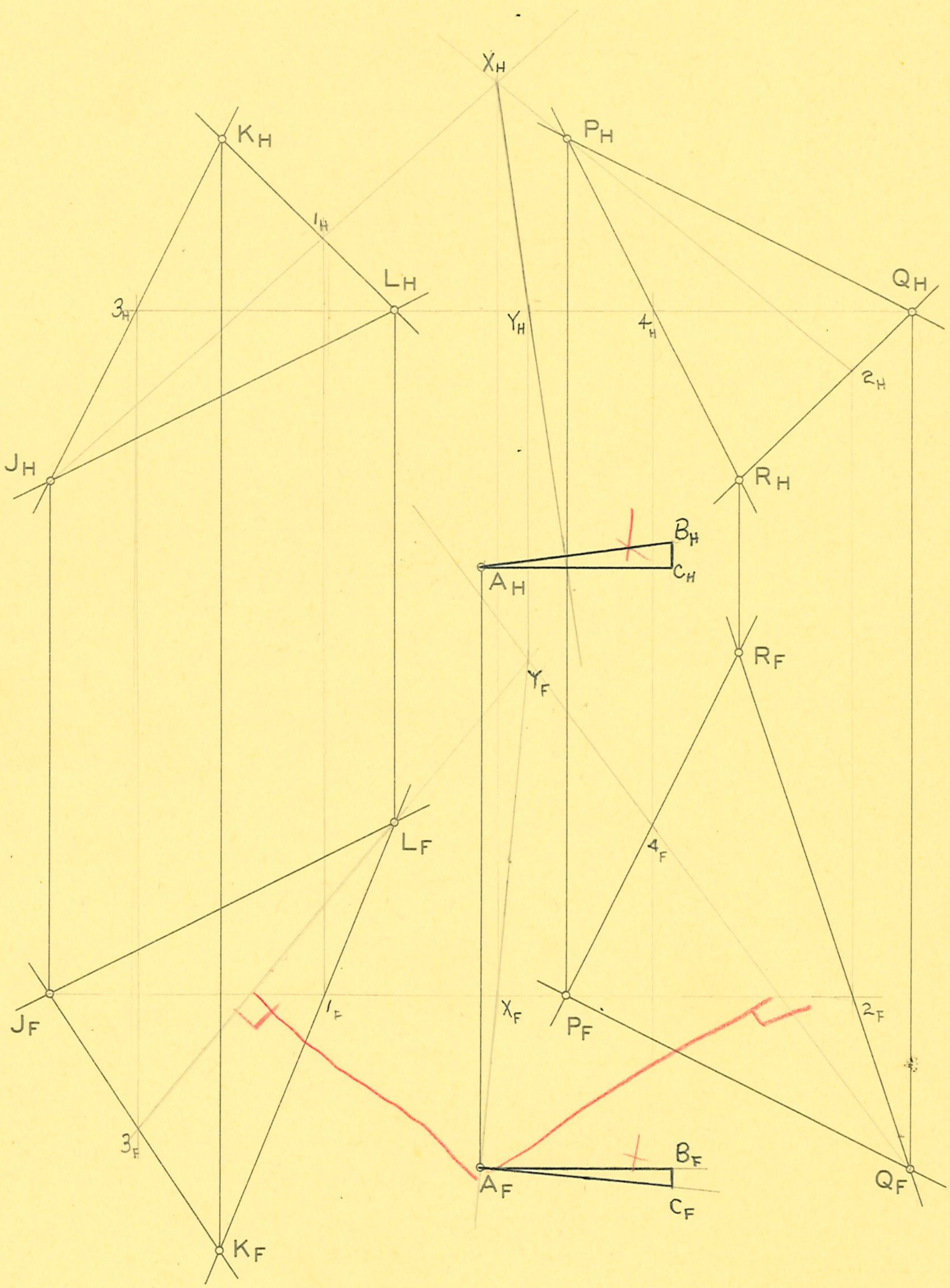
5-14	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Pass a plane through JK perpendicular to the triangle ABC.



D

Draw a plane ABC perpendicular to the planes JKL and PQR. Represent the plane by a triangle.

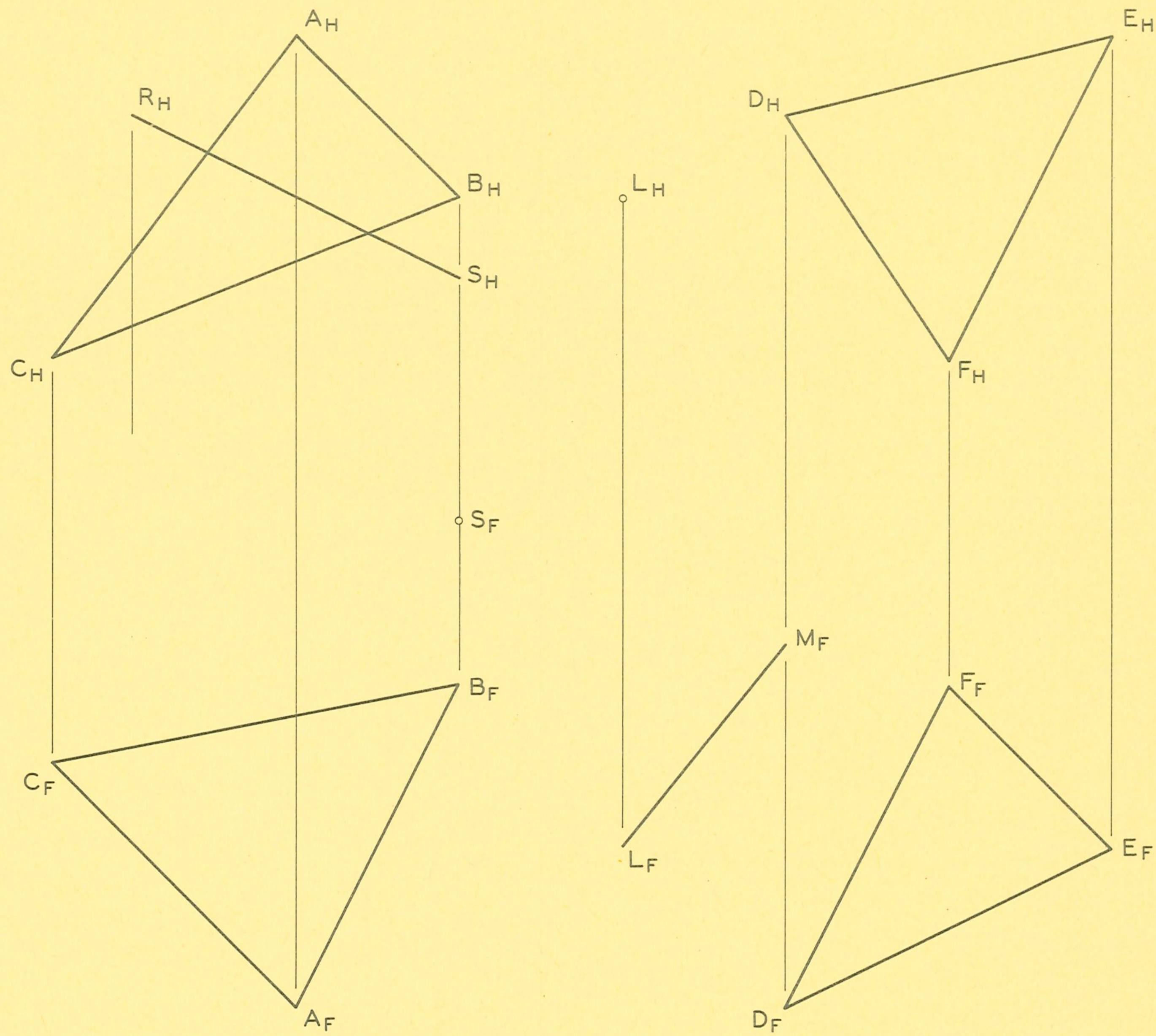


D

6.5

5-16	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

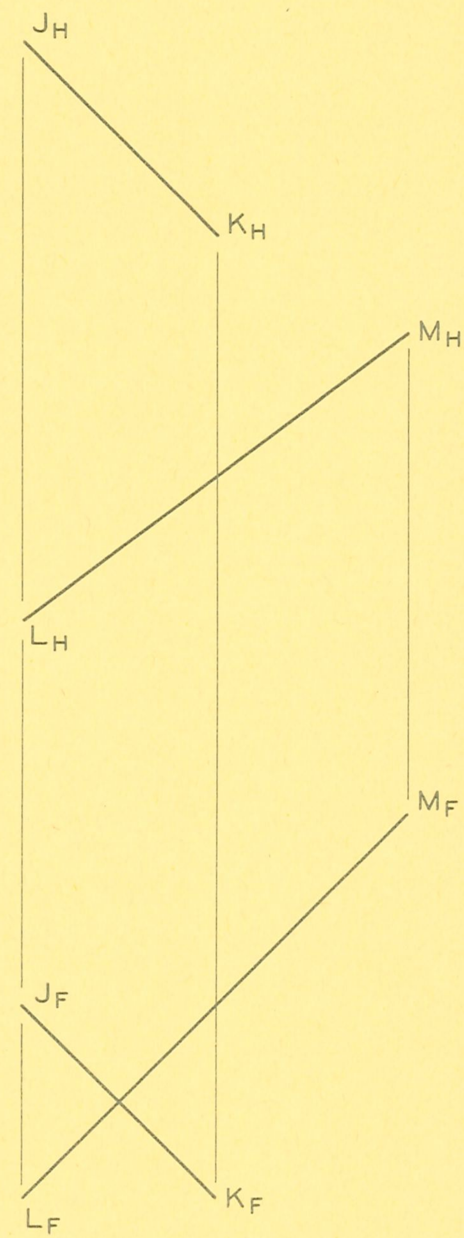
(a) Draw the line RS parallel to the triangle ABC and indicate its visibility.
(b) Draw the line LM parallel to the triangle DEF.



D

5-17	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

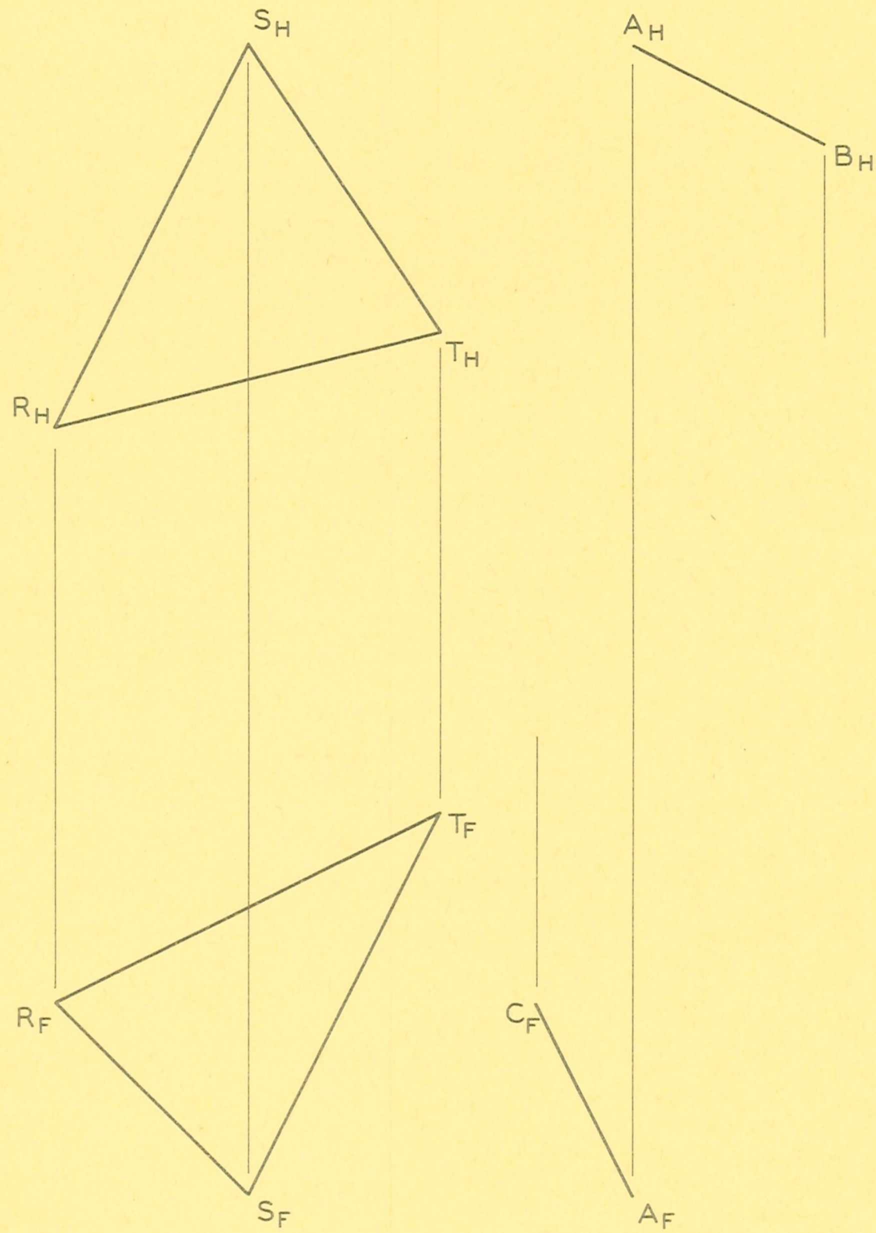
Pass a plane through LM parallel to JK and measure its dip. Measure the distance between JK and LM.



D

5–18	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

Draw the triangle ABC parallel to the triangle RST and measure the distance between them.

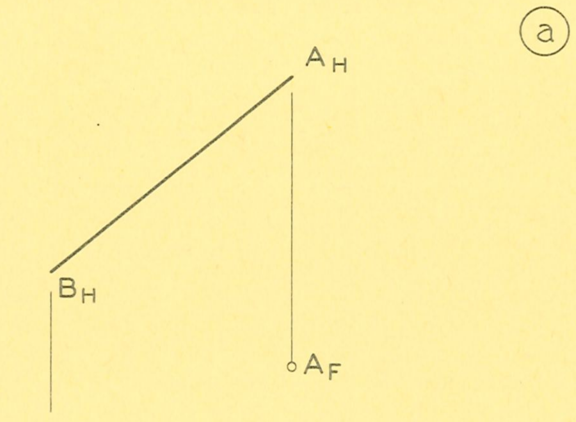


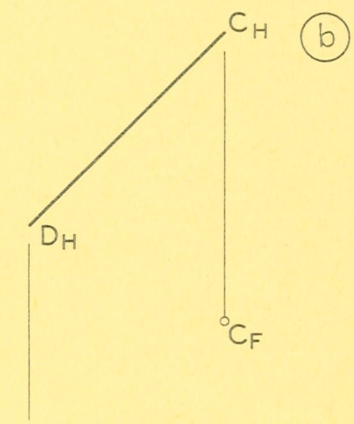
D

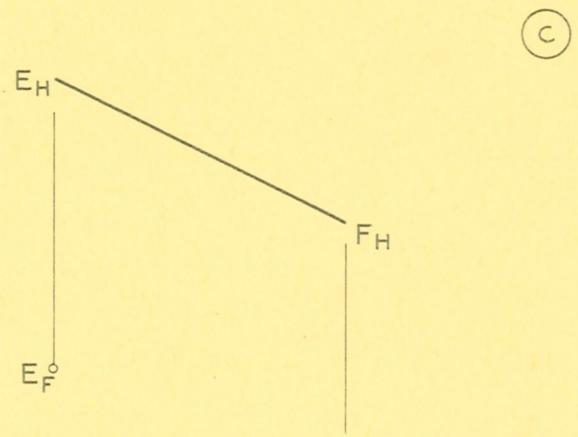
5-19	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

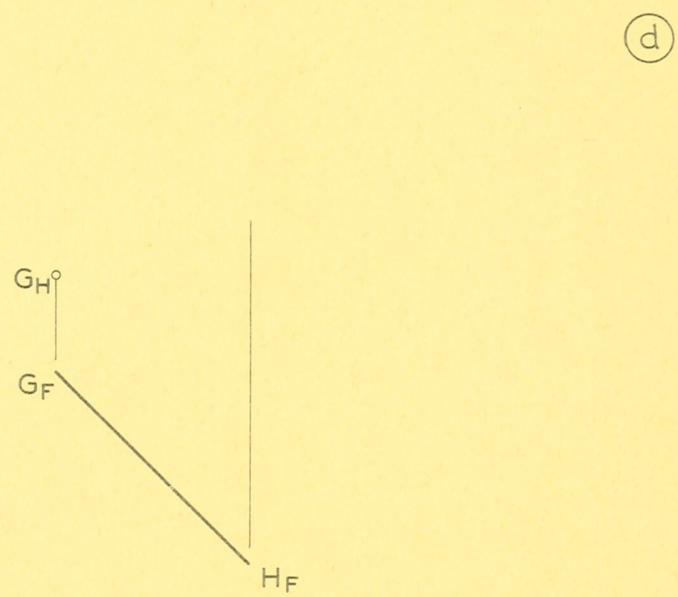
Using revolution, draw the front and top views of the following lines:

(a) AB is 2″ long and extends downward.
(b) CD makes 25° with a frontal plane and extends downward.
(c) EF makes 37° with a horizontal plane and extends downward.
(d) GH makes 35° with a profile plane and extends backward.



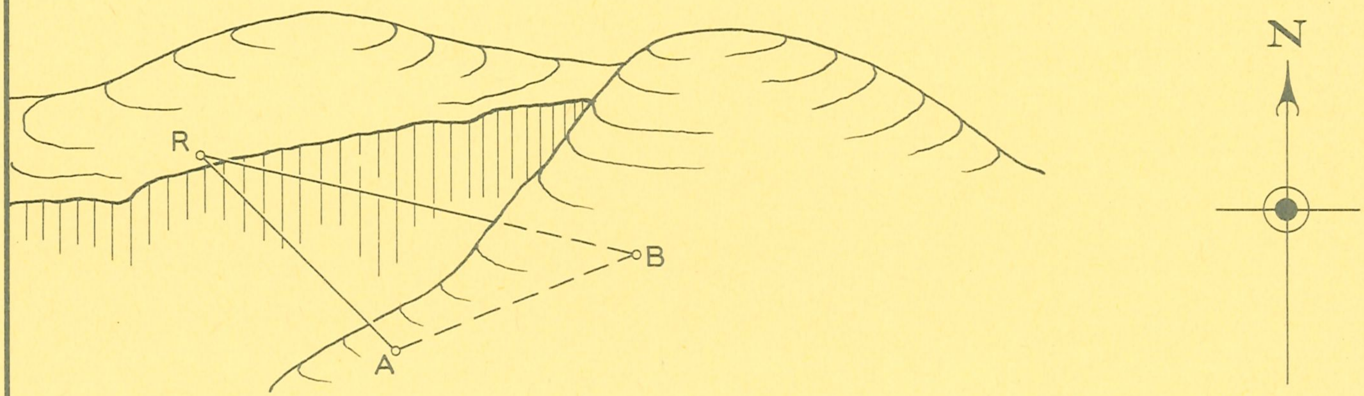






D

A and B are two points on the ground that are to be connected by means of a tunnel. Both of these points can be seen from a point R across a canyon. The line RA bears S 28°E and slopes downward 40°. The line RB bears S 74°E and slopes downward 19°. It is found that A is 150 ft. below R and that B is 125 ft. below R. Draw the tunnel AB and find its bearing, length and grade. Scale: 1″ = 100 ft. Use revolution.



R_H

R_F

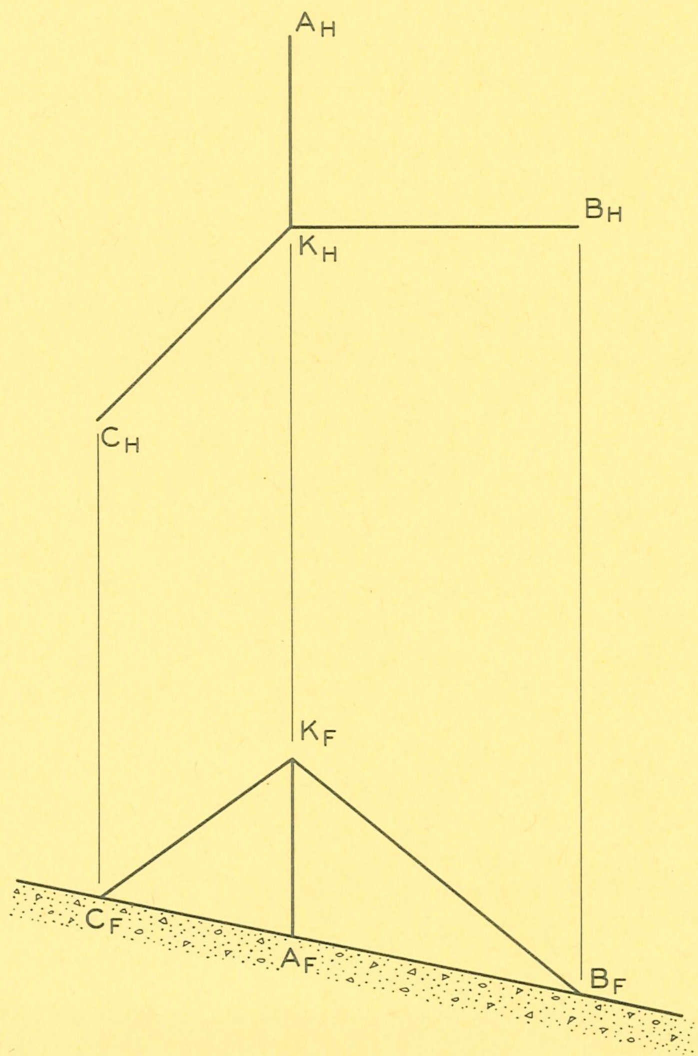
D

ENGINEERING DESCRIPTIVE GEOMETRY

NAME

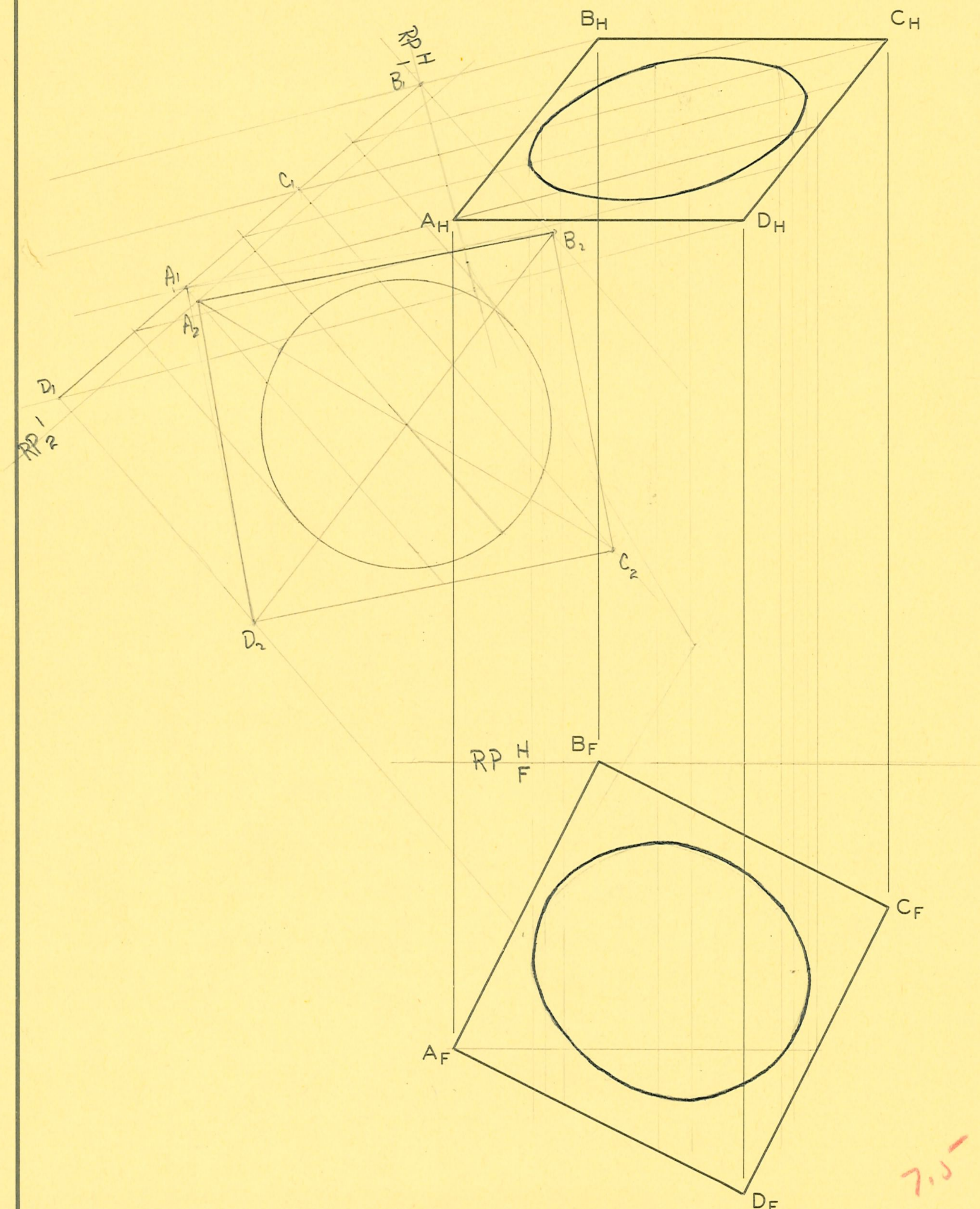
DESK-SECTION

Using revolution, measure the angles between the legs of the tripod shown below. Revolve the legs into a clear space.



D

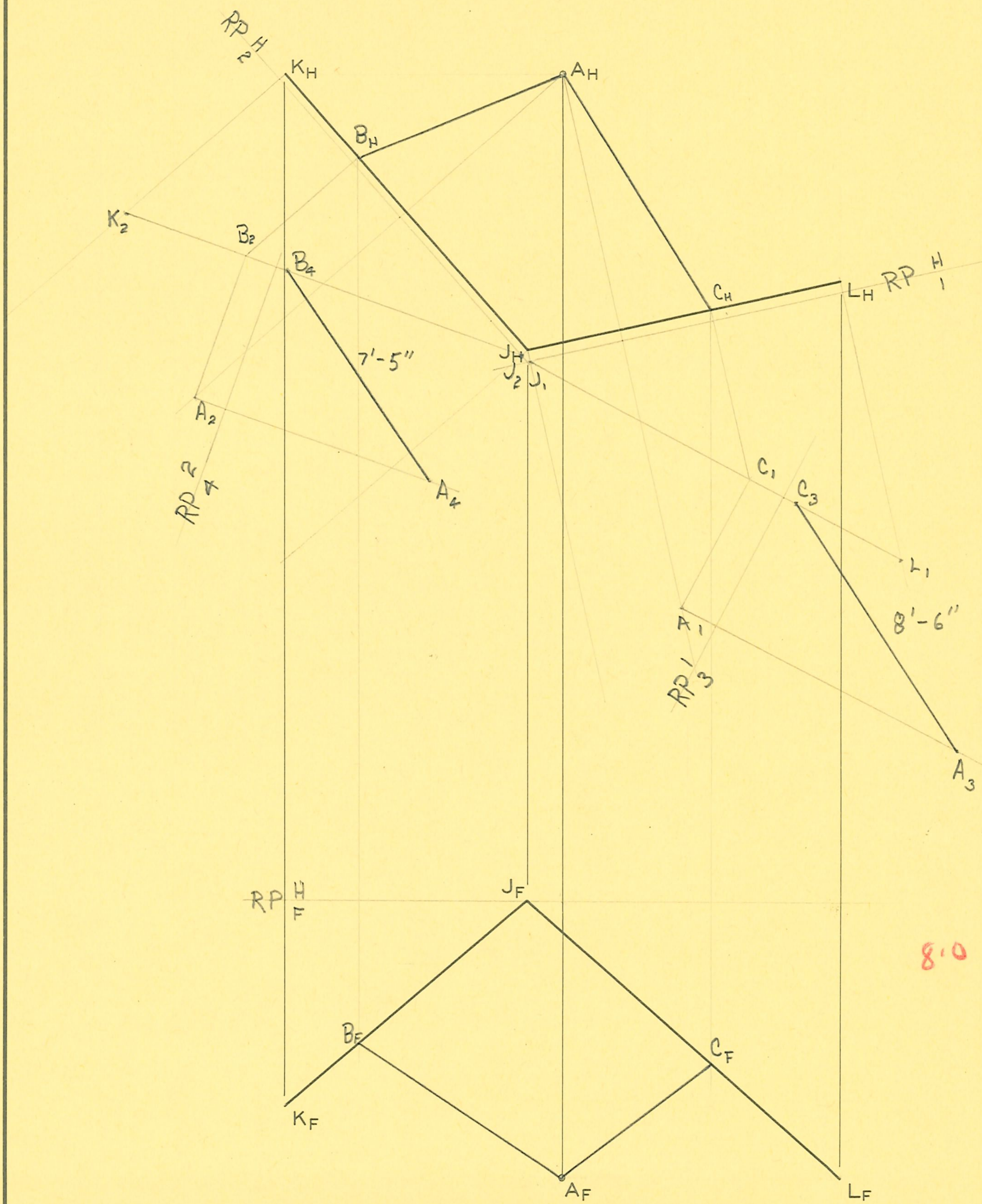
Using revolution, draw the front and top views of a 2″ diameter hole in the thin metal plate ABCD at its center.



D

5-23	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

JK and JL are two members of a structure. Draw lines which represent the shortest connecting members from A to JL and from A to JK. Measure the true lengths of the connecting members. Scale: ¼″ = 1′-0″.

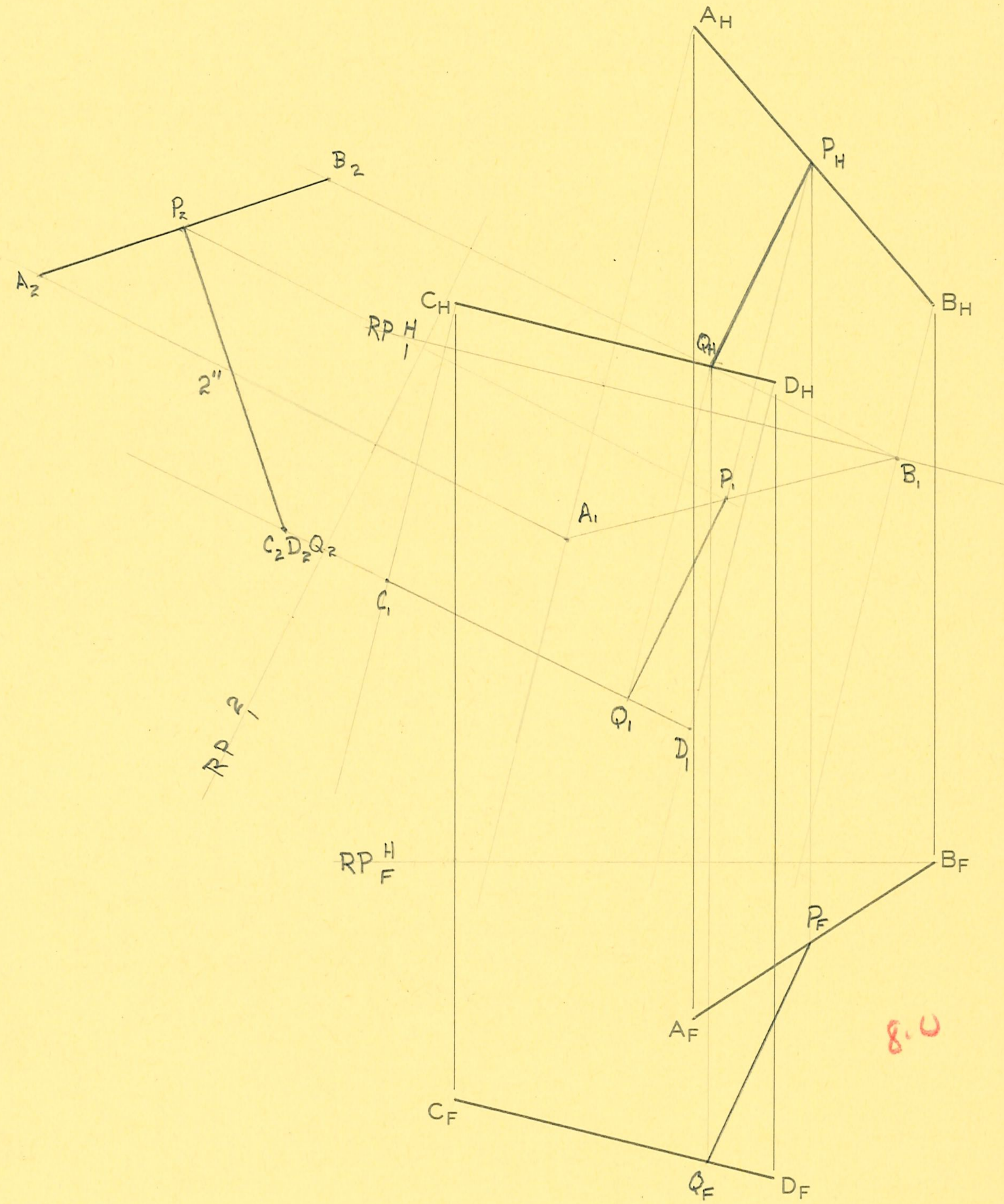


8.0

D

5-24	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

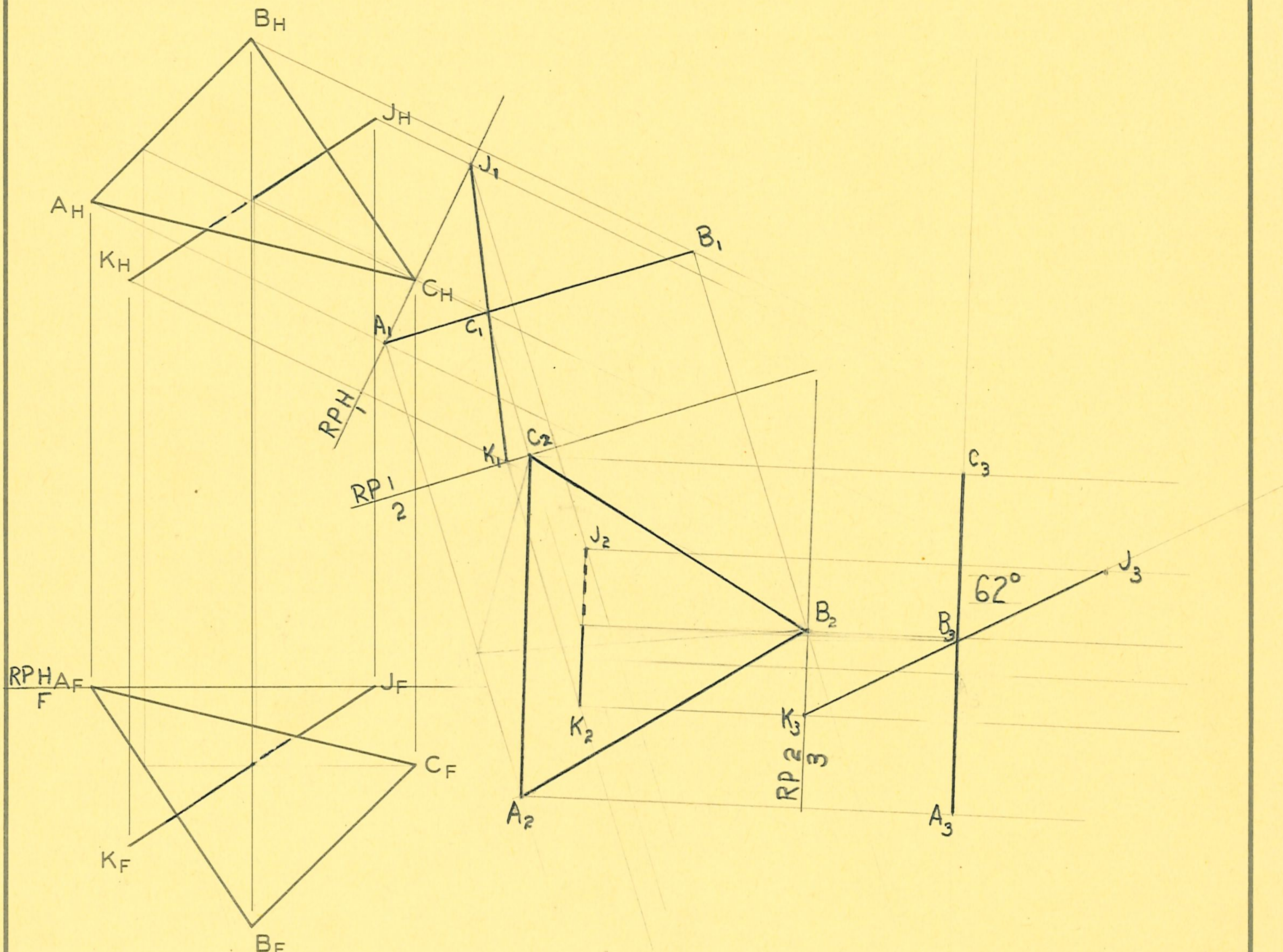
Draw the shortest connecting line between AB and CD and measure its true length.



D

5-25	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Measure the angle JK makes with triangle ABC. Use the direct method and check the solution by revolution. Find where JK intersects the triangle and show its visibility.

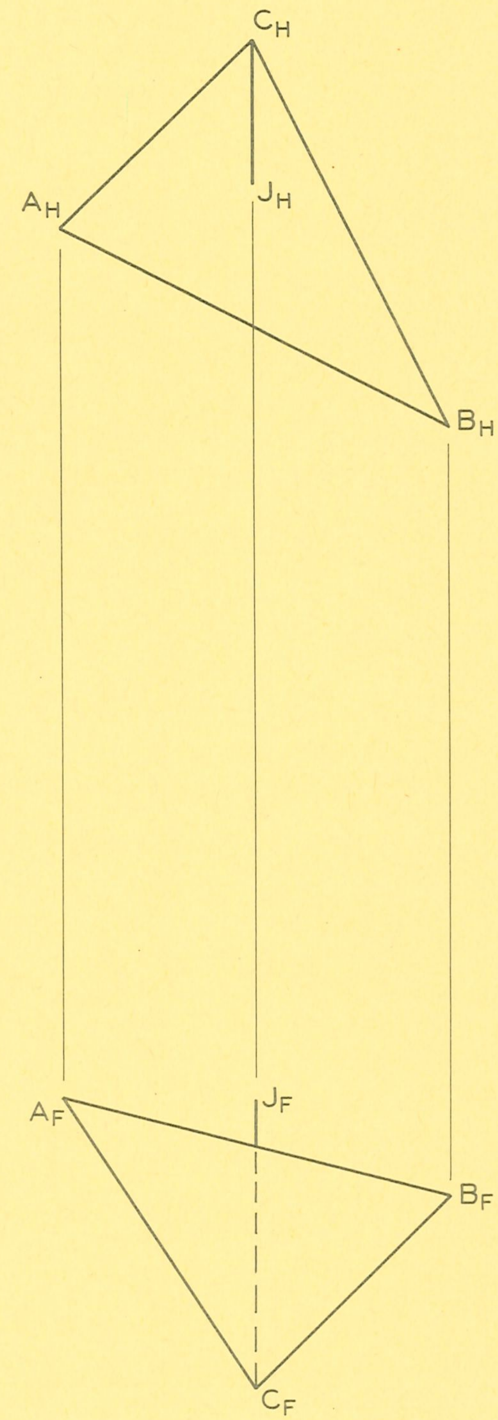


8.0

D

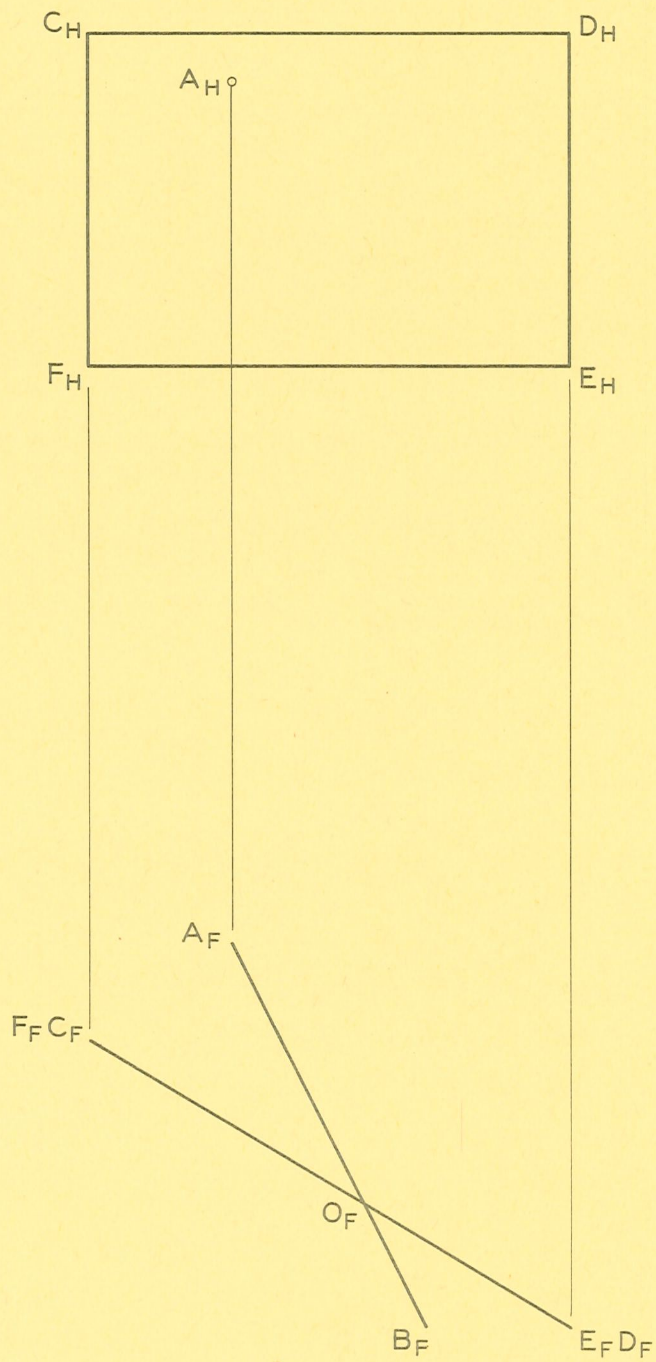
5-26	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Using the complementary angle method, measure the angle between JC and the triangle ABC. Check the solution by showing the triangle in the view which shows the true shape of the projecting plane.



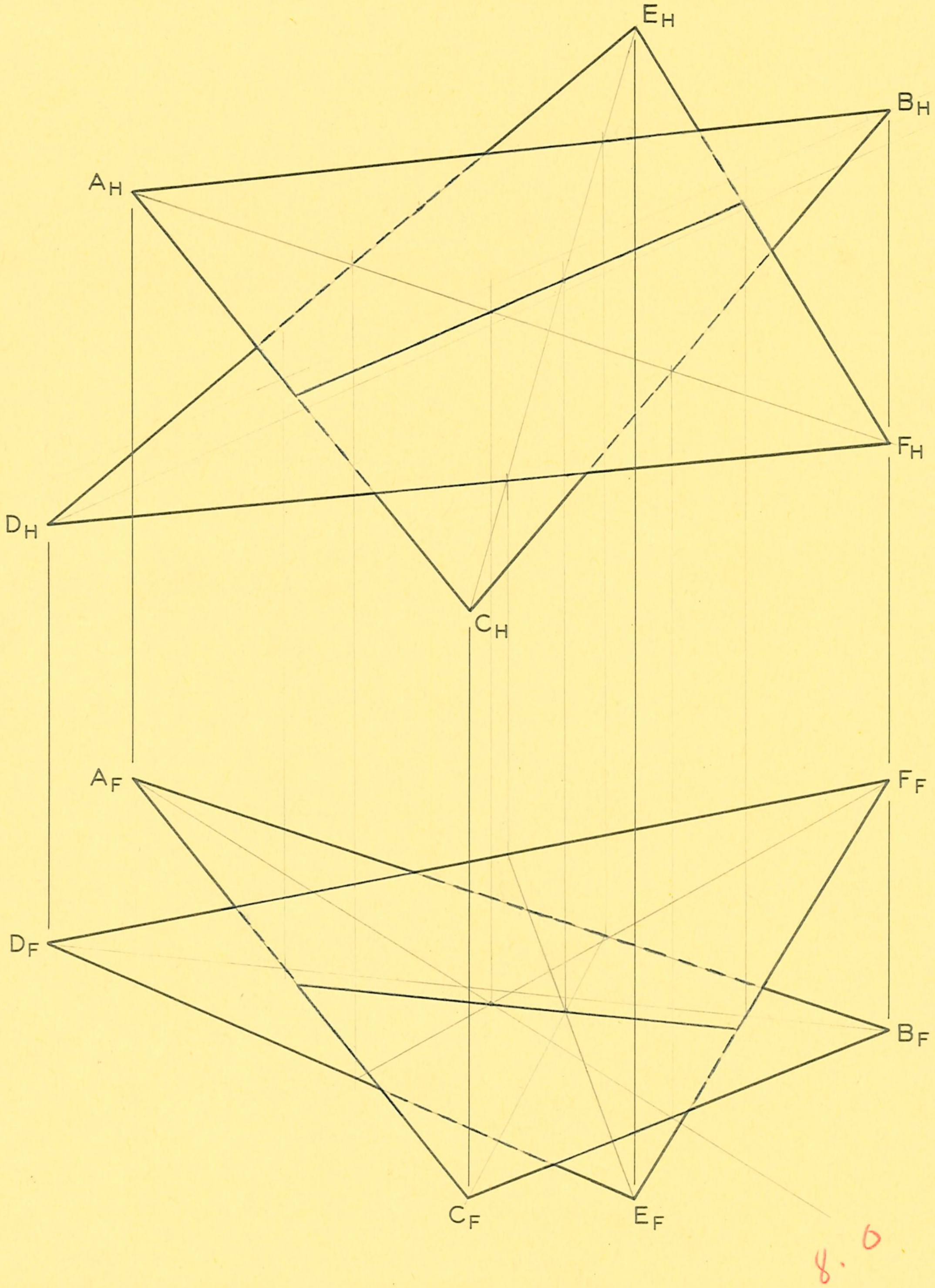
D

Draw the top view of the line AB which intersects the plane CDEF at O and makes 25° with it. Measures the distance AO.



D

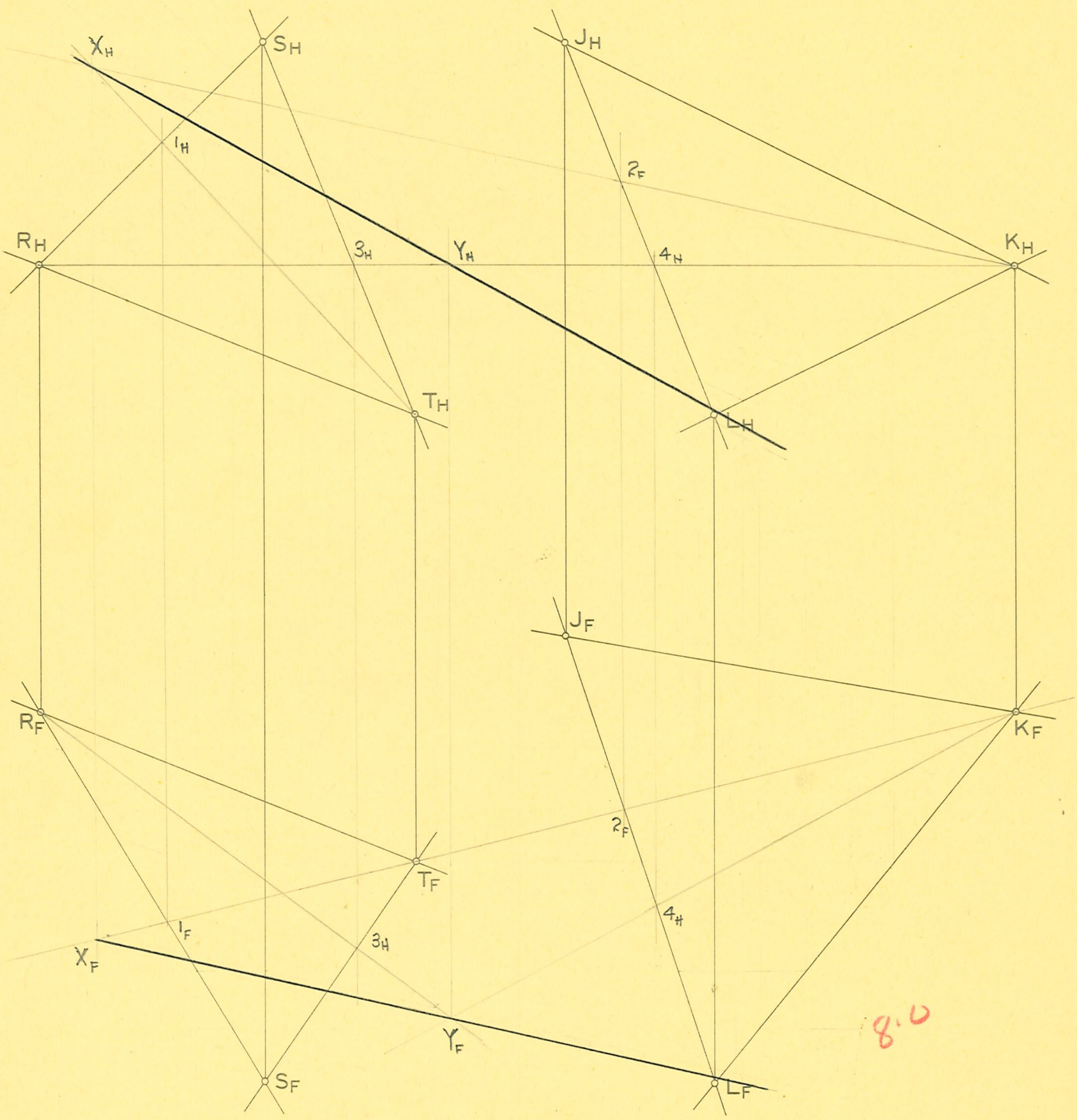
Find the intersection of the opaque triangles ABC and DEF. Complete the views with the proper visibility of the edges.



D

5-29	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

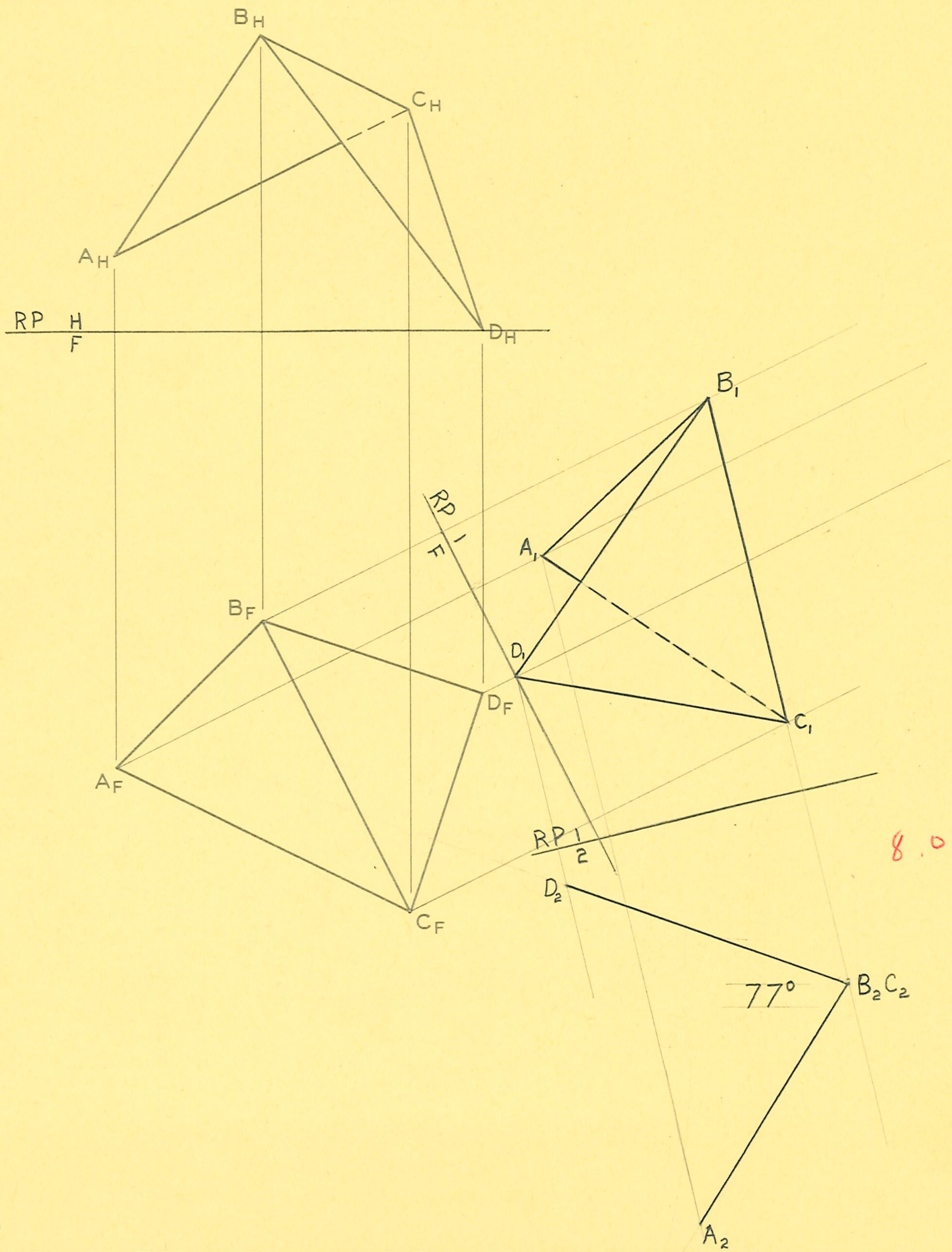
Find the intersection of the planes RST and JKL, XY.



D

5-30	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

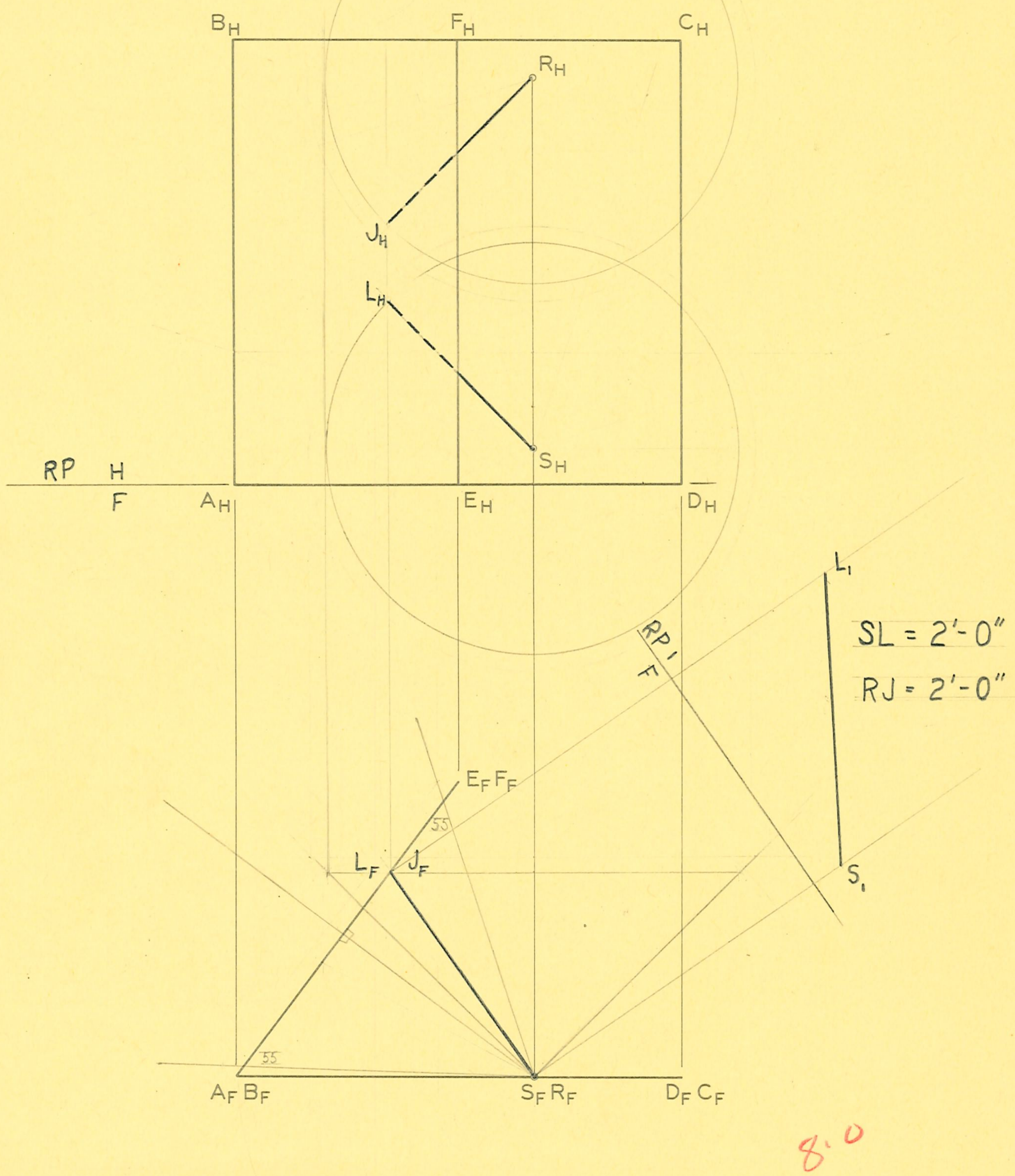
Measure the angle between the planes ABC and BCD. Solve by the direct method and check by cutting plane and revolution.



D

5-31 | ENGINEERING DESCRIPTIVE GEOMETRY | STEVEN F. BELLENOT NAME | 90 DESK-SECTION

ABCD and ABFE are steel plates welded along AB. They are to be strengthened by welding two braces, SL and RJ, from points S and R to the plate ABFE. The braces are to make 45° with ABCD and 55° with ABFE. Draw front and top views of the braces and measure their true lengths. Scale: 1" = 1'-0".

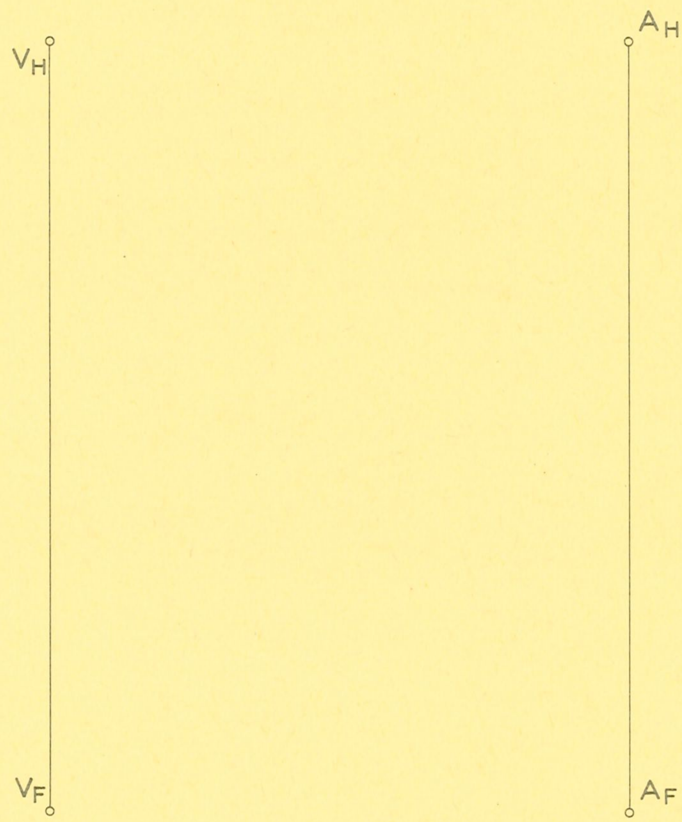


D

5-32	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Pass a plane through point A which will slope downward, forward, to the right, and make 67° with a horizontal plane and 50° with a frontal plane. Construct locus cones with vertices at V. Represent the plane by a triangle.

	∡ H	∡ F	Slope
Plane	67°	50°	dfr
⊥ Line			



D

 ENGINEERING DESCRIPTIVE GEOMETRY

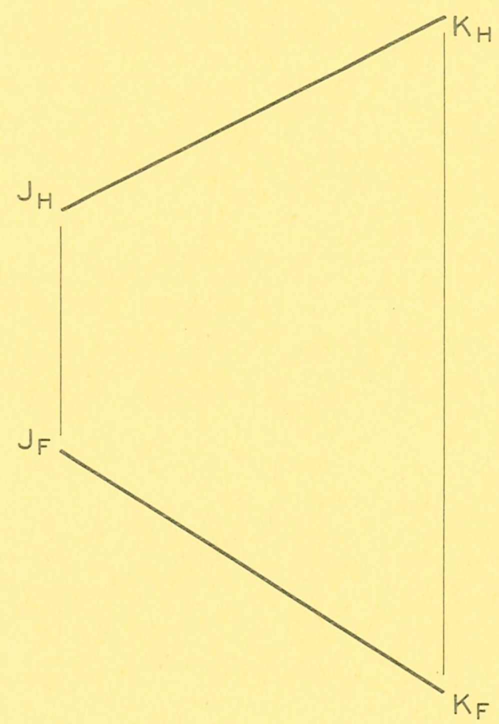
NAME

DESK-SECTION

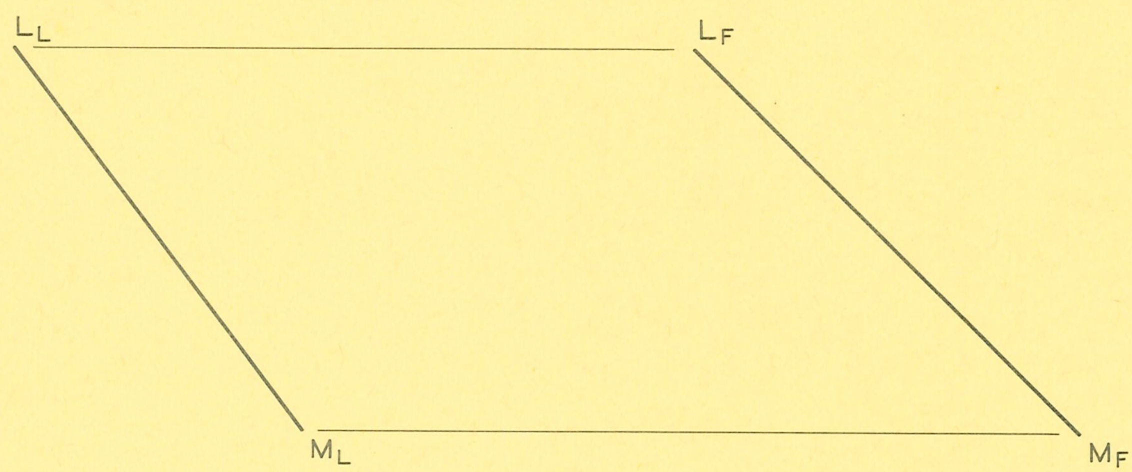
(a) Pass a plane through JK which slopes downward and forward and makes 52° with a horizontal plane.

(b) Pass a plane through LM which slopes downward and backward and makes 48° with a frontal plane.

(a)

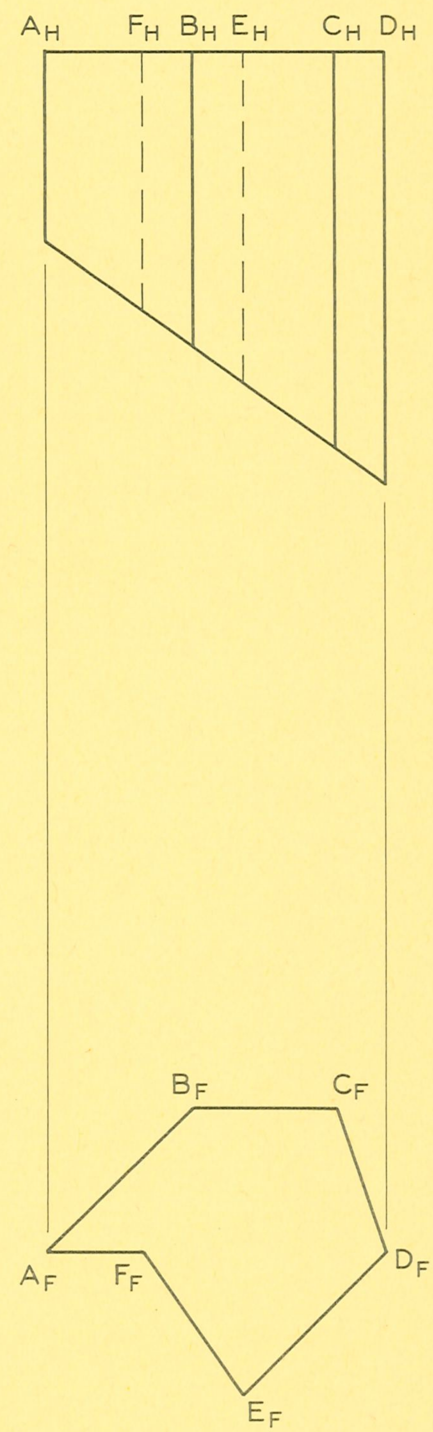


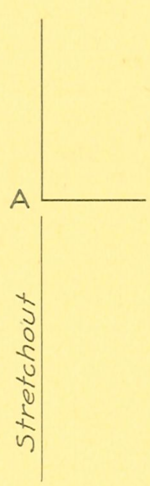
(b)



D

Make a complete development of the truncated prism. Include the base and the cut surface in the development and begin with point A as indicated.



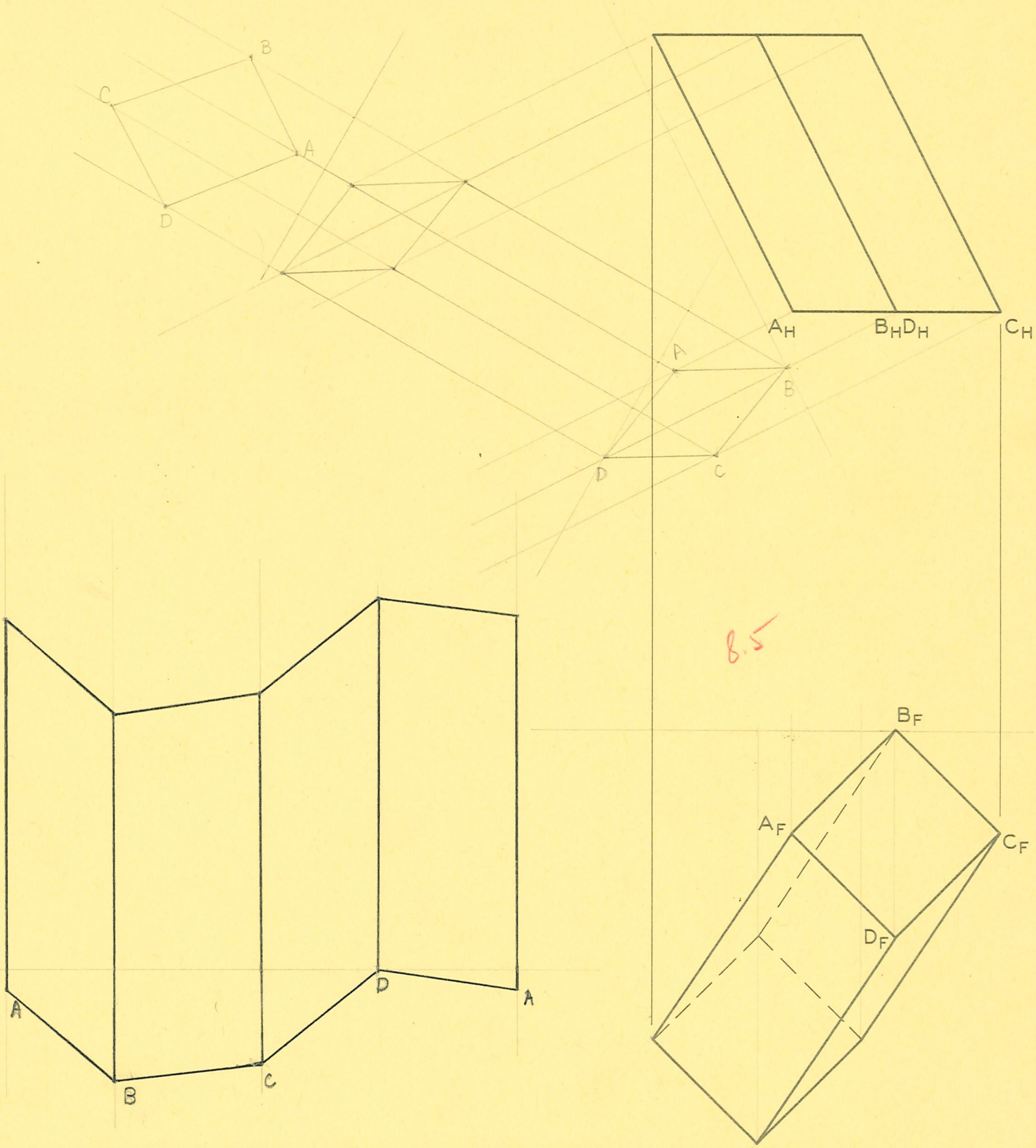


D

NAME

DESK-SECTION

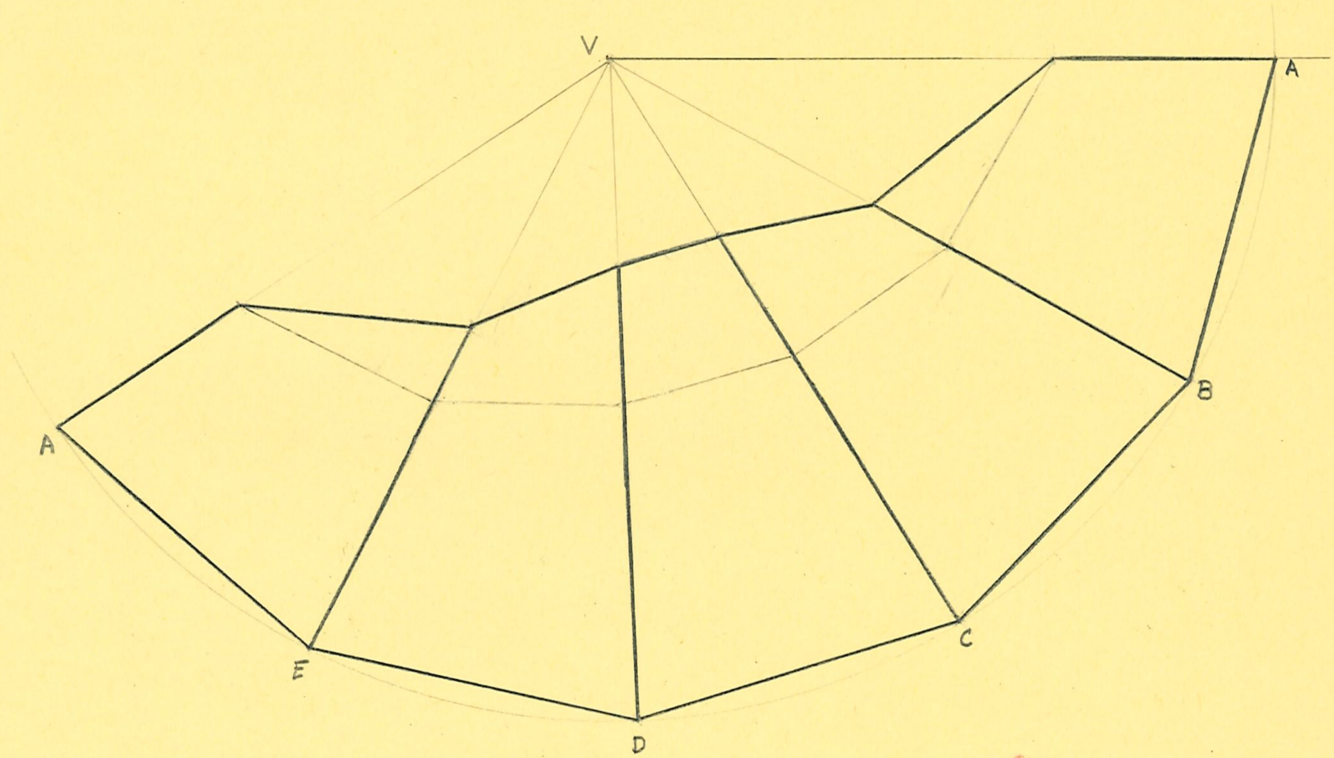
Make a development of the lateral surface only of the oblique prism.



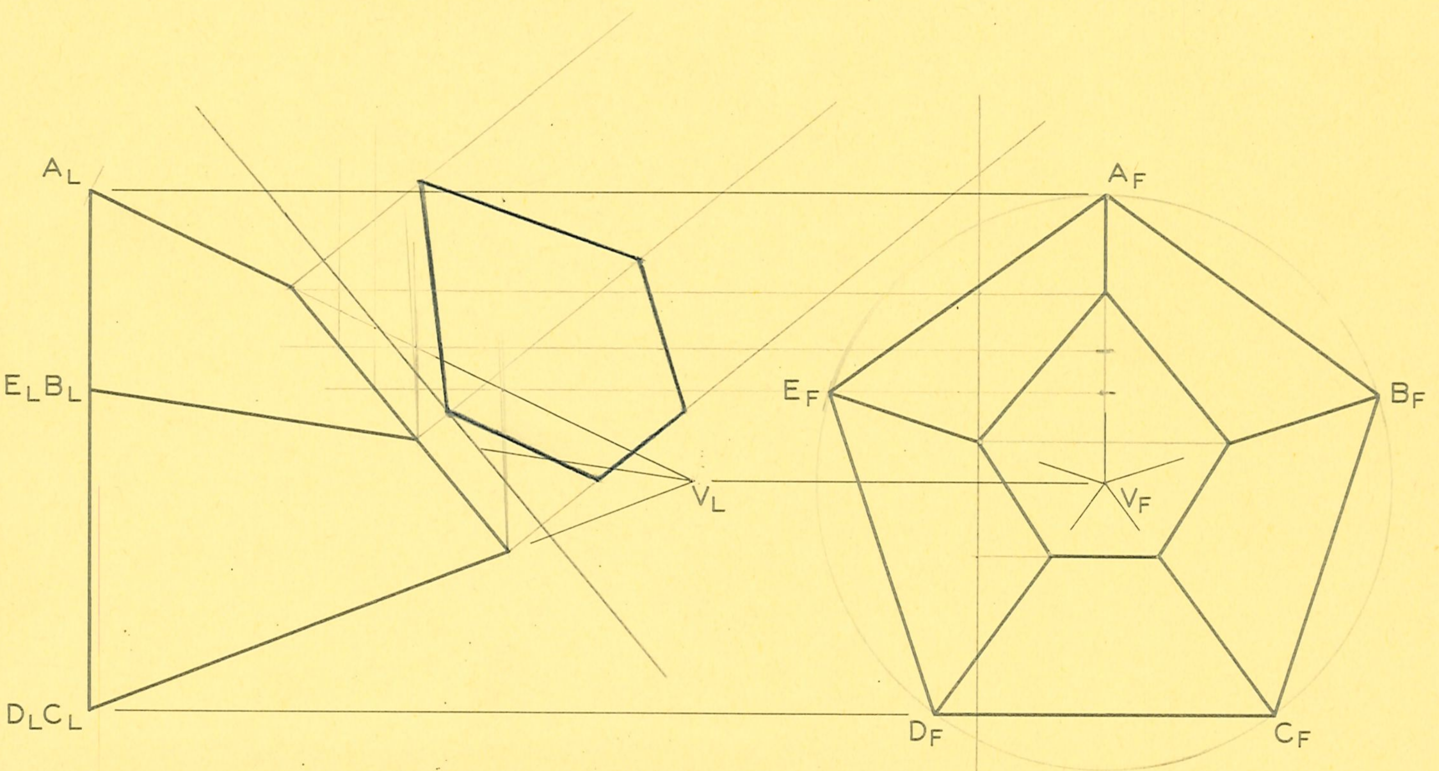
D

6-2	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F BELLENOT (NAME)	9D (DESK-SECTION)

Make a development of the lateral surface and the cut surface of the truncated pyramid. Begin the development with edge VA placed horizontally on the sheet as indicated.



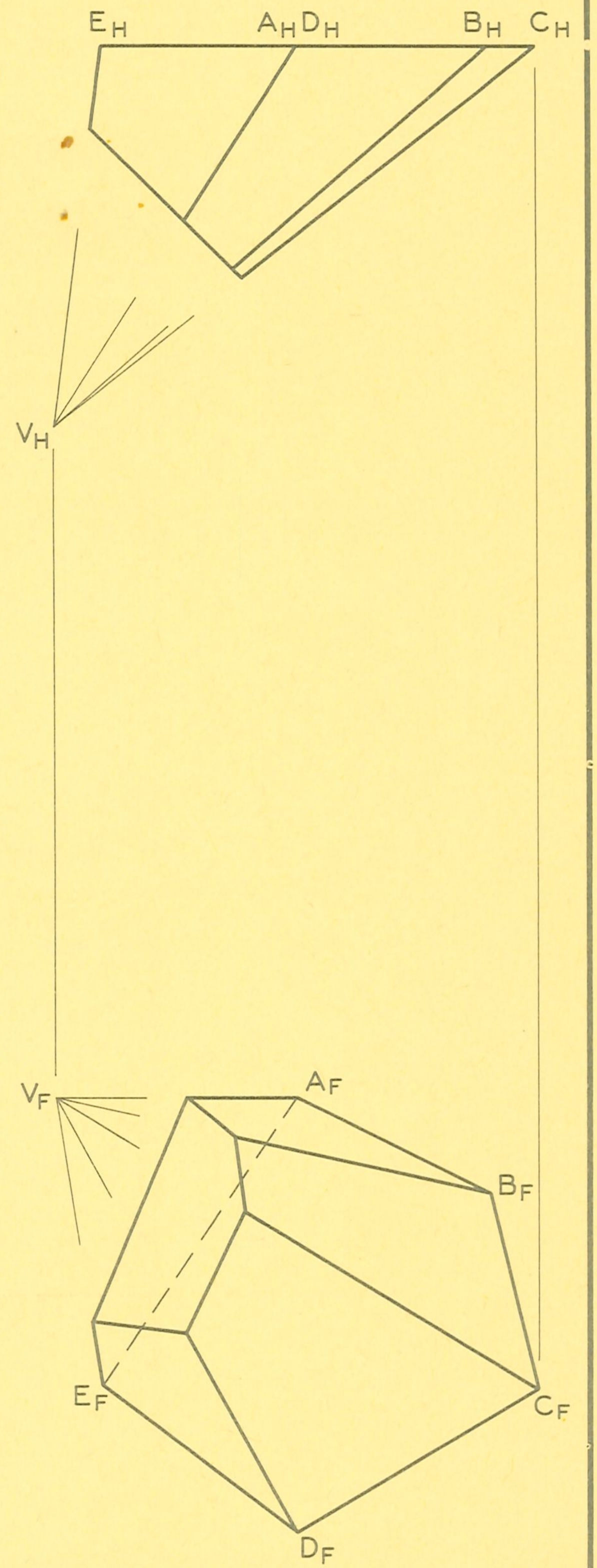
8.0



D

6-3	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F BELLENOT NAME	90 DESK-SECTION

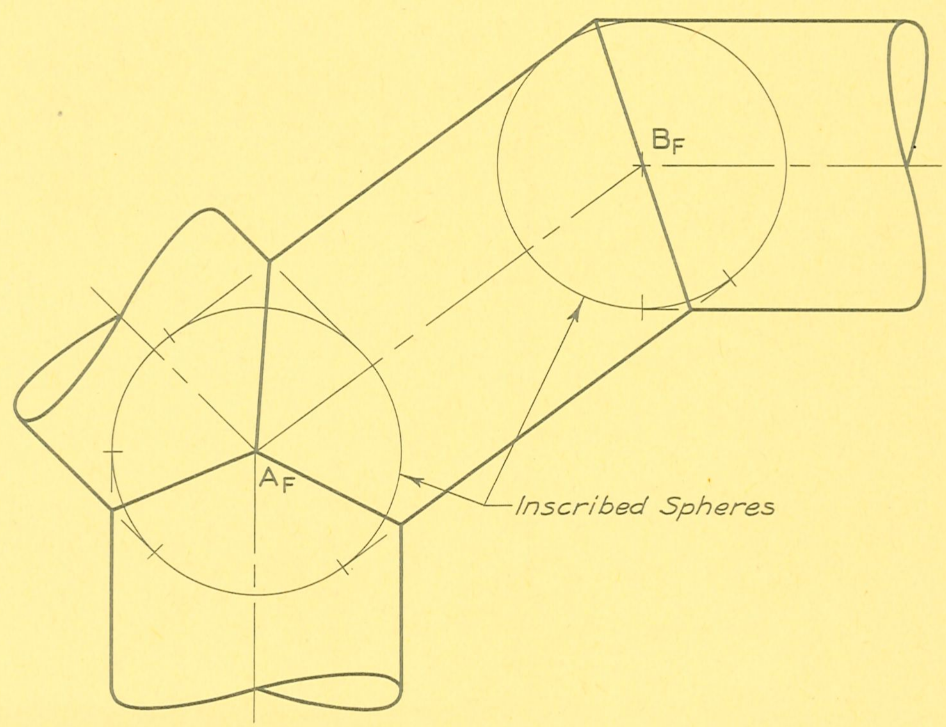
Develop the lateral surface and the base of the truncated oblique pyramid. Begin the development with edge VC placed horizontally on the sheet as indicated.



V

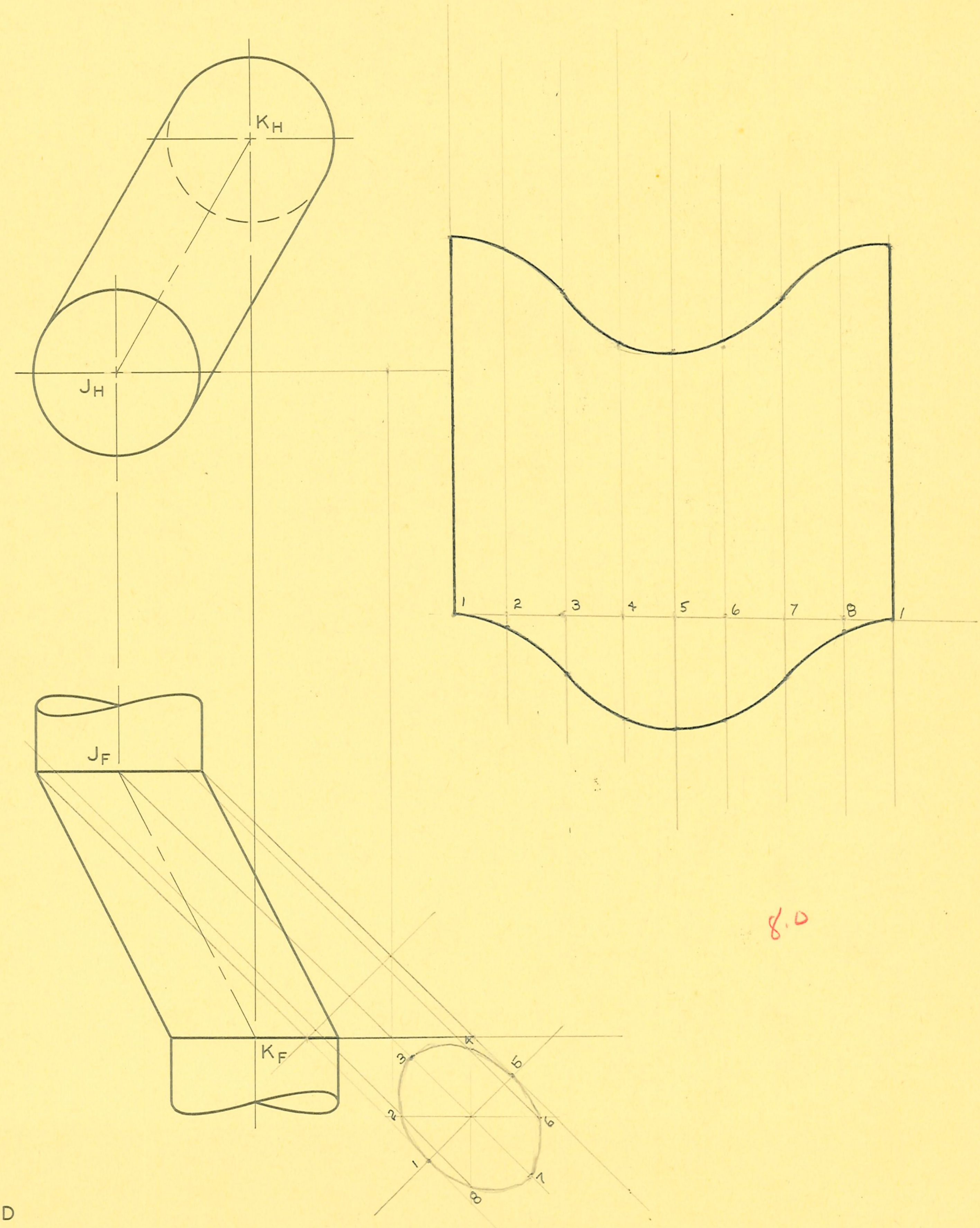
D

Make a development of the 18″ diameter pipe branch having the center line AB. Scale: 1″=1′-0″.



D

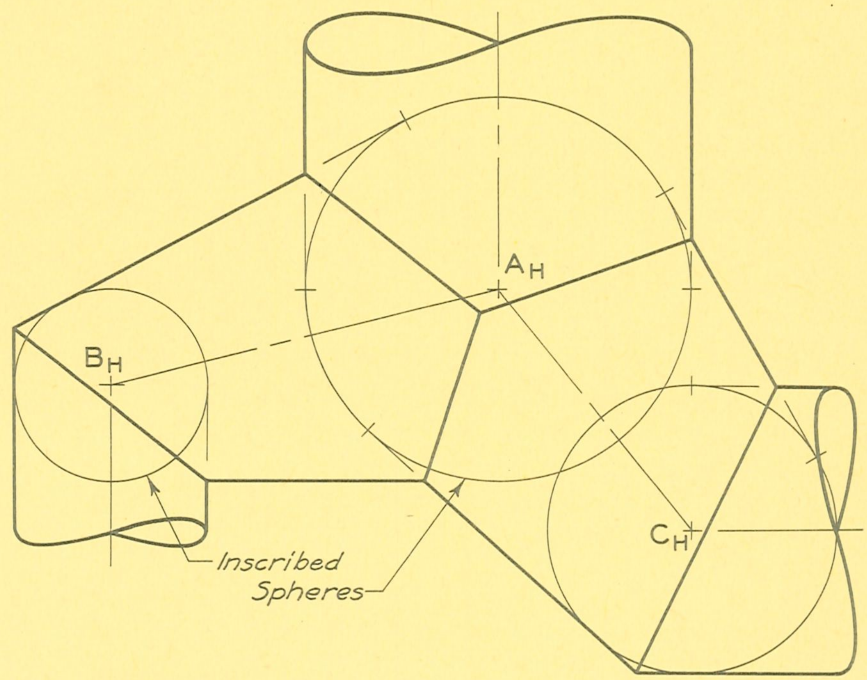
Make a development of the oblique cylinder, with the center line JK, used to connect two 15″ diameter vertical pipes as shown. Scale: 1″=1′-0″.



D

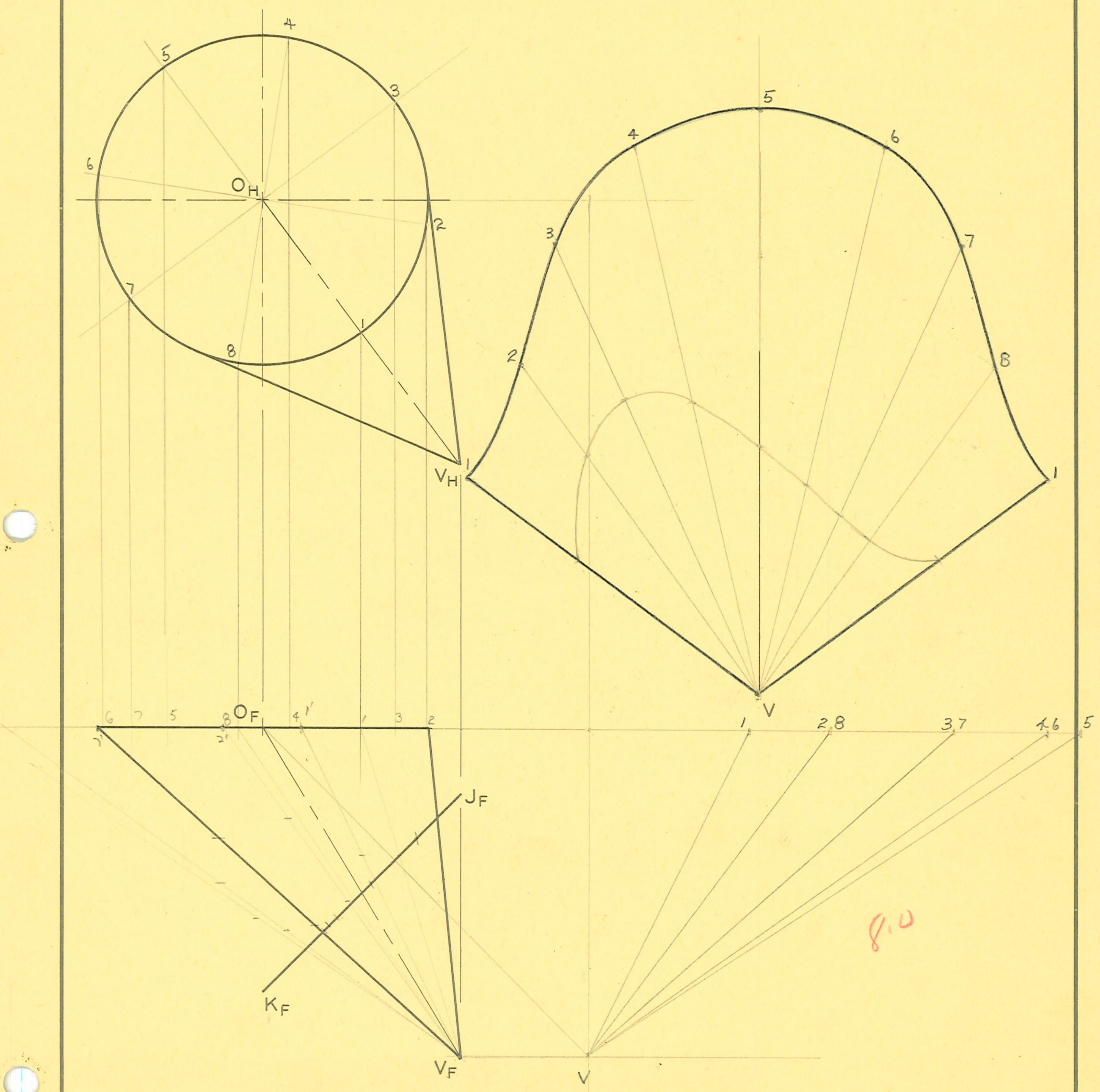
6-6	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Three pipes having diameters of 24″, 18″, and 12″, respectively, are to be connected as shown. Make a development of the conical connecting piece having the axis AB. Scale: 1″ = 1′-0″.



D

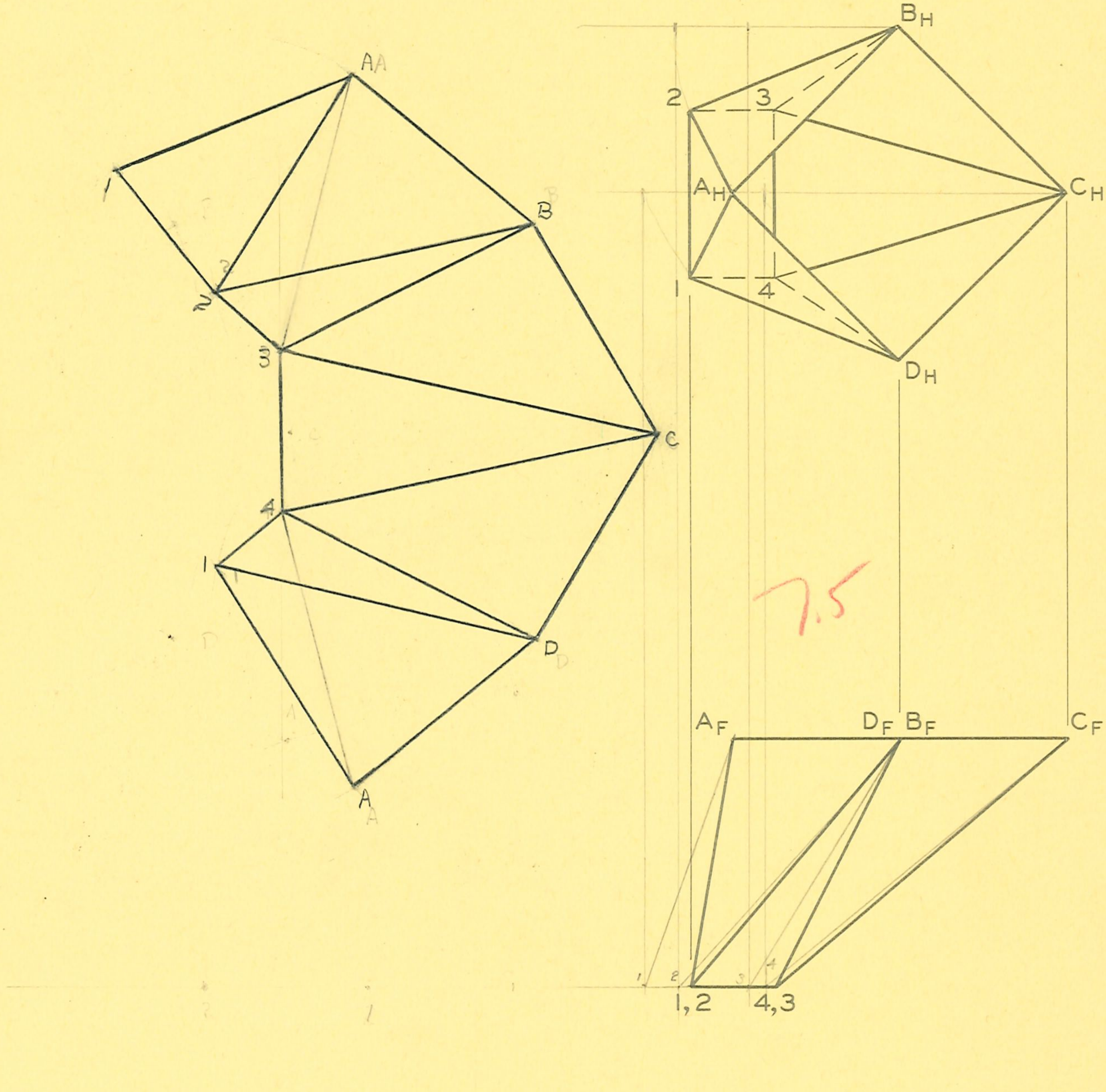
Make a development of the oblique cone. Begin the development with the longest element placed vertically on the sheet as indicated. On the development show the intersection of the cone with an ortho-frontal plane through JK.



D

6-8	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

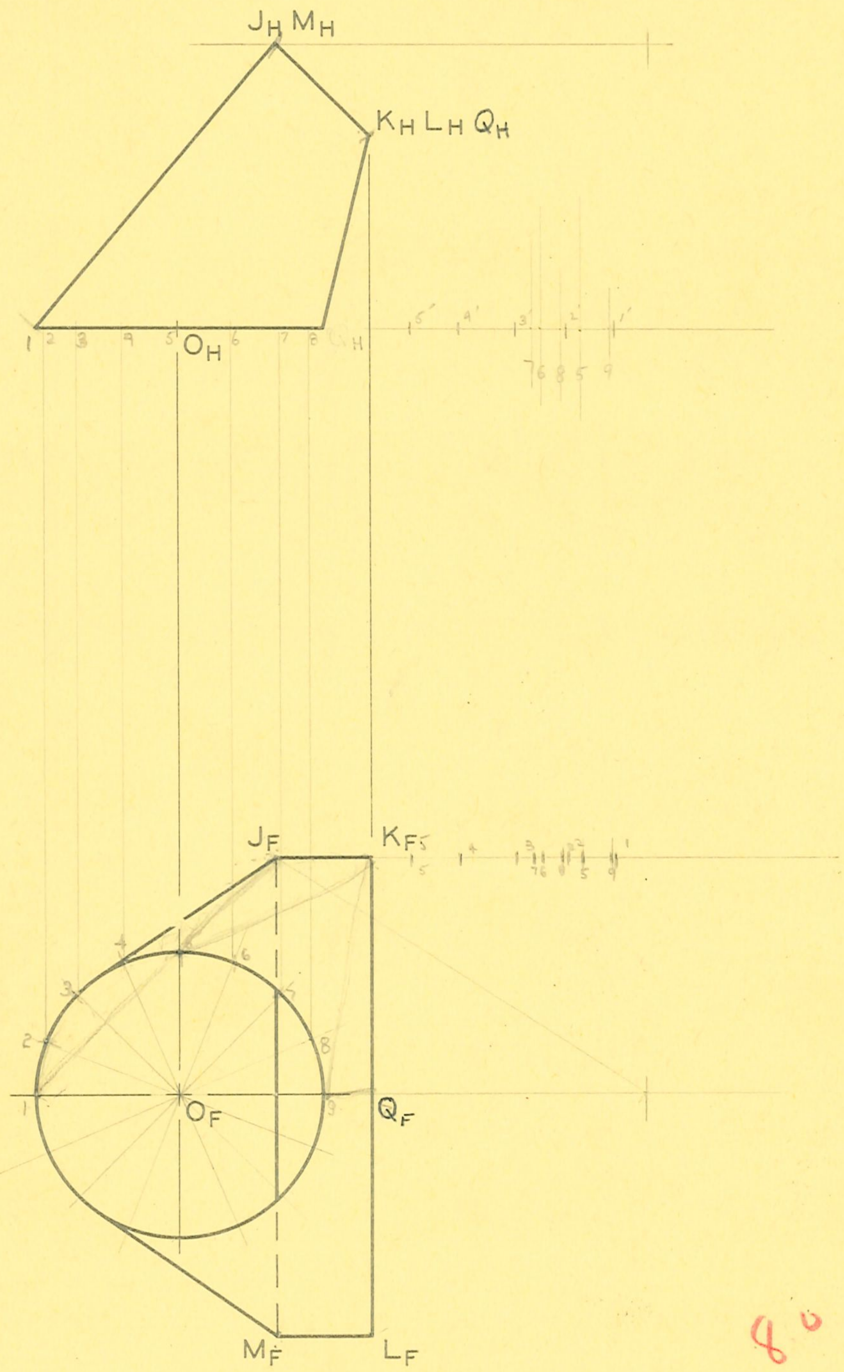
ABCD and 1, 2, 3, 4 are the open ends of a sheet metal hopper. Make a development of the hopper.

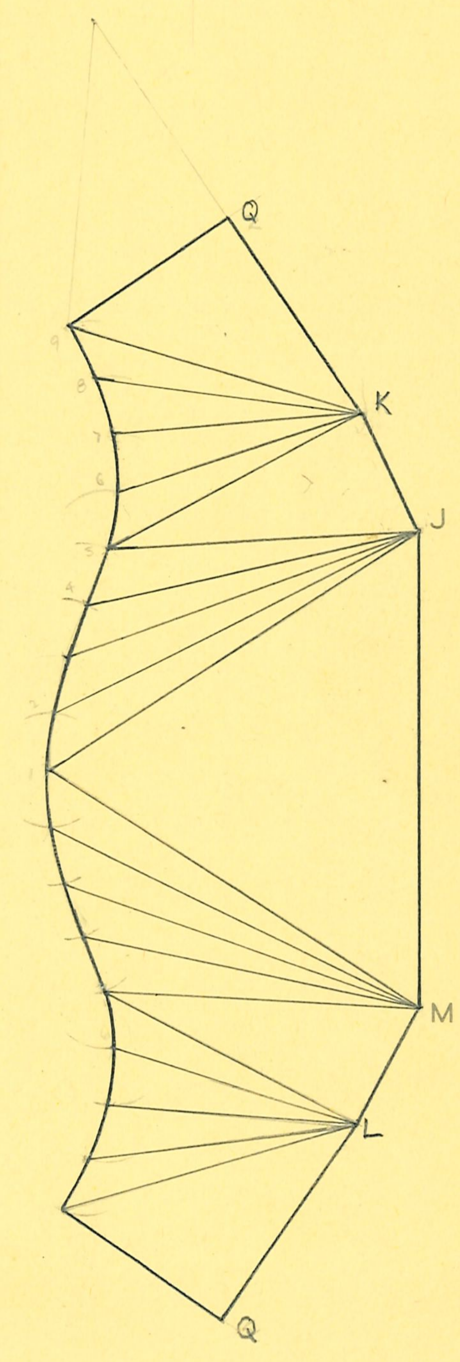


D

6-9	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

The rectangle JKLM and the frontal circle with center O are the ends of a sheet metal transition piece. Complete the front and top views and make a development of the piece. Begin the development with JM placed on the sheet as indicated.



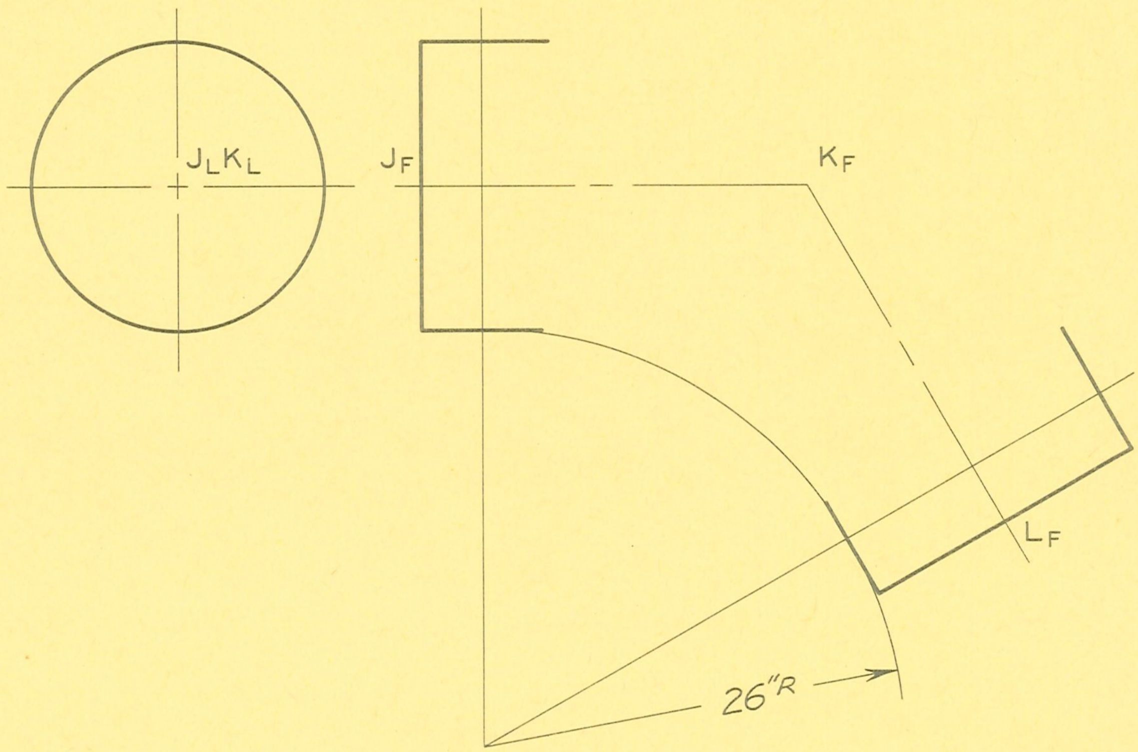


8

D

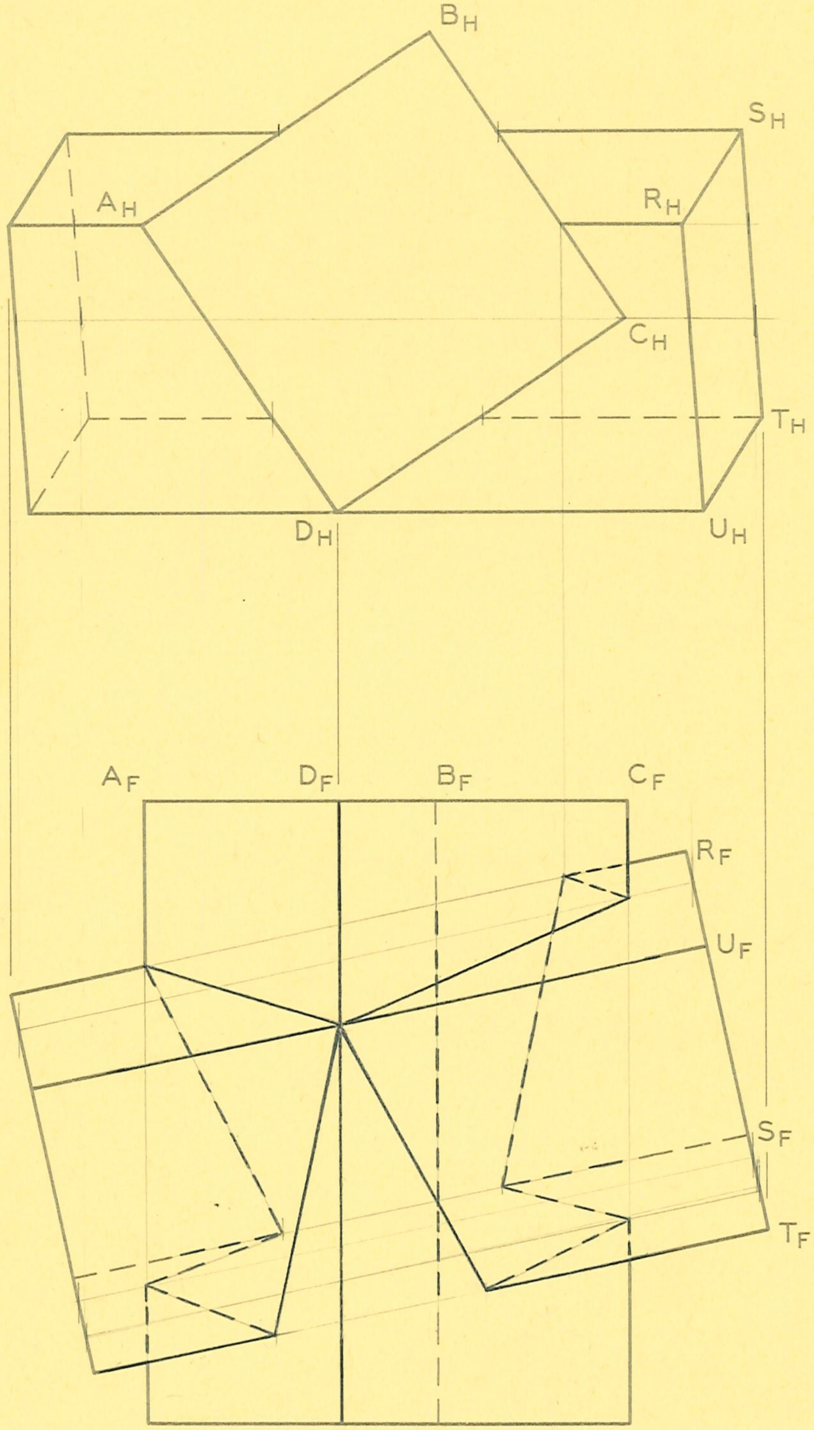
6-10	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

JK and KL are the center lines of two 18″ diameter pipes to be connected by a four-piece elbow. J and L are the ends of the elbow, which has a minimum radius of bend of 26″. Draw the front view of the elbow and make its development. Find the size of the minimum piece of sheet metal, exclusive of seams, required to make the elbow. Scale: 1″ = 1′-0″.



D

Complete the front view of the intersecting prisms. Omit the portion of each which is inside the other.

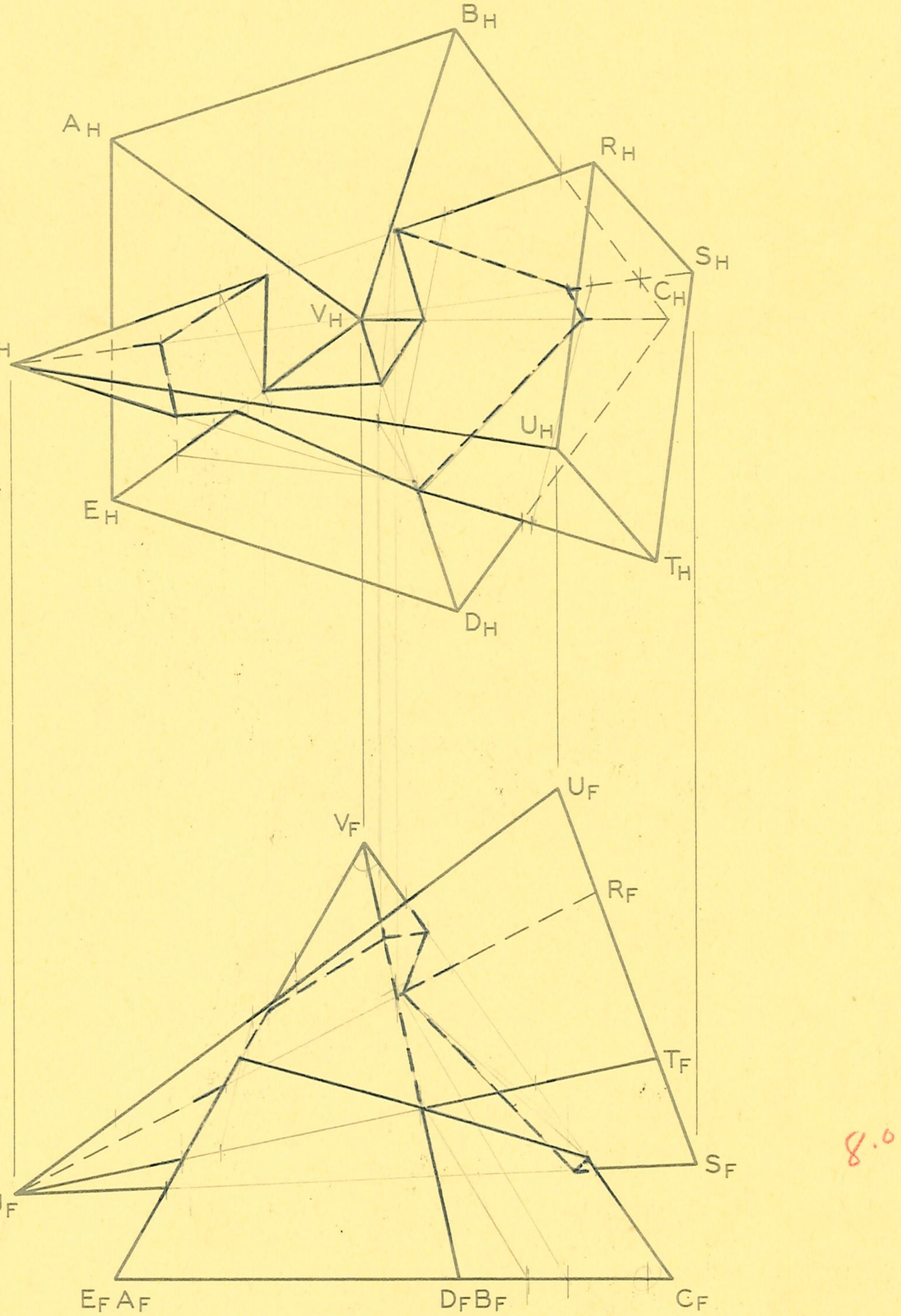


8.5

D

7 – 1	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

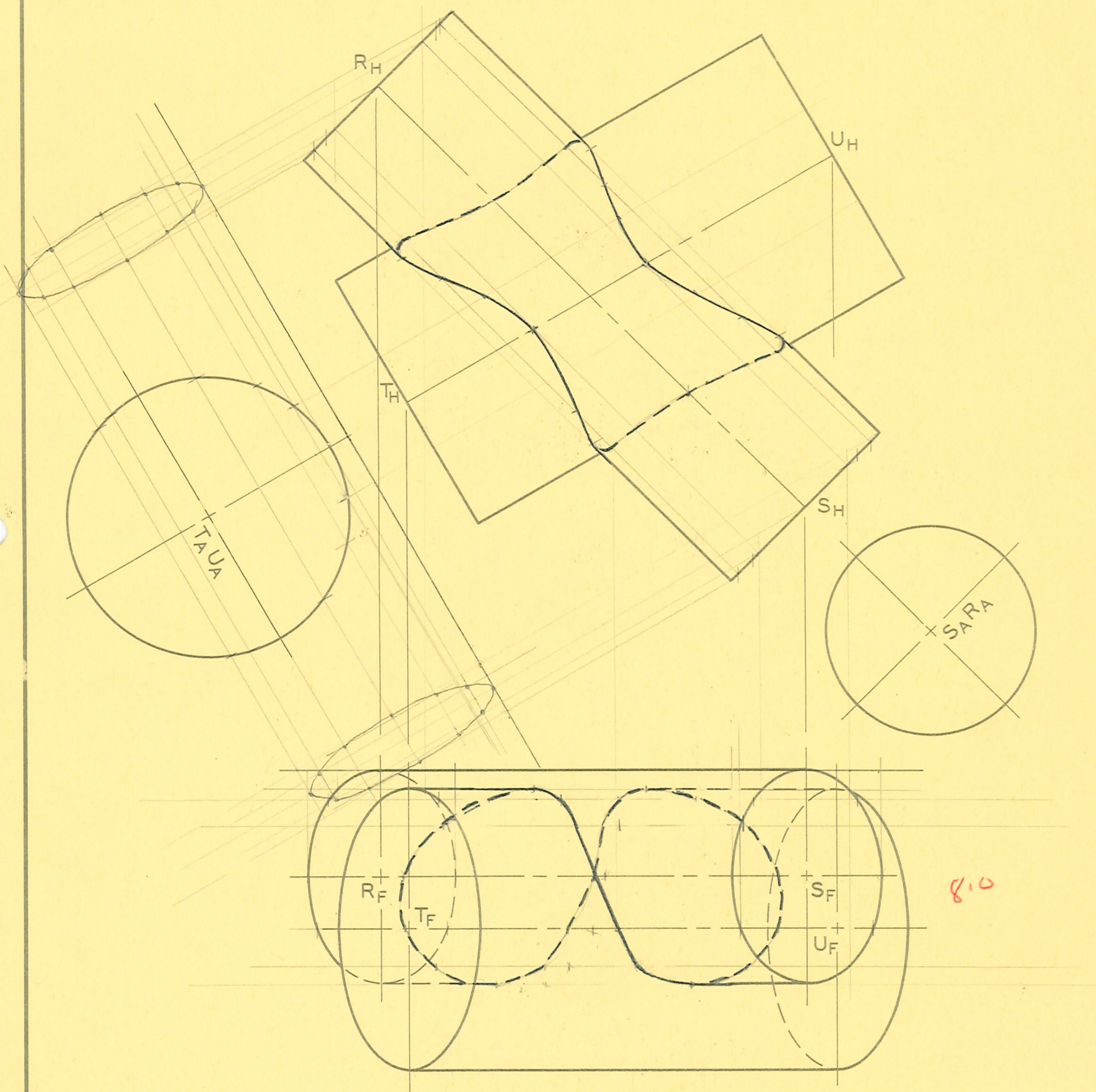
Find the intersection of the right pyramids. Omit the portion of each which is inside the other, and draw them as a single unit.



D

7-2	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

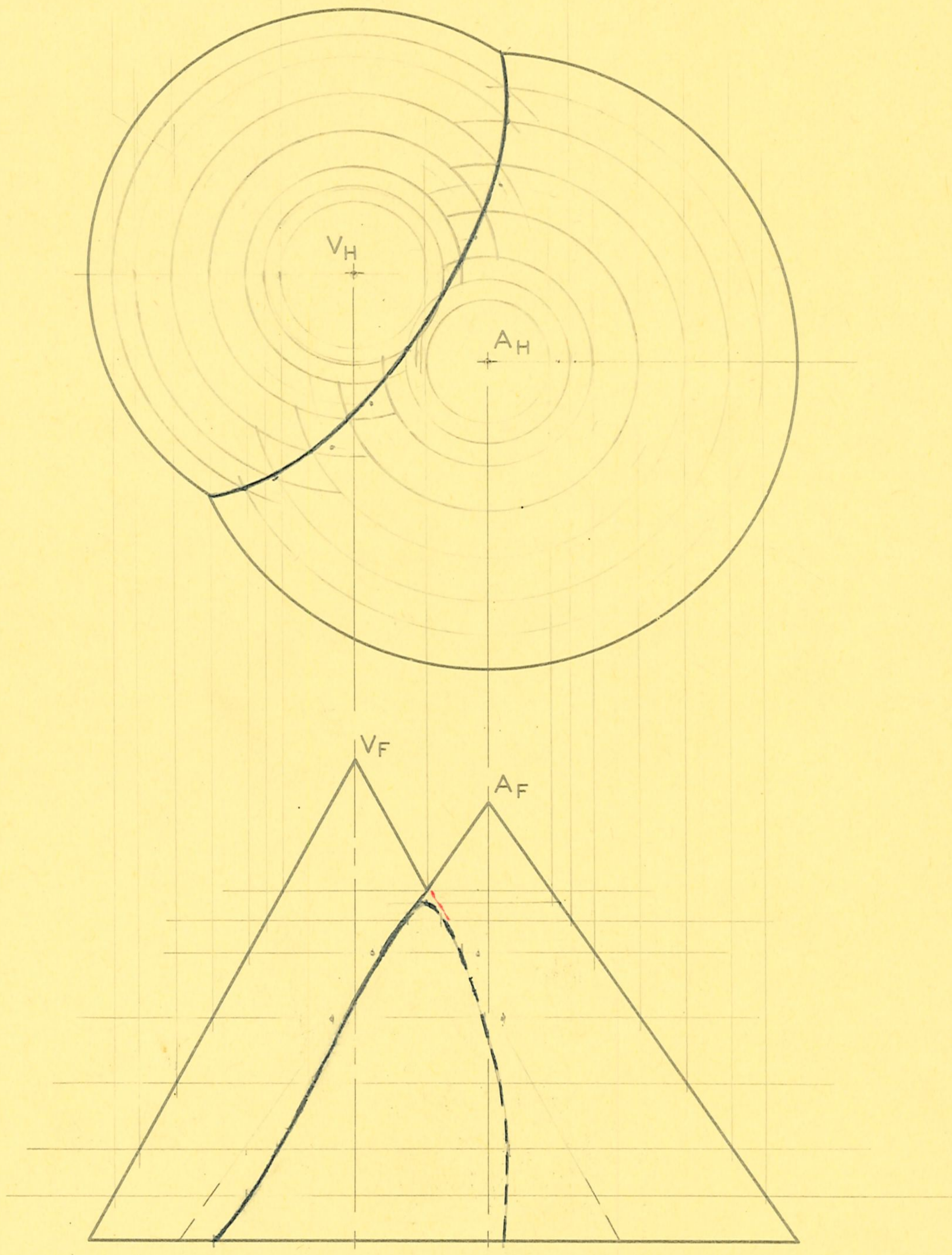
Complete the front and top views of the intersecting cylinders. In the solution make no use of the ellipses shown in the front view.



D

7-3	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Complete the front and top views of the intersecting cones. Omit the portion of each which is inside the other.

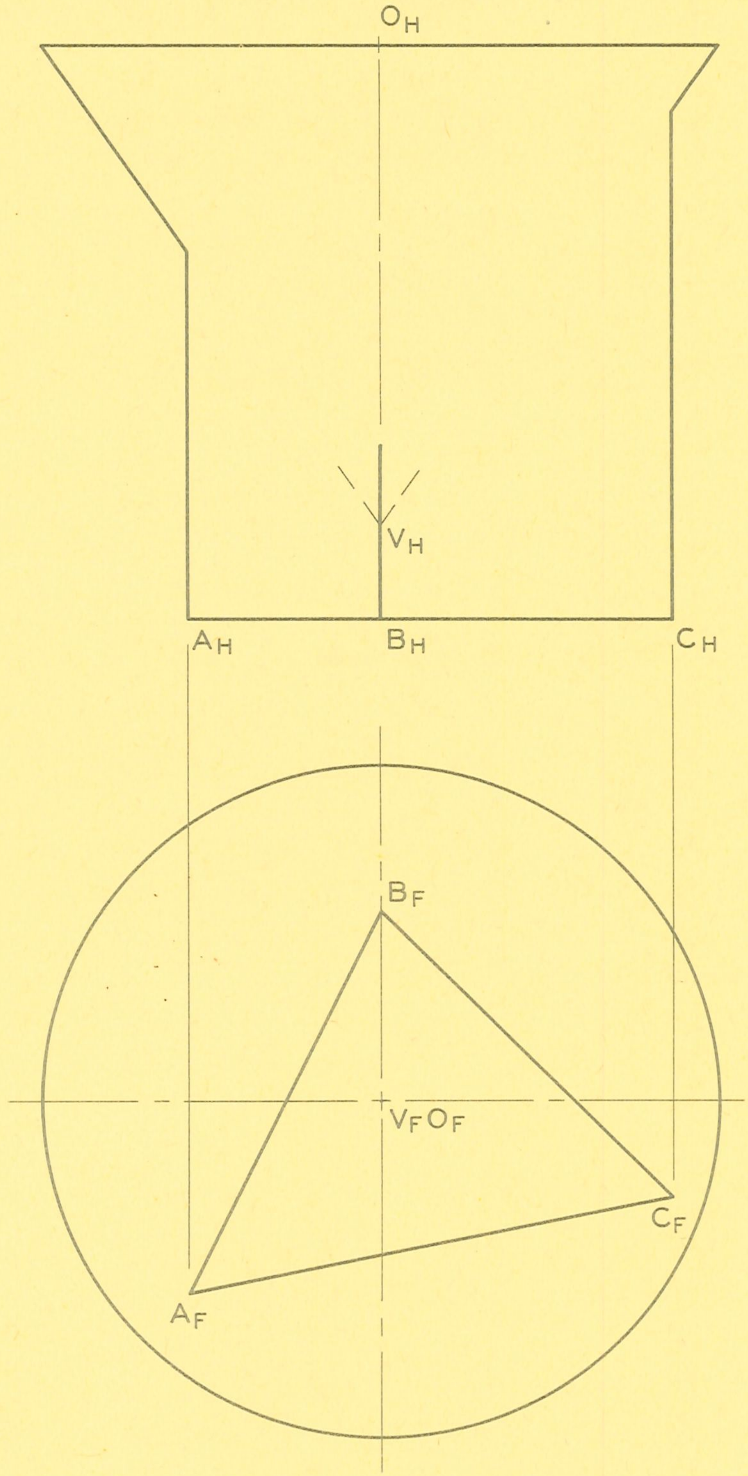


7.5

D

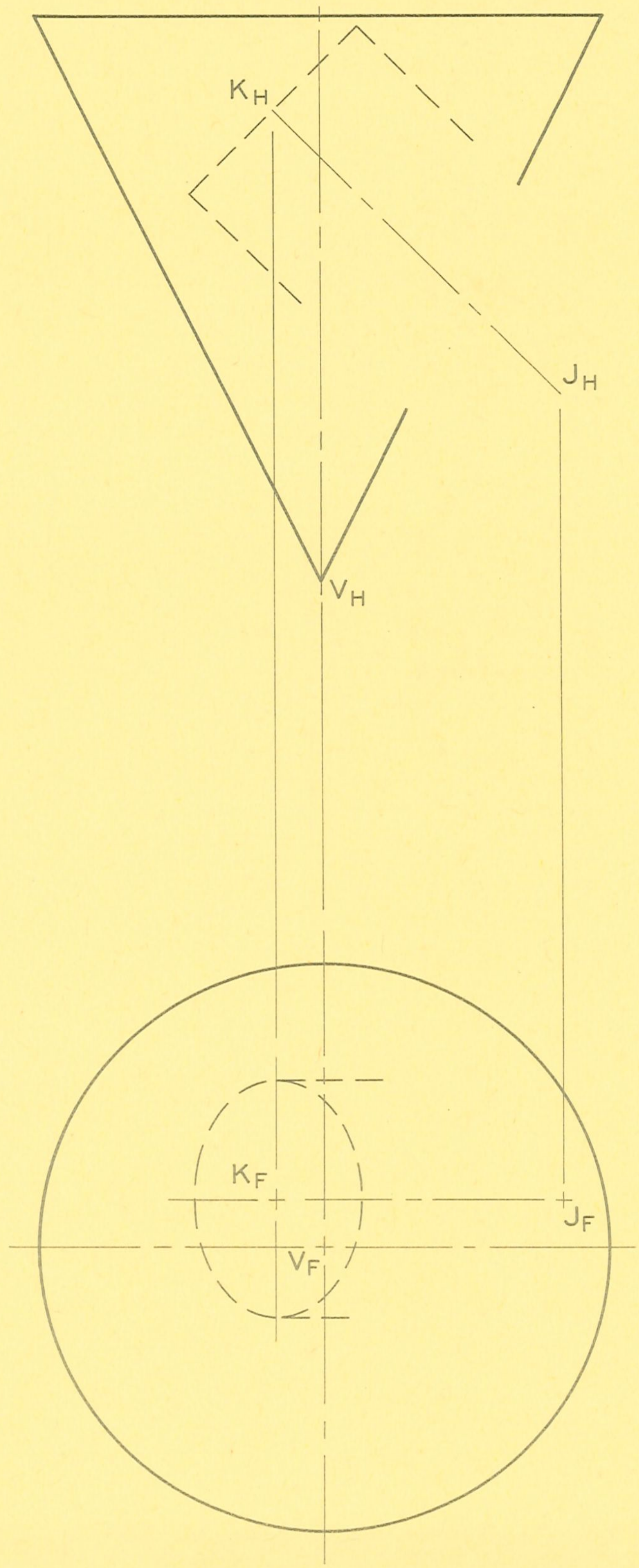
7-4	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

Complete the top view of the intersecting prism and cone. Omit the portion of each which is inside the other.



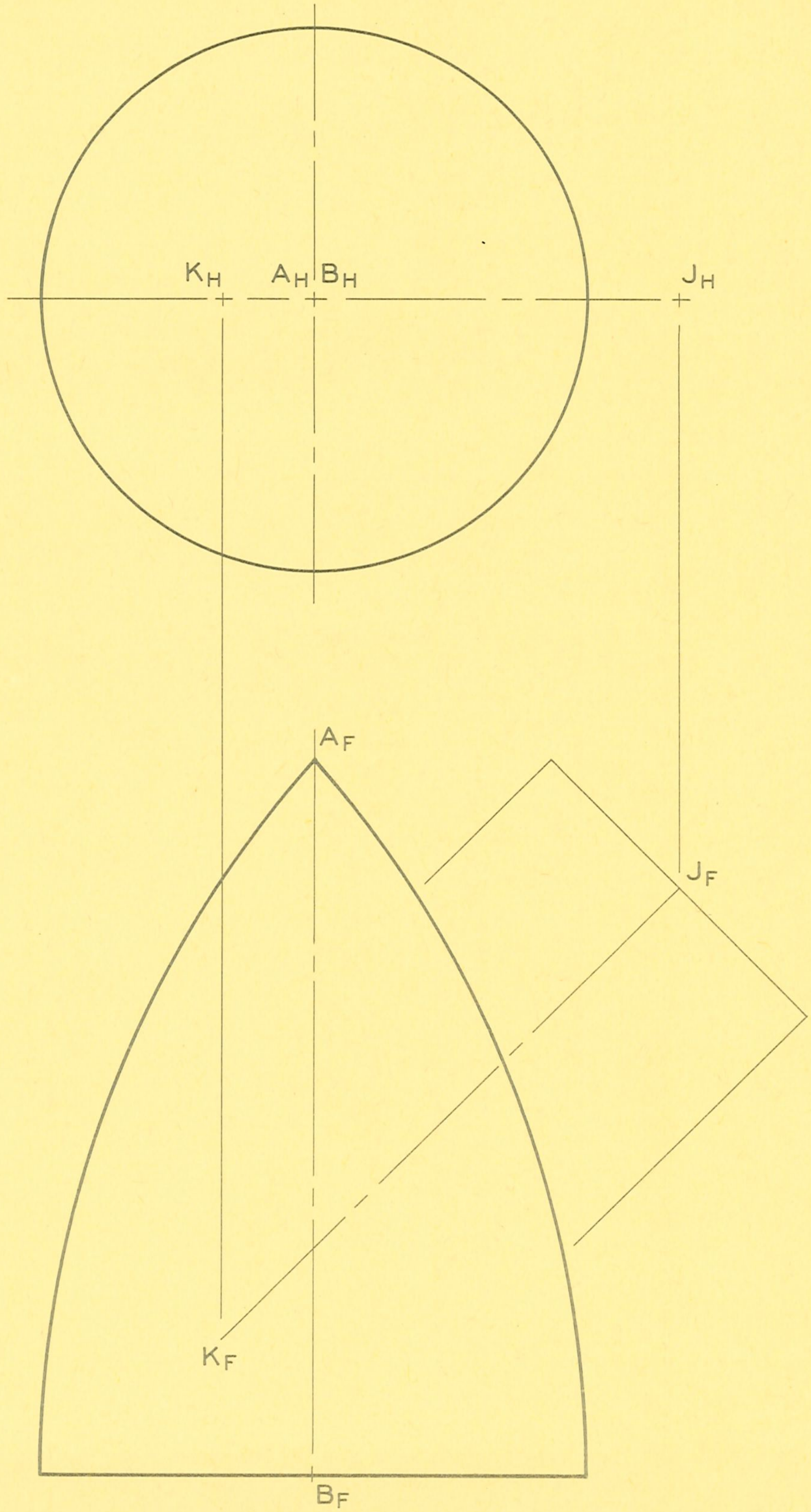
D

JK is the axis of a 1¼″ diameter hole drilled in a solid cone as indicated. Draw the front and top views of the cone with the hole in it. This cone is to be used as a model with a wooden cylinder inserted in the hole.



D

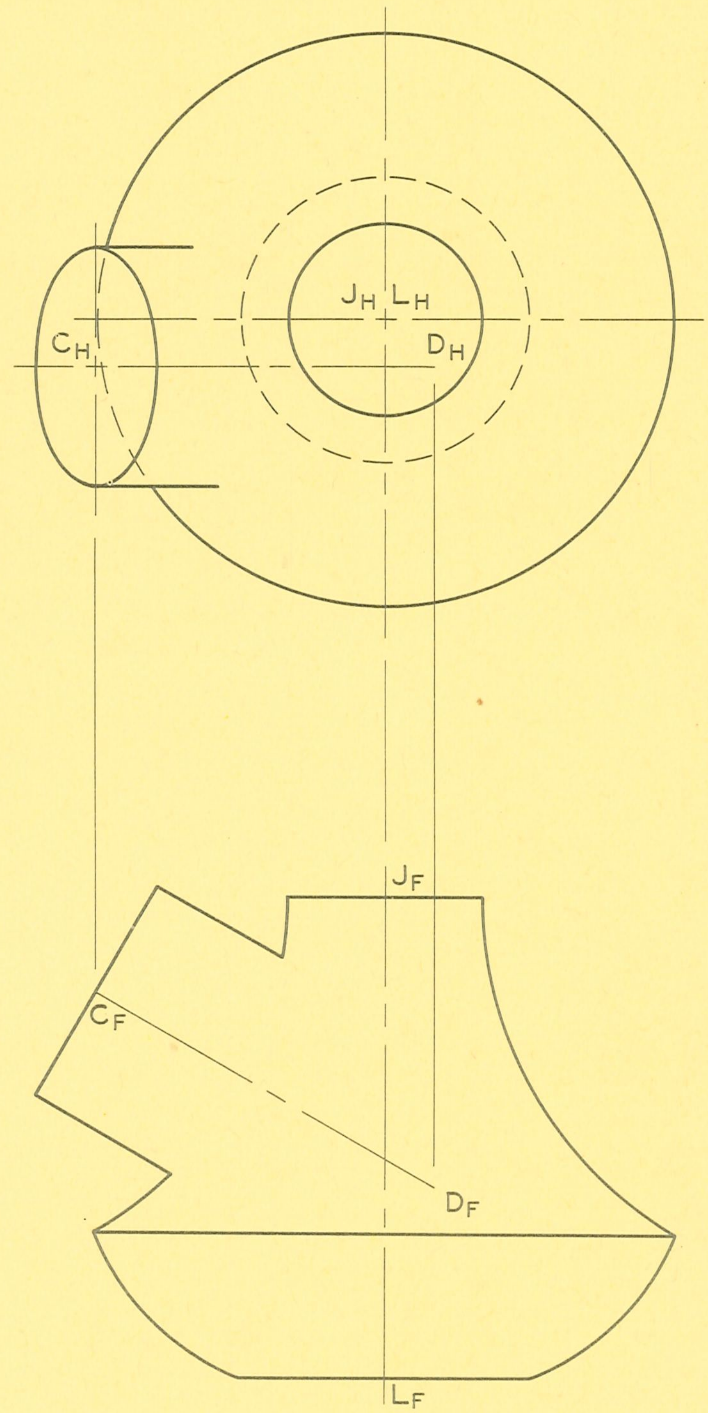
AB is the axis of the ogival nose of a rocket which has a 24″ diameter hatch for instrumentation. The opening for the hatch is the intersection of the nose with an imaginary cylinder having the axis JK. Draw the front and top views of the hatch. Solve by cutting spheres. Scale: 1″ = 1′-0″.



D

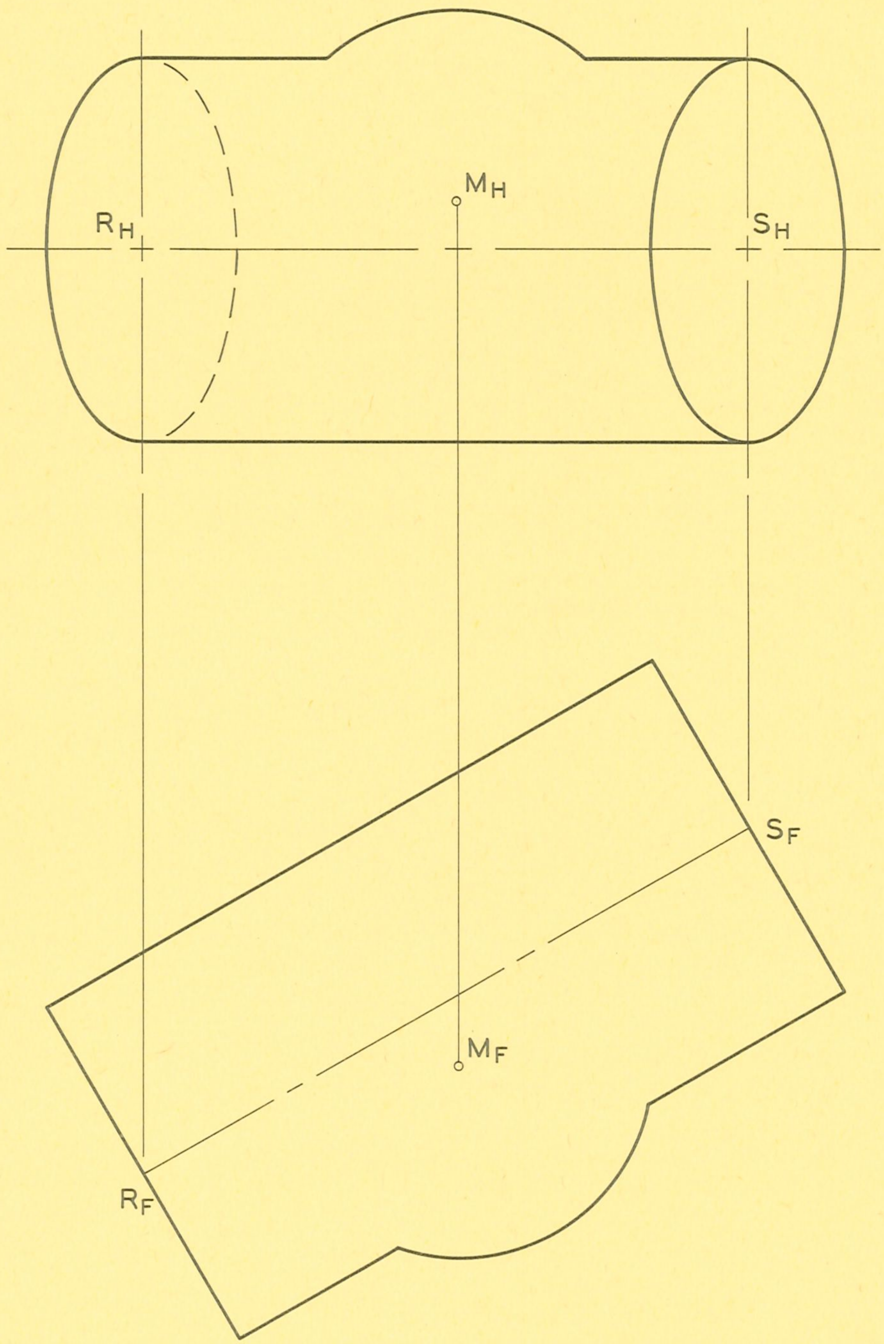
7-7	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

Find the intersection of the right circular cylinder and the surface of revolution whose axis is JL. Omit the portion of each which is inside the other.



D

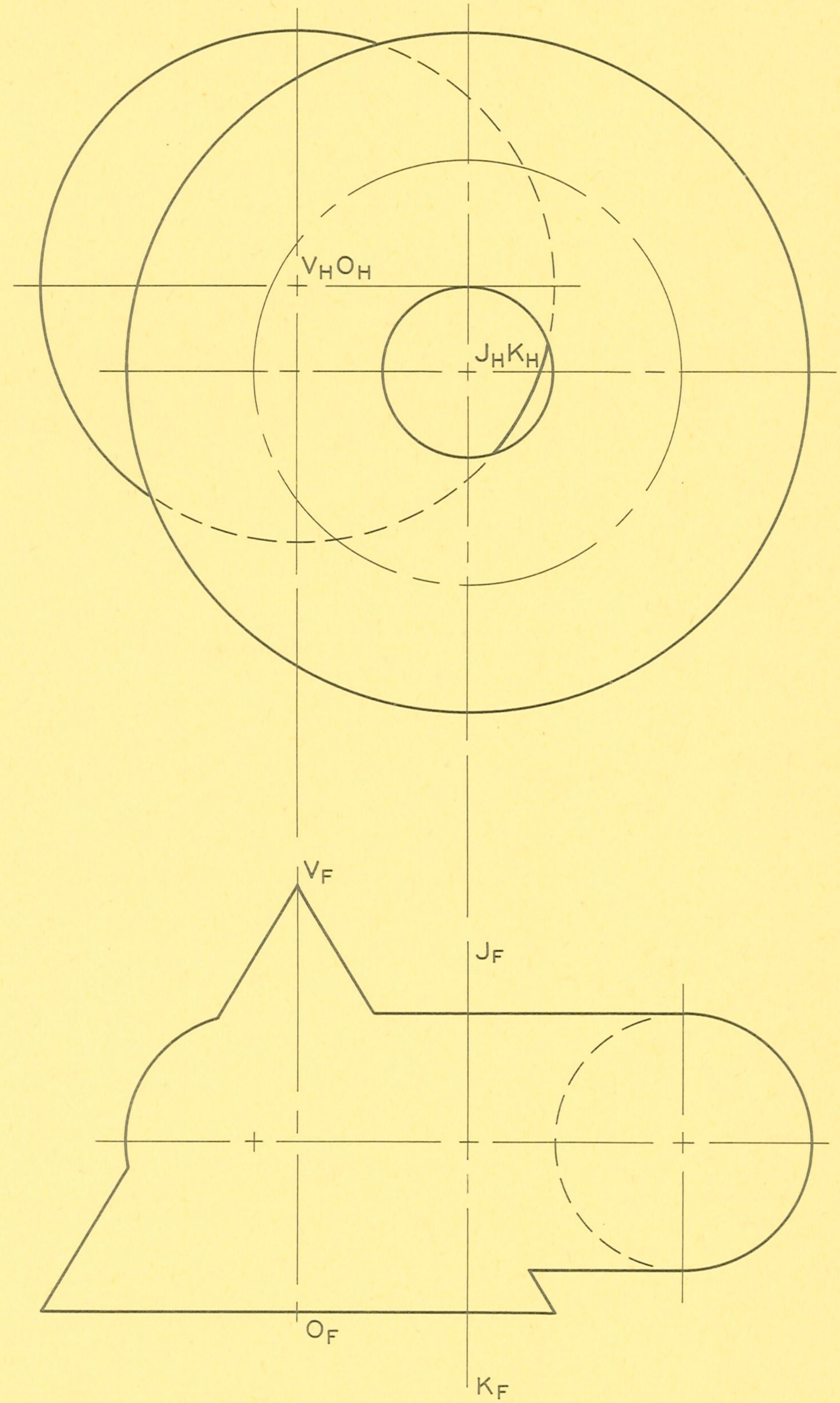
M is the center of a 2″ diameter sphere. Find the intersection of the sphere and the right circular cylinder whose axis is RS. Omit the portion of each which is inside the other.



D

7 – 9	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

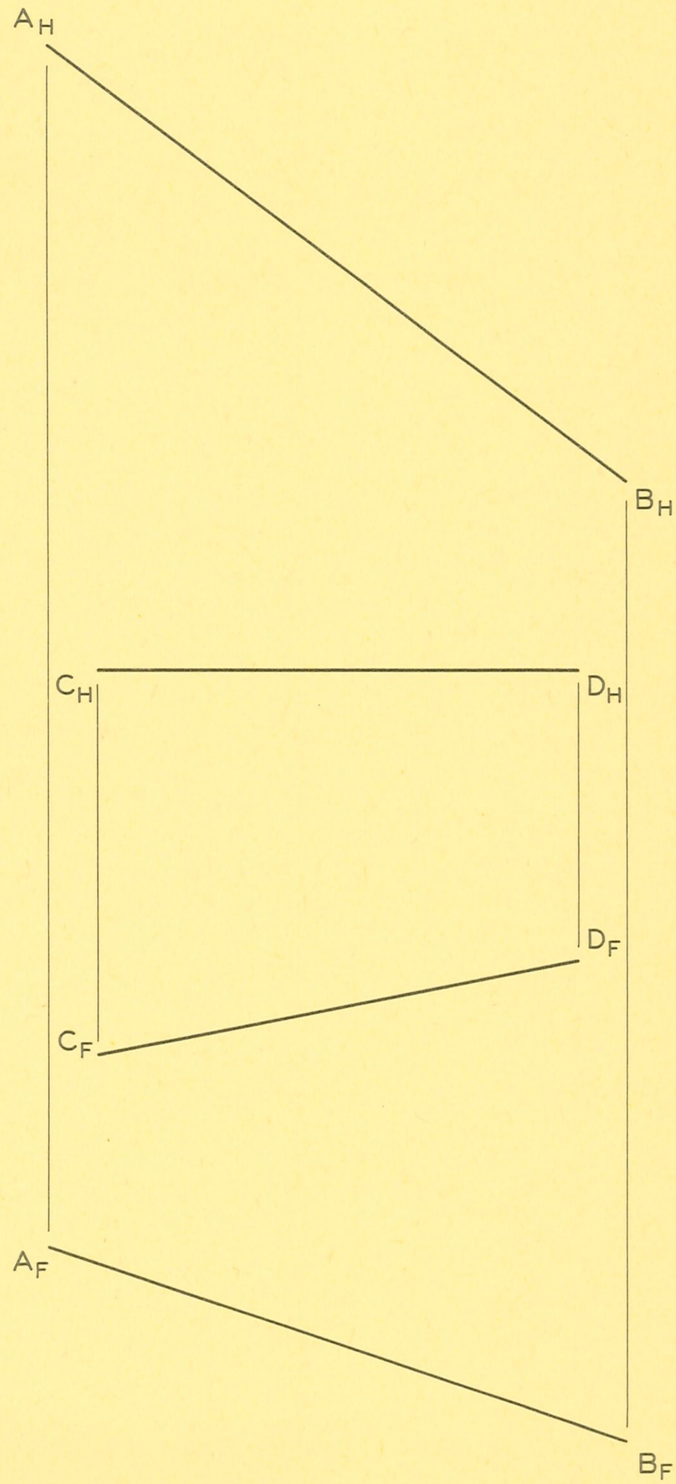
JK is the axis of an annular torus. Find the intersection of the torus and the right circular cone whose axis is VO. Omit the portion of each which is inside the other.



D

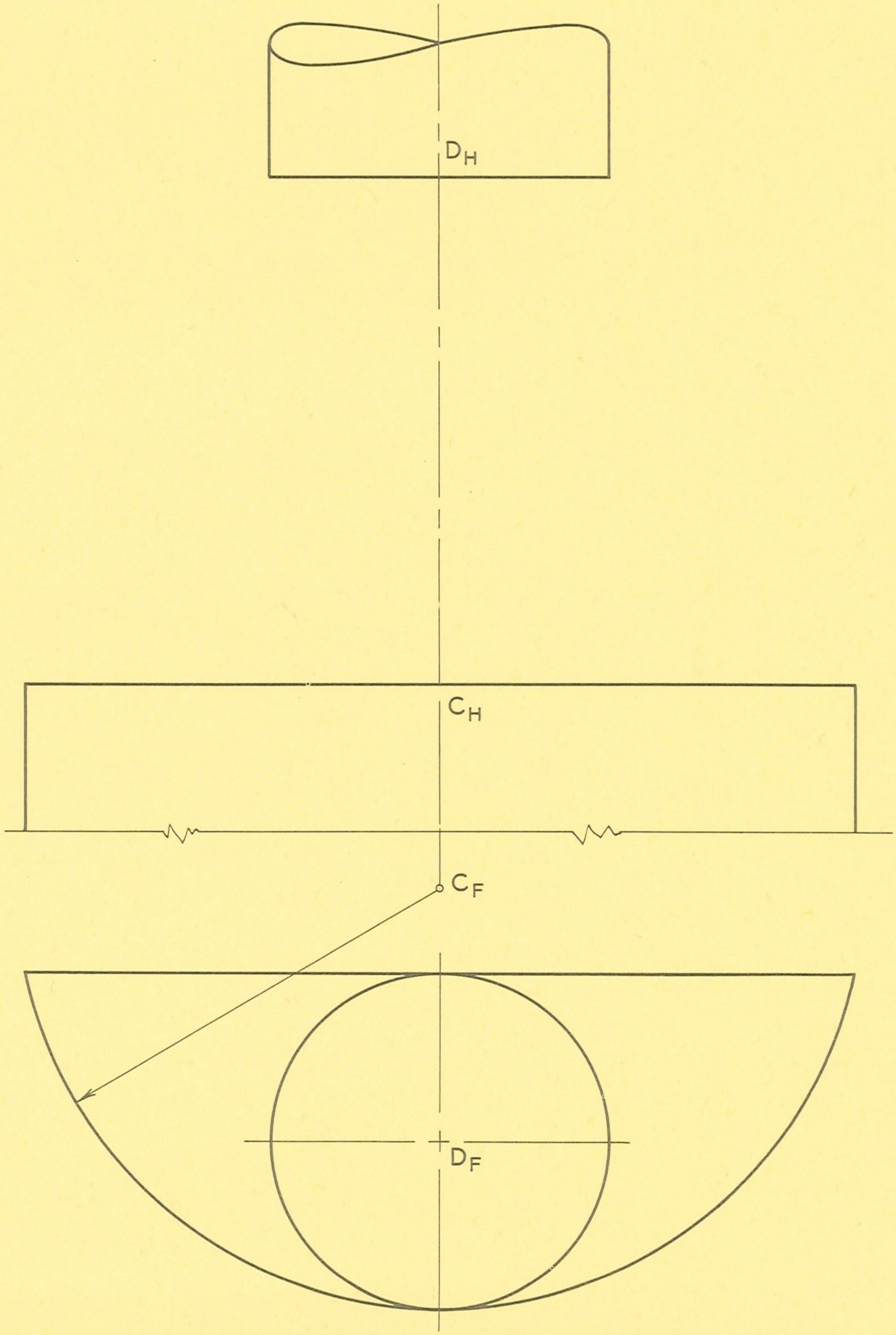
7–10	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

AB and CD are the directrices of a hyperbolic paraboloid. Draw AD and BC and nine other equally spaced elements of one generation. Consider the surface to be a thin opaque sheet with the elements drawn on both sides. Draw the hidden portions of the elements. Also, draw a view of the surface in which the plane director appears as an edge view.



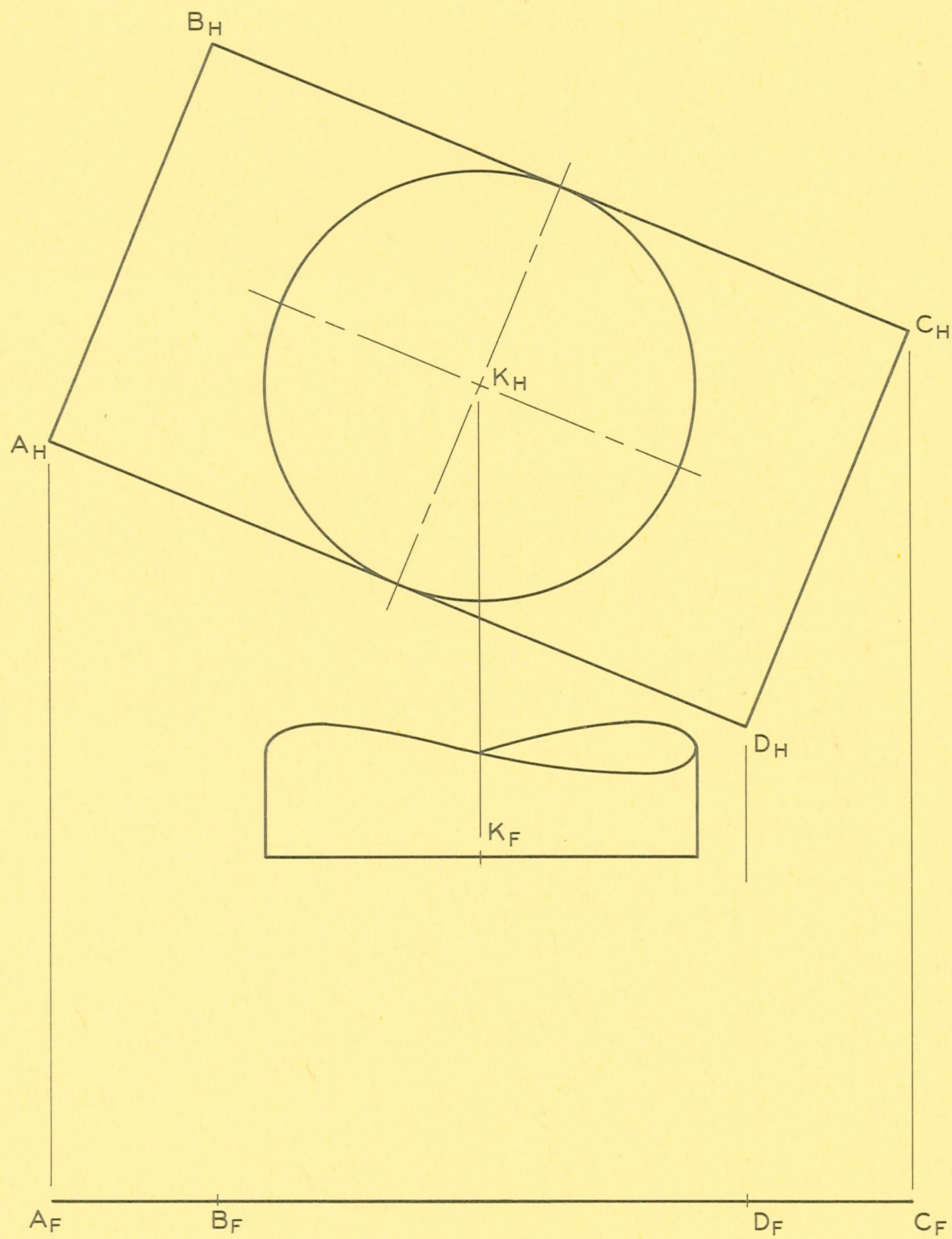
D

The circular arc with center C is the end of an irrigation flume to be connected to the end of a circular pipe at D. Design the transition piece in the form of a cylindroid. Show 24 elements equally spaced around the circle at D. Draw them on both sides of opaque material.



D

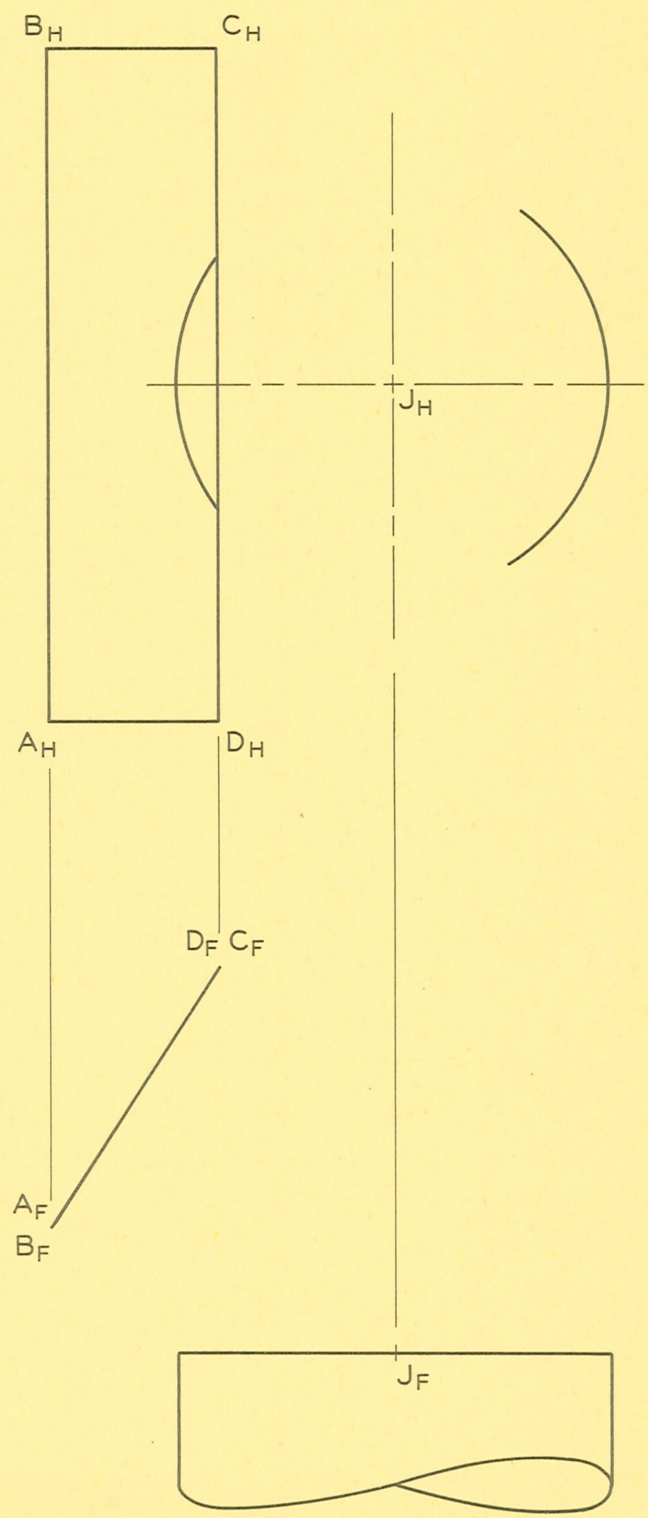
Design a molded transition piece to connect the circular pipe end at K and the opening ABCD. Use two right conoidal portions having AB and CD as directrices. Draw 16 elements equally spaced around the circle. Show the form of a reinforcing rib mid-way between the openings.



D

8-3	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

Design a molded transition piece to connect the circular pipe end at J and the opening ABCD. Use two oblique conoidal portions having BC and AD as directrices. Draw 16 elements equally spaced around the circle on both sides of opaque material. Draw three principal views.

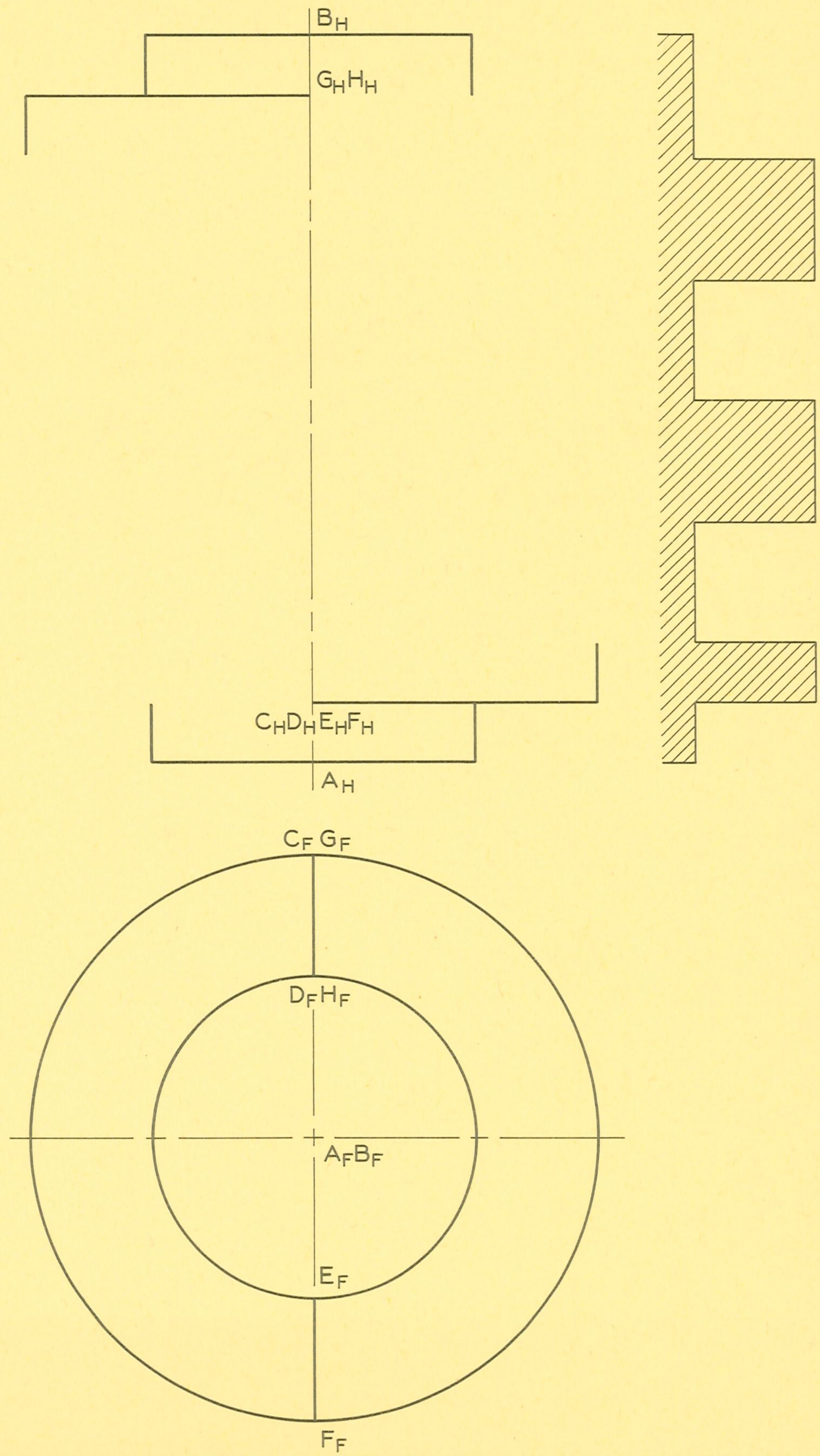


D

NAME

DESK-SECTION

Draw two and one-half turns of a right-hand single square screw thread that has a pitch of 1½″. AB is the axis and CD and EF are elements of the helicoids. The thread is between the frontal planes through CD and GH. Draw 16 elements per turn of the helicoids. Omit hidden portions of helicoids and elements in the top view.



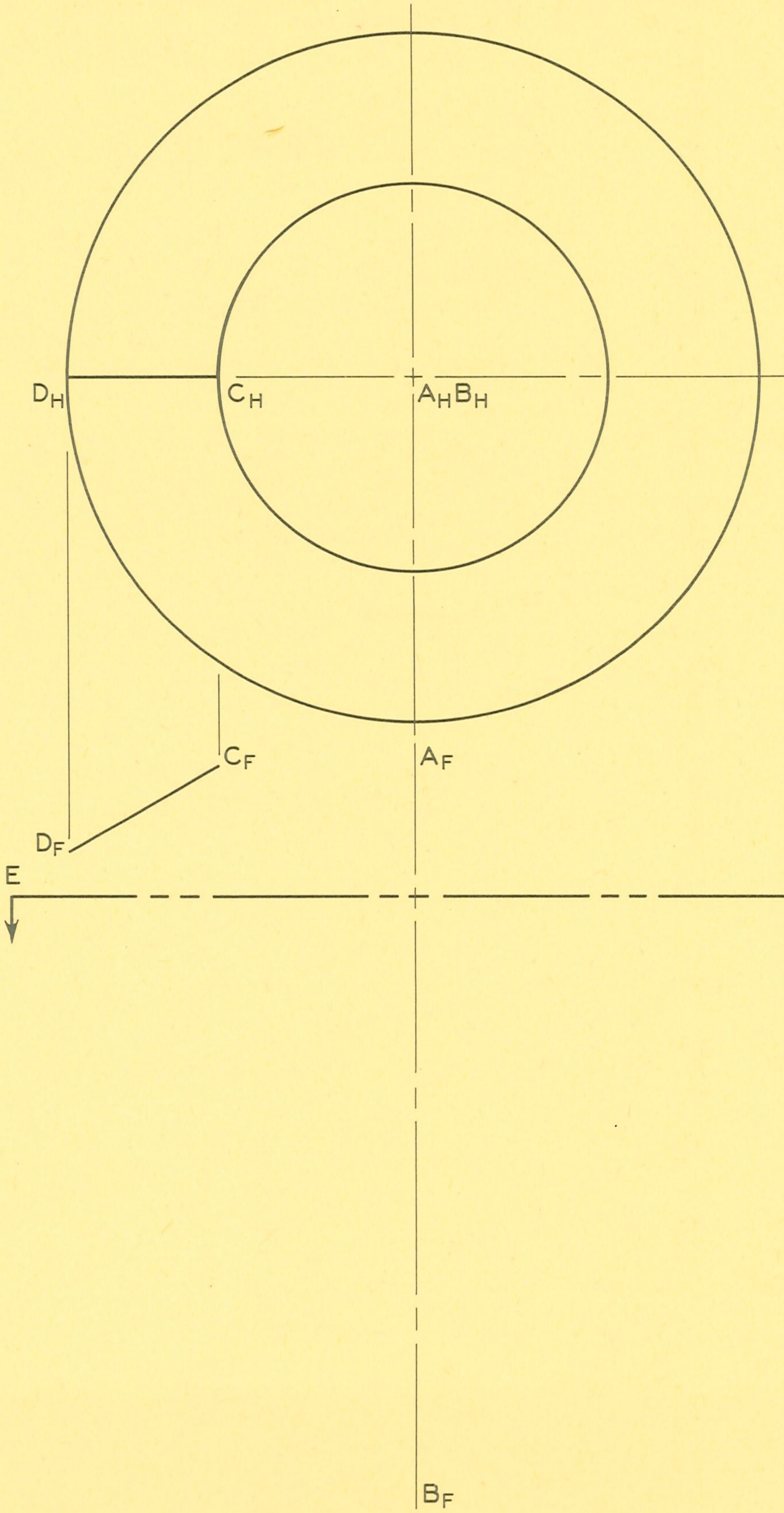
D

 ENGINEERING DESCRIPTIVE GEOMETRY

NAME

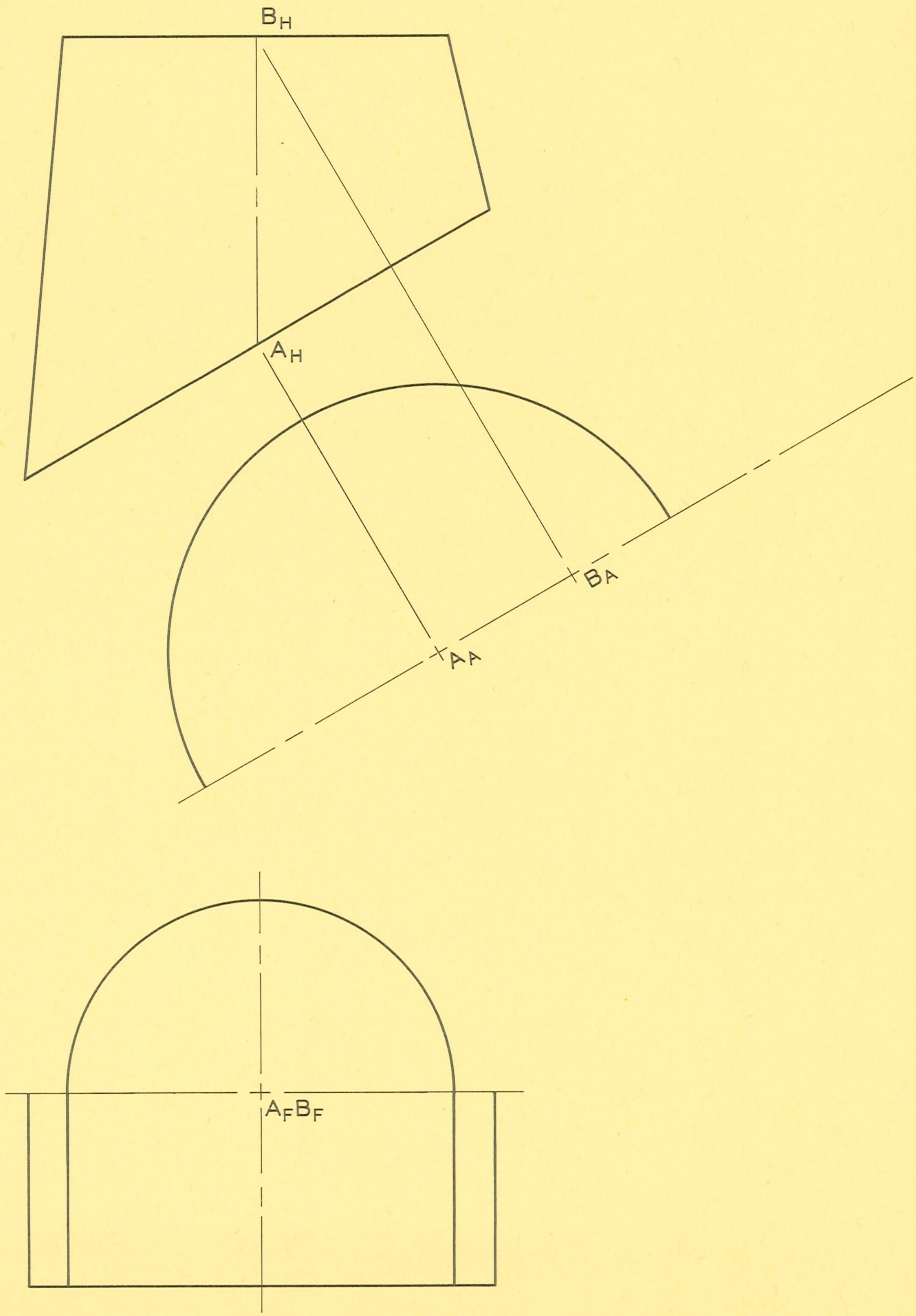
DESK-SECTION

AB is the axis and CD is the generatrix of a left-hand oblique helicoid having a lead of 3". Draw one and one-quarter turns of the helicoid as an opaque sheet with 24 elements per turn on the upper side. Draw section EE and name the curve. The helicoid may be the upper surface of a triple V-thread. Show lightly in outline a section made by a frontal plane through AB.



D

The semicircles at A and B are to be connected by an arched ceiling in the form of a warped cone whose directrices are the semicircles and the line AB. Two elements are shown. Draw 11 other elements on both sides of the surface, spaced equally around the semicircle at A. Complete the Aux. Elev. and show the intersection of the elements and AB produced, with correct visibility.

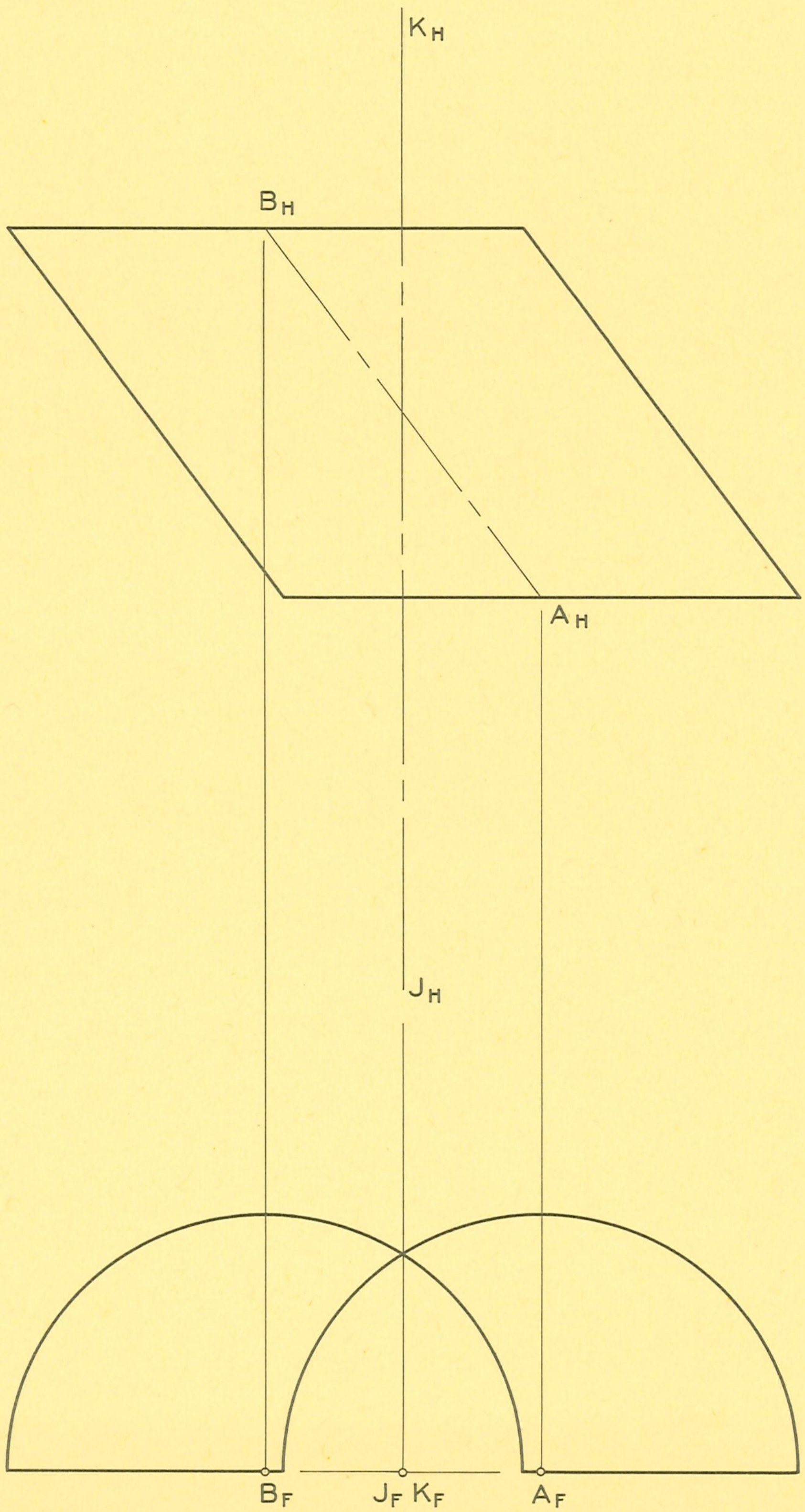


D

NAME

DESK-SECTION

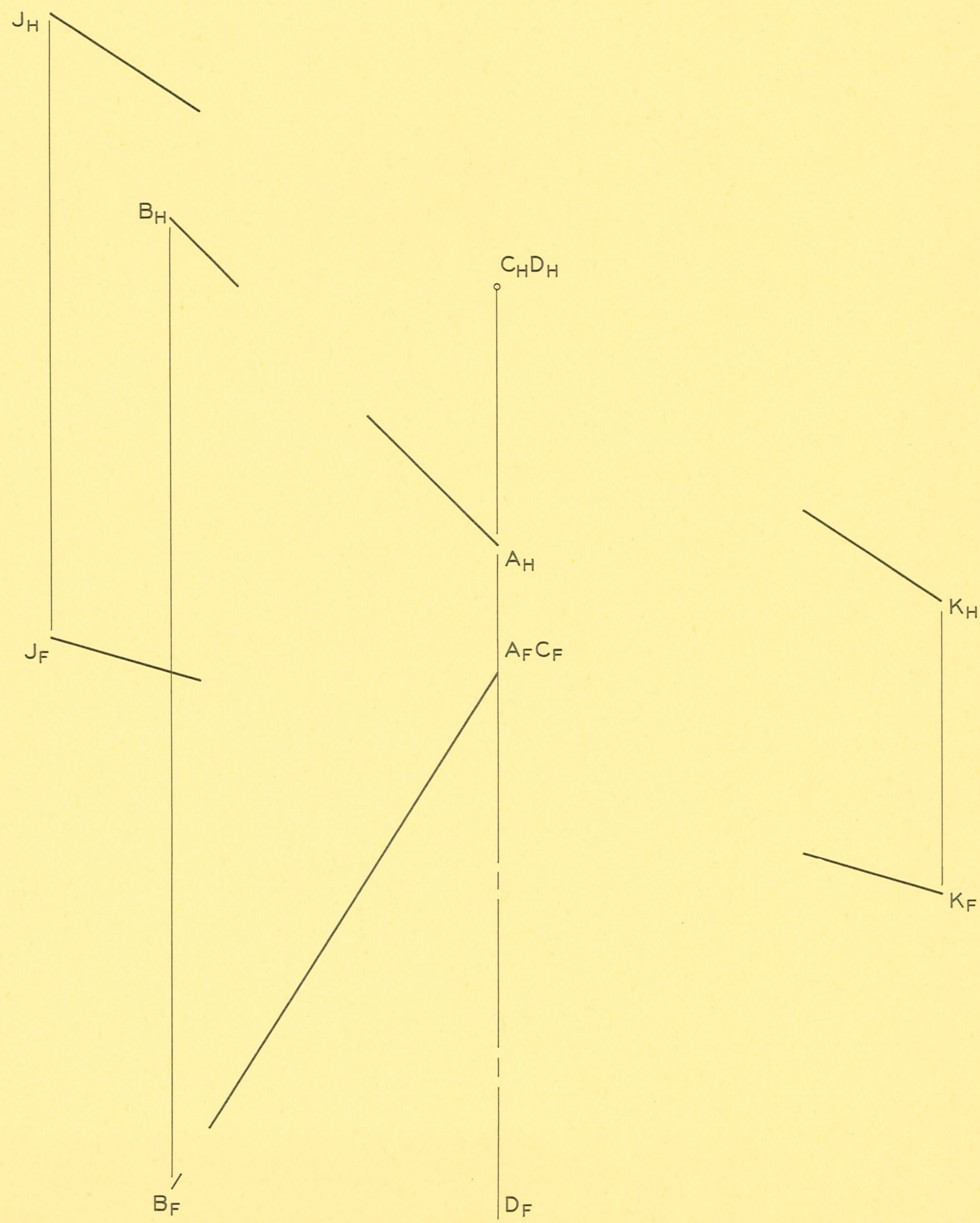
Make the basic layout as a Cow's Horn for the soffit of a masonry bridge to connect the semicircles at A and B. The straight directrix is JK. Draw 13 elements with equal angular spacing in the front view. Draw the front, top and right-side views and an auxiliary elevation looking in the direction AB. Consider the elements to be ruled on the outside of the surface in all views except the auxiliary elevation in which view they should be on the inside.



D

AB is the generatrix and CD is the axis of a hyperboloid of revolution. Draw 24 equally spaced elements. Show the elements ruled on both sides of thin opaque material. Find and name the section made by an orthofrontal plane through JK, and find the piercing points for JK.

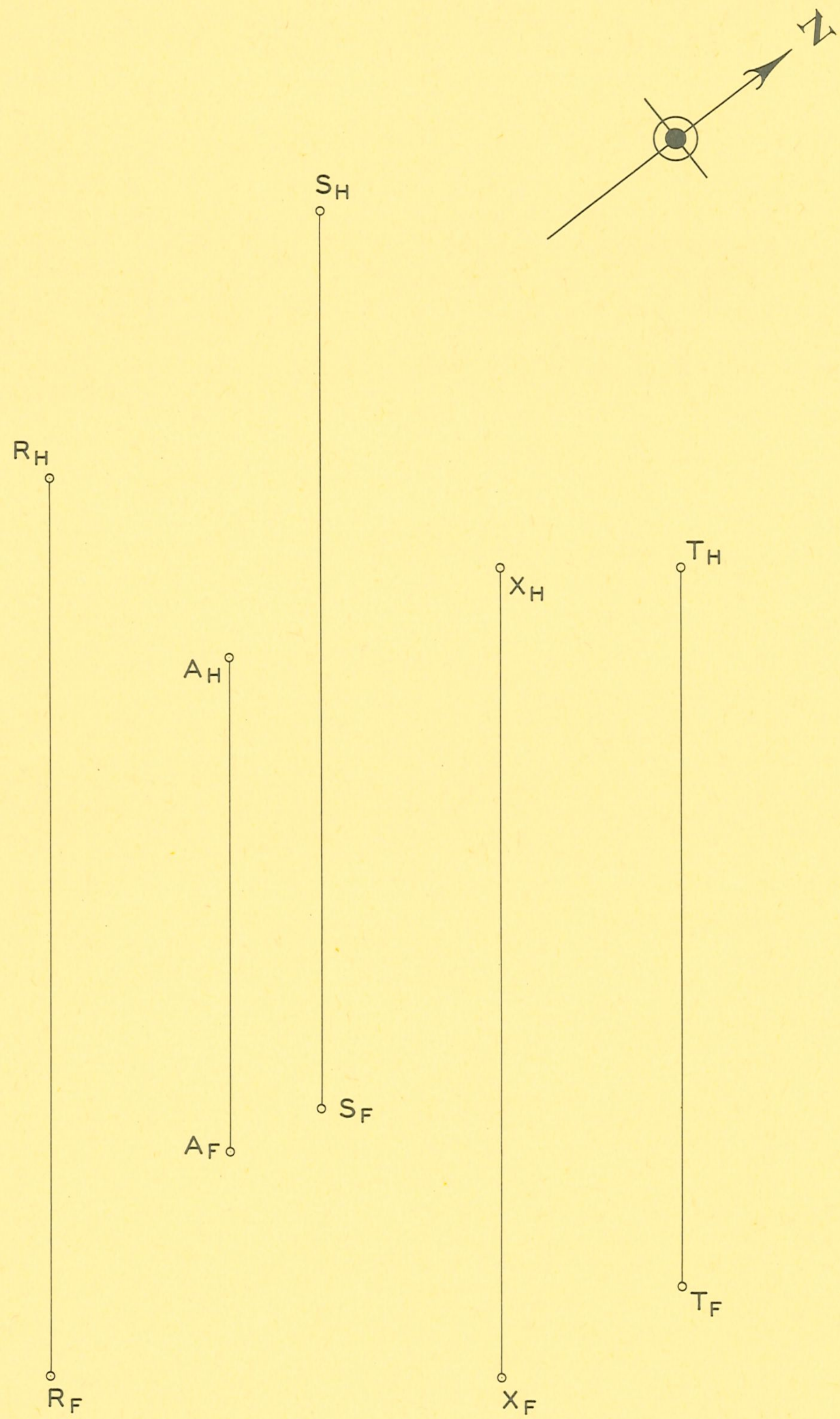
Structures of this form have been used as cooling towers in England and on the Continent. Typical dimensions: Height 233'; diameter of base 190'; gorge 111', top 130'.



D

8 – 9	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

R, S, and T are in the hanging wall of a vein of ore. X is in the foot wall. Measure the strike, dip, and thickness of the vein. From point A on the ground, draw and measure the following workings to the vein: a vertical shaft, a level tunnel, and a tunnel on a 20% upgrade. Show these in the front and top views. Scale: 1″ = 80 ft.

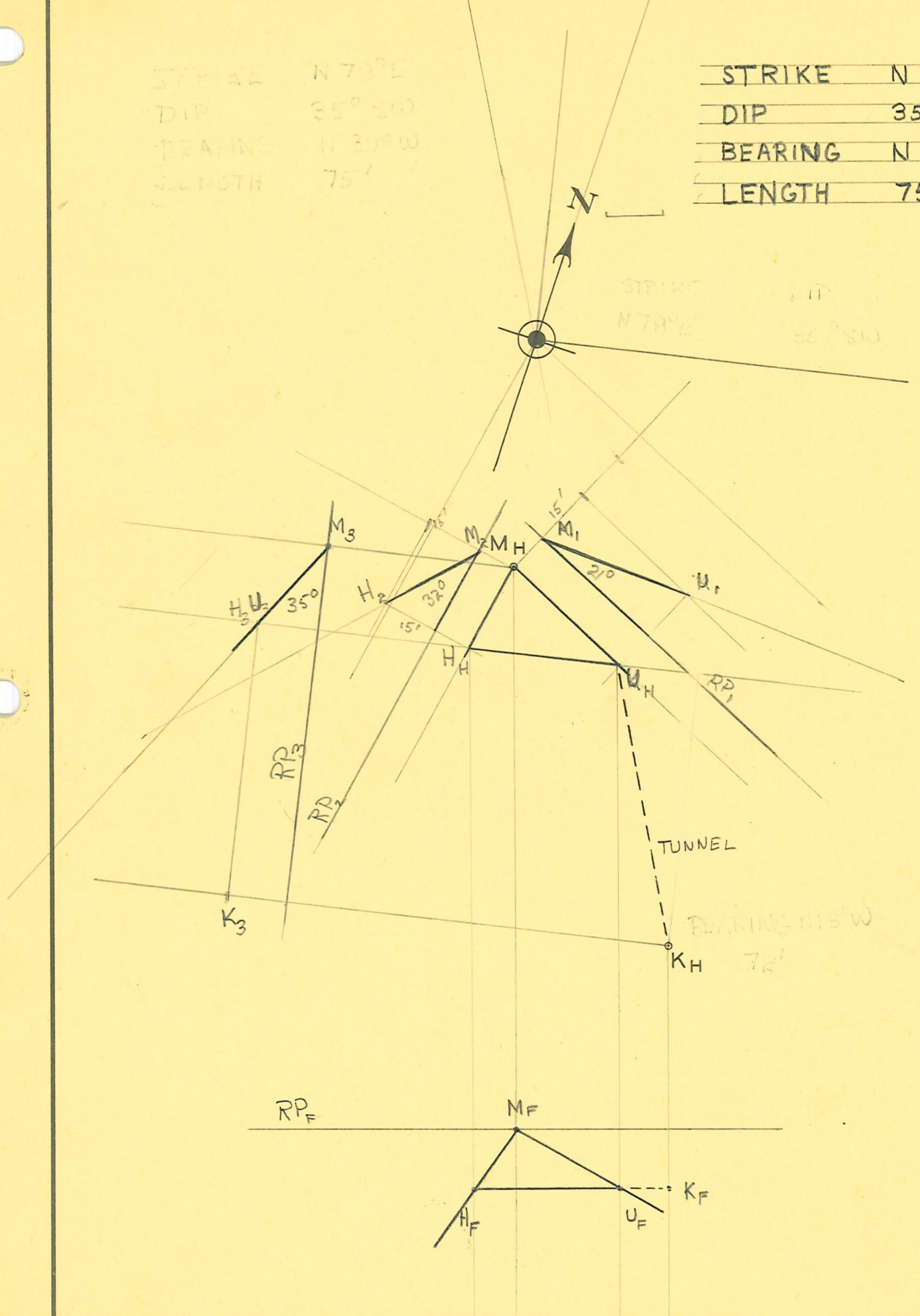


D

9 – 1	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

Two apparent dips at M, in the upper bedding plane of a stratum of shale, are 32°S 10°W and 21°S 65°E. Measure the strike and dip of the stratum. Show a level tunnel from K, 15 ft. below M, to the stratum and measure its length and bearing. Scale: 1″ = 40 ft.

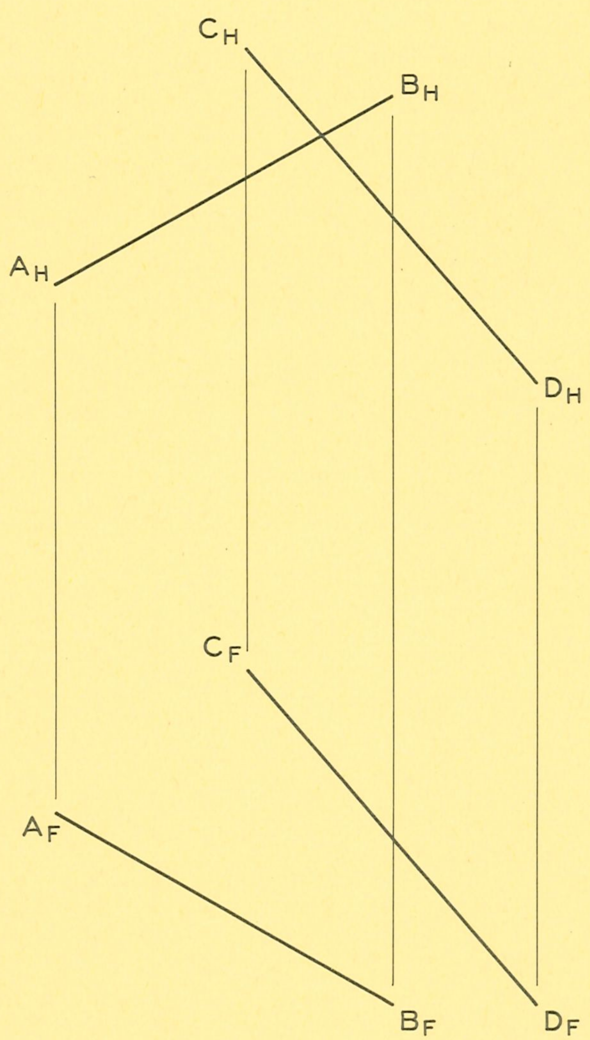
STRIKE	N 78° E
DIP	35° SW
BEARING	N 30° W
LENGTH	75′



D

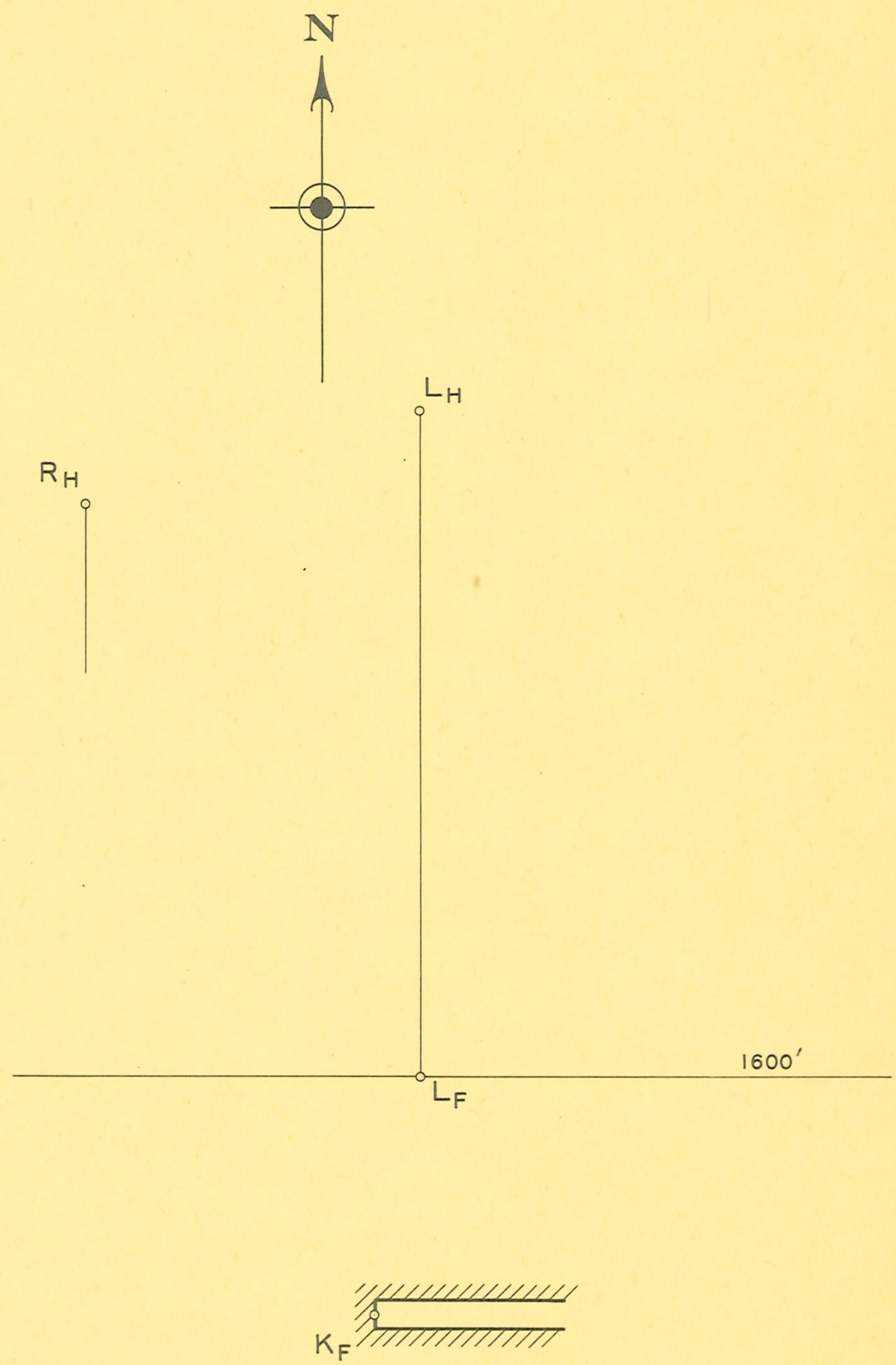
9 – 2	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

AB and CD represent two workings in a mine. Find the length of the shortest crosscut on a 25% upgrade from CD to AB. Draw the front and top views of the crosscut. Also, draw and measure a vertical shaft and the shortest level crosscut connecting the workings. Scale: 1″ = 80 ft.



D

Point L, at elevation 1600 ft., is in the hanging wall of a vein of low grade copper ore 15 ft. thick. The vein strikes S 72°E and dips 50° southwesterly. R is in a fault plane and is 80 ft. below L. The fault strikes S 35° W and dips 70° southeasterly. Find the intersection of the ore and the fault plane. K is the northwesterly end of a drift in the ore. How far can it be extended before striking the fault plane? Draw front and top views of the extended drift. Scale: 1″ = 80 ft.



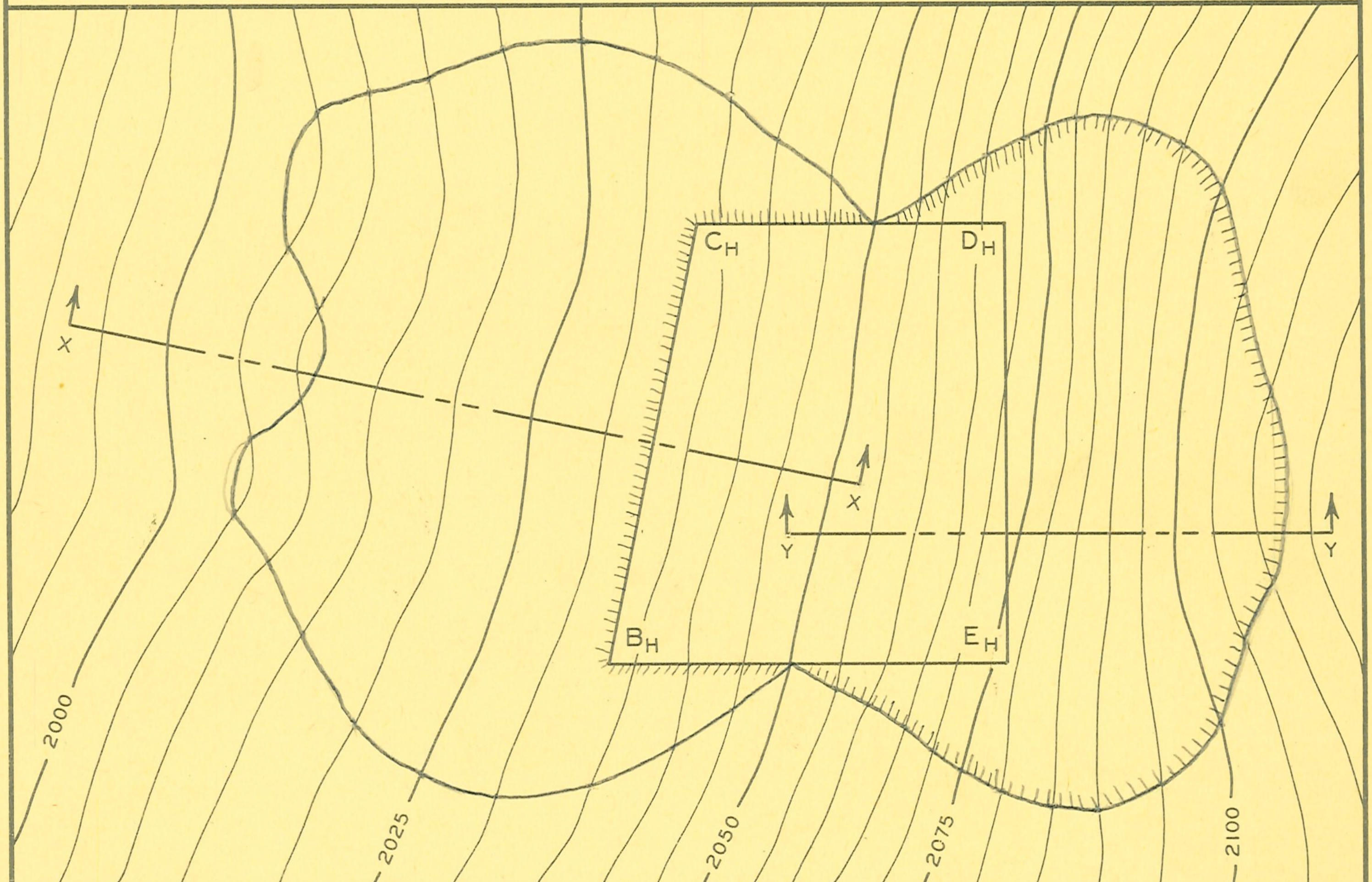
D

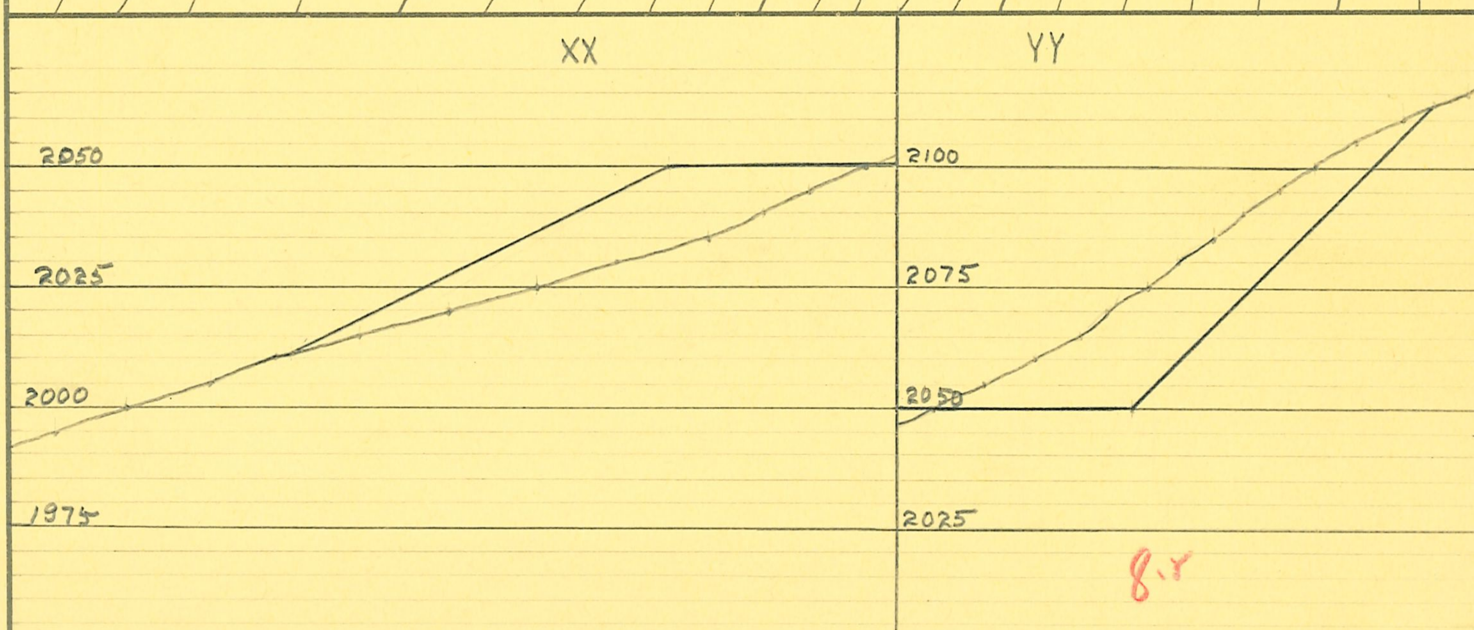
Ore was discovered at the point Q at the elevation of 4980′ on the hanging wall of a vein of low grade ore that is 10′ thick, strikes N 10°E, and dips 35° northwesterly. Find the probable outcrop of the hanging wall and the footwall. Show and measure the shortest tunnel on a 5% upgrade from point A on the surface of the ground to the vein. Also, show a section (profile) of the mountain made by a vertical plane along the center line of the tunnel. Find the depth of a vertical shaft from the point C on the ground to the vein. Scale: 1″ = 80 ft.

D

9-5	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

On the contour map of the hillside given below, show the extent of the cut and fill required to obtain the level area BCDE at elevation 2050'. Use the following slopes: 1 to 1 for cut, and 2 to 1 for fill. Also, show the sections XX and YY. Scale: 1" = 40 ft.



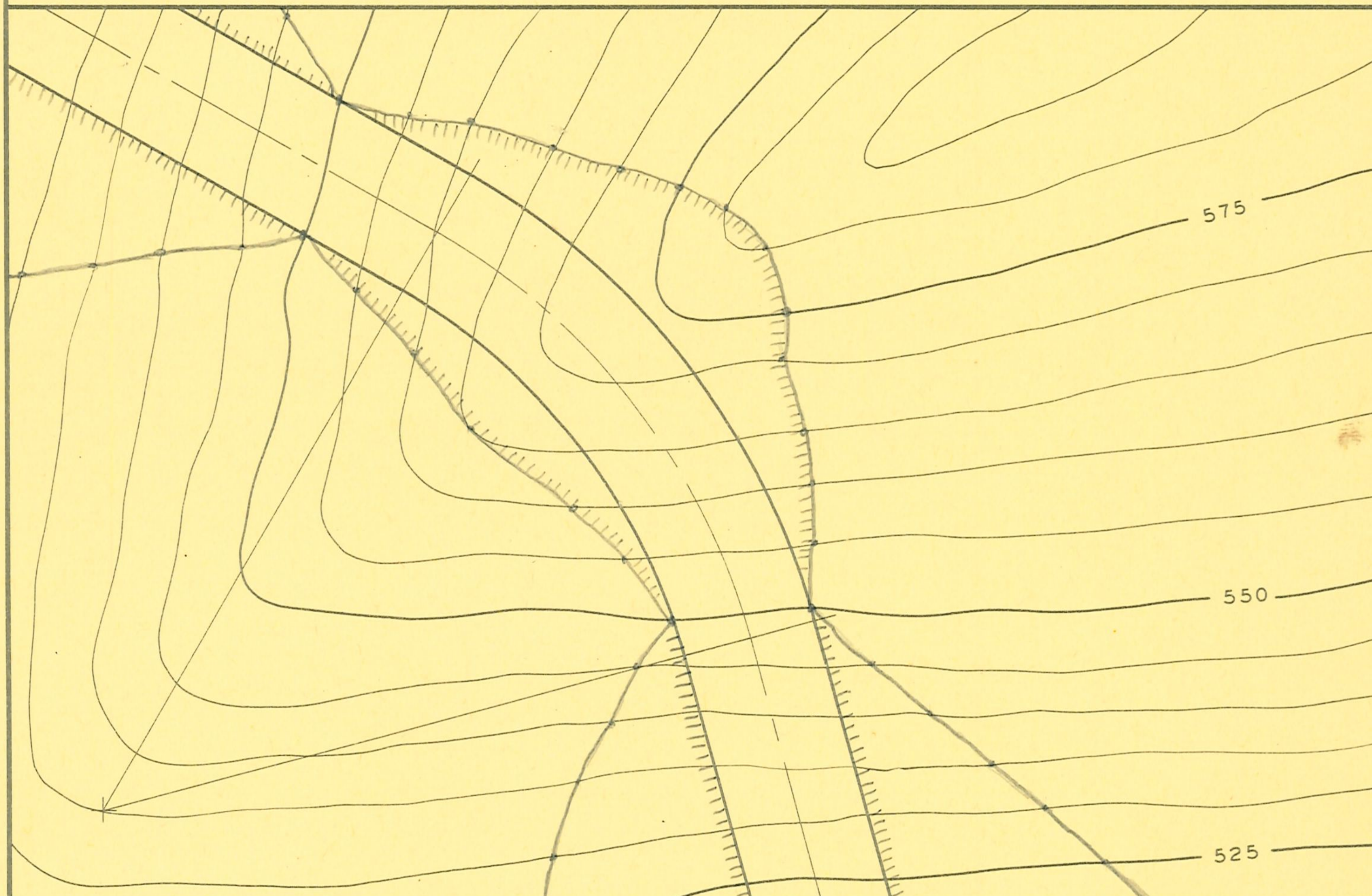


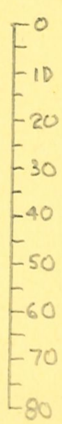
8.8

D

9-6	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

On the given contour map show the extent of the cuts and fill required to make the level road-bed indicated. The elevation of the road-bed is 550′. The slopes are to be as follows: 1 to 1 for cut, 2 to 1 for fill. Scale: 1″ = 40 ft.

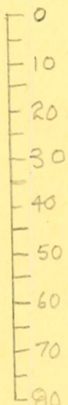


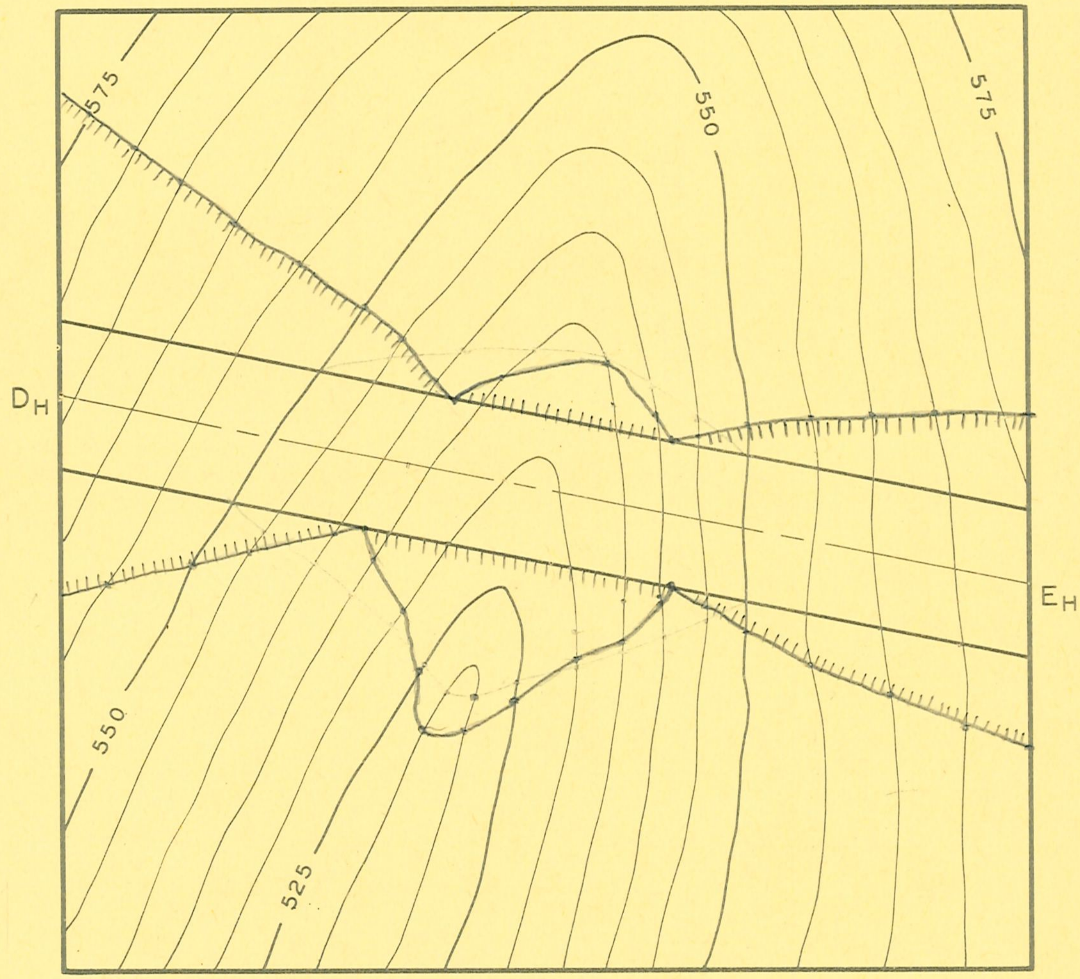


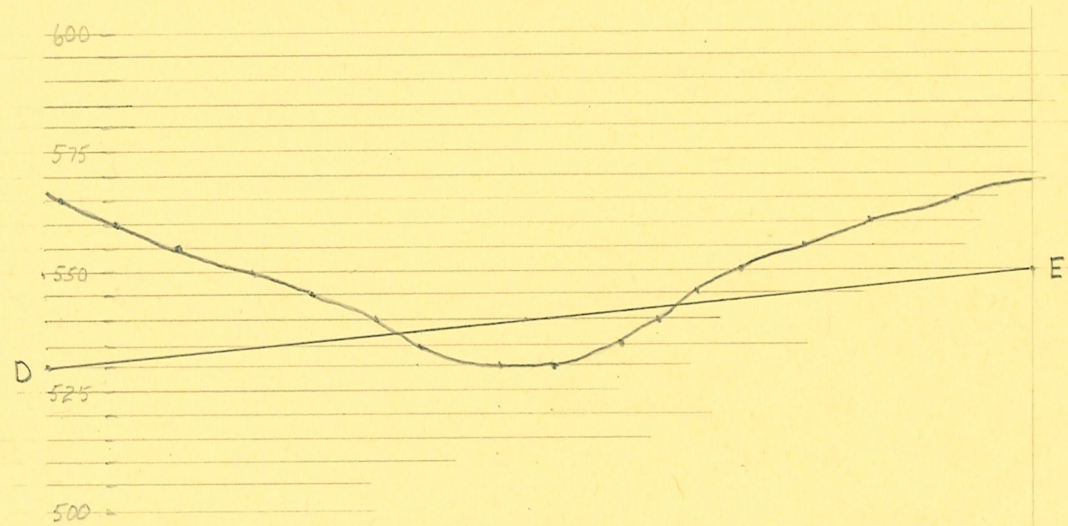
D

9–7	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F BELLENOT NAME	DESK-SECTION

Show the extent of the cut and fill required to make the road-bed on a grade from D to E. The elevation at D is 530′ and E is 550′. Use the following slopes: 1 to 1 for cut, 2 to 1 for fill. Draw the profile DE. Locate and measure the length of the culvert needed and find its grade. Scale: 1″ = 40 ft.



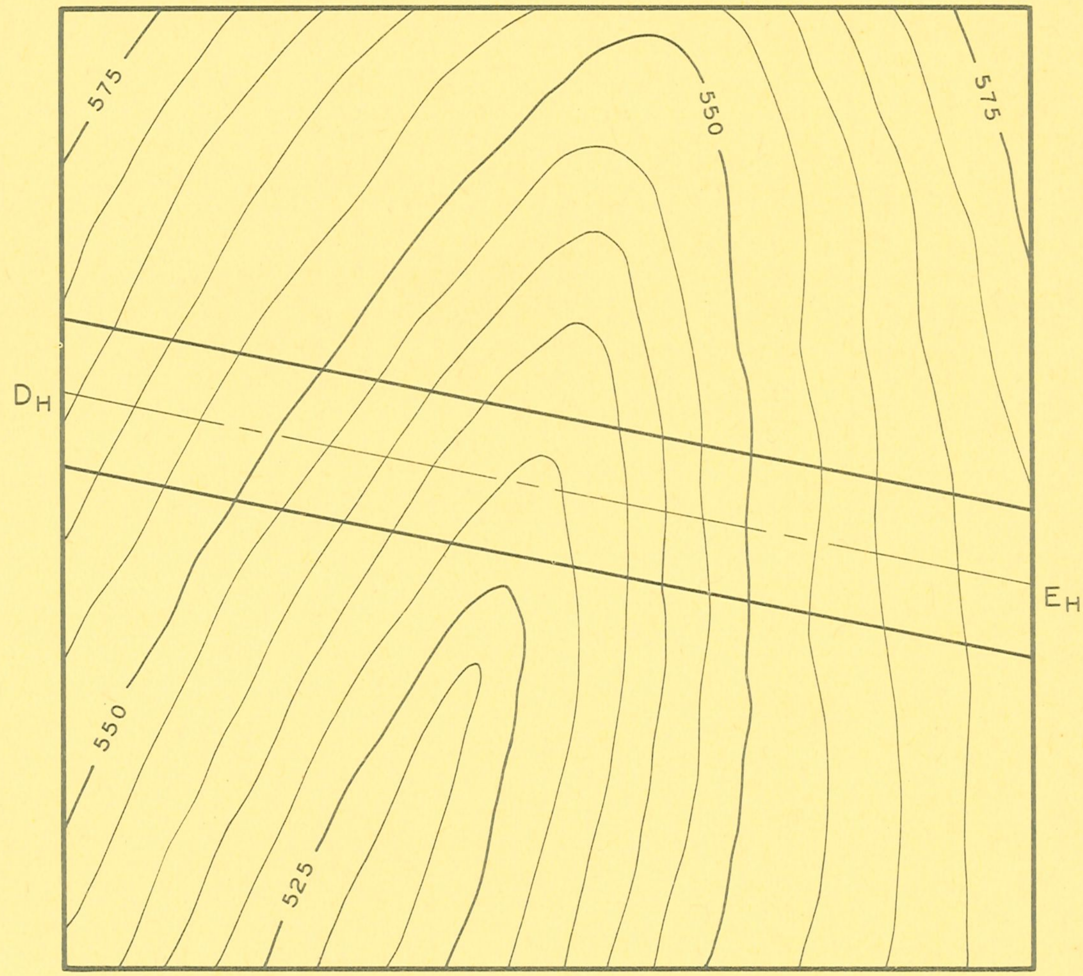




D

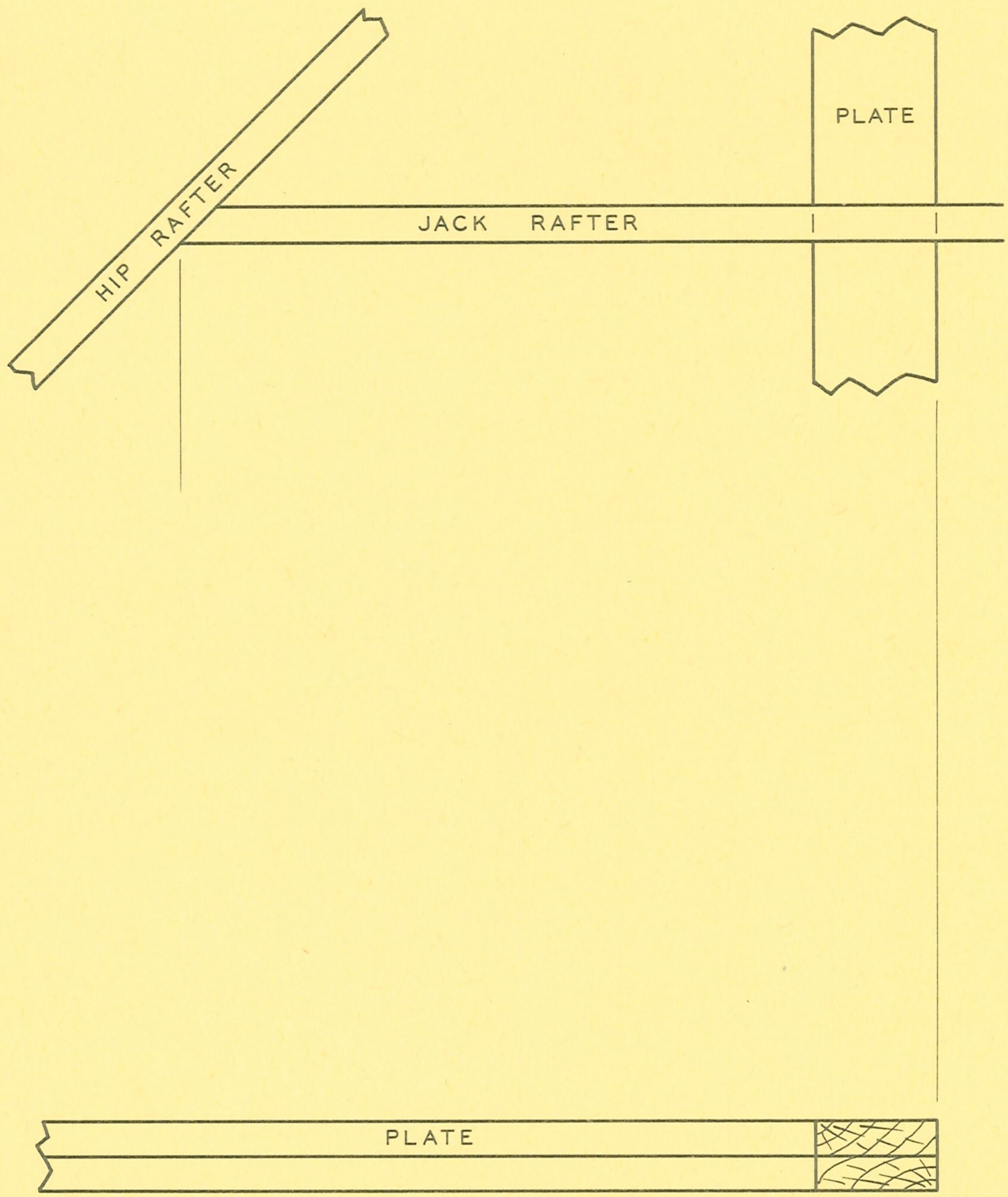
9 - 8	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	DESK-SECTION

Show the extent of the cut and fill required to make the road-bed on a grade from D to E. The elevation at D is 530′ and E is 550′. Use the following slopes: 1 to 1 for cut, 2 to 1 for fill. Draw the profile DE. Locate and measure the length of the culvert needed and find its grade. Scale: 1″ = 40 ft.



D

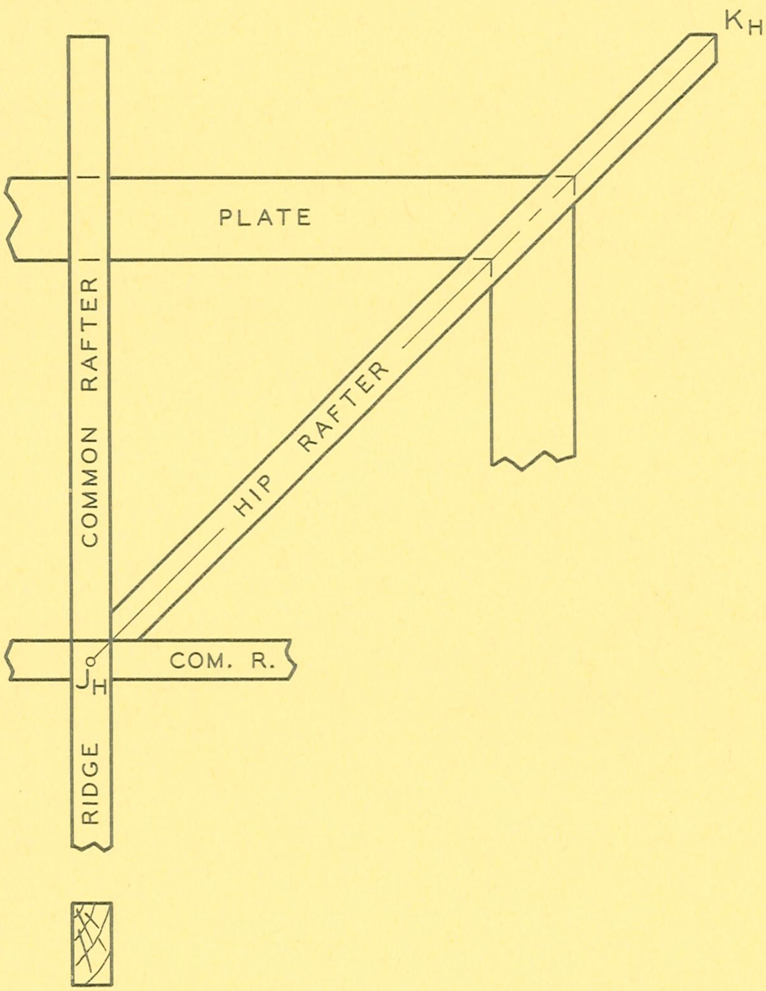
Complete the top view and draw the face and edge views of a short 2″ x 6″ jack rafter for a roof of 1/3 pitch. The rafter has an overhang of 8″ and is notched half way through. Measure its length and the angles for the cuts on its ends. Use stock size lumber. Scale: $1\frac{1}{2}'' = 1'\text{-}0''$.



D

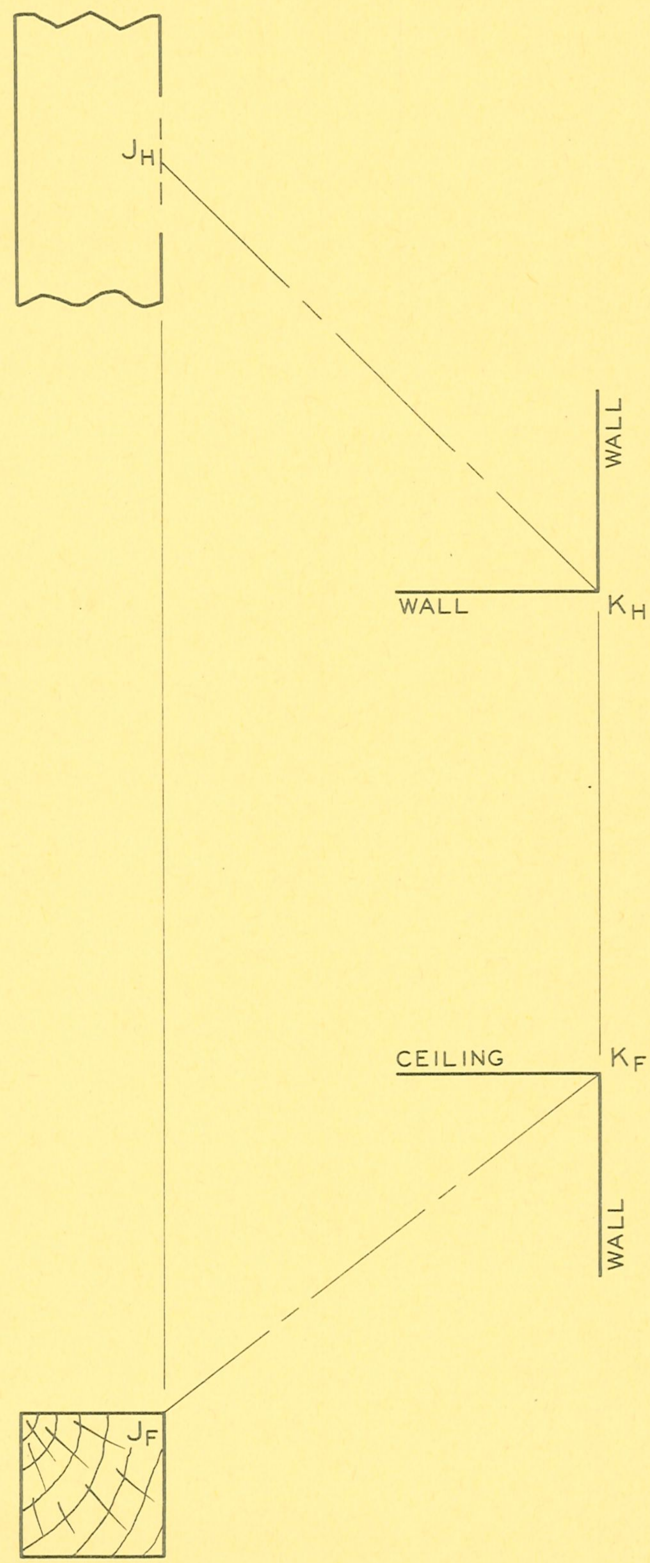
10 – 1	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

JK is the hipline of the roof of a guard house. The top of the wall plate is 1'-8" below the top of the ridge. The 2" x 4" common rafters have an overhang of 6", and the top edge of each is 3" above the outside edge of the plate. Draw the front, face, and edge views of the hip rafter shown and measure its length and the angles for the cuts on its ends. Use stock size lumber. Scale: 1½" = 1'-0".



D

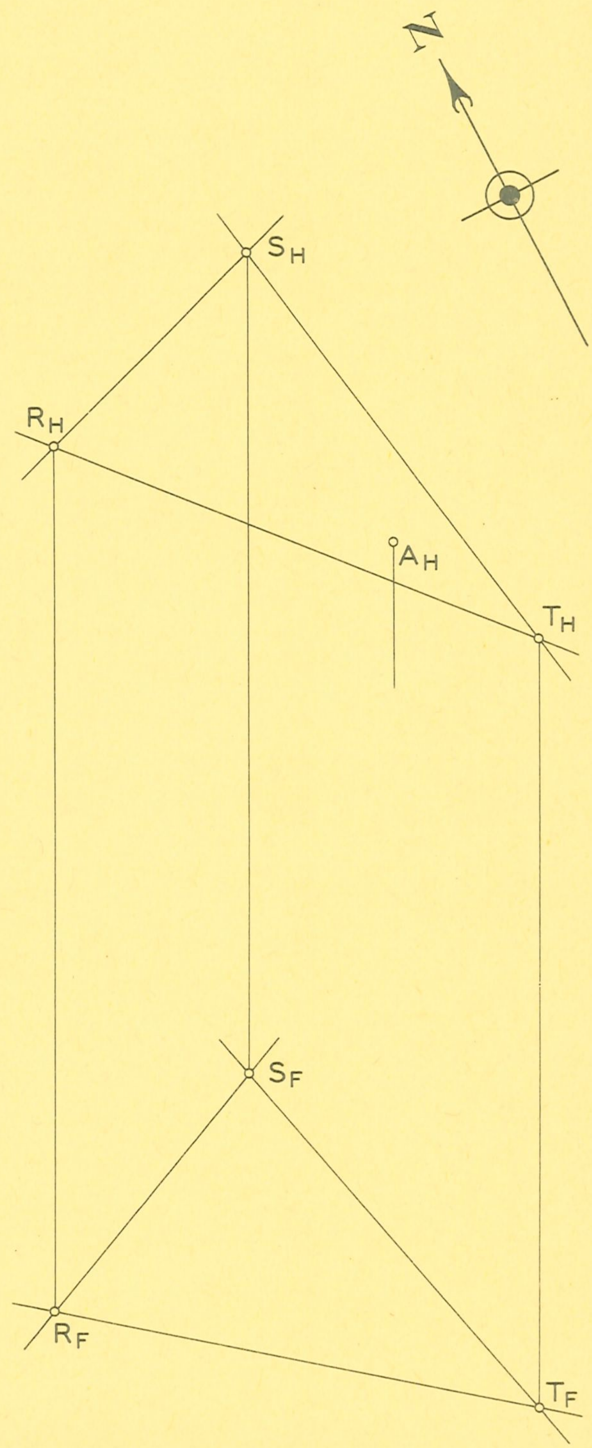
JK is the axis of a 3" x 4" timber brace cut to fit the surfaces shown. The 4" faces are vertical. Draw the front, top, face, edge, and end views of the brace. Measure its length and the angles for the cuts on the ends. Use nominal sizes. Scale: 1½" = 1'-0".



D

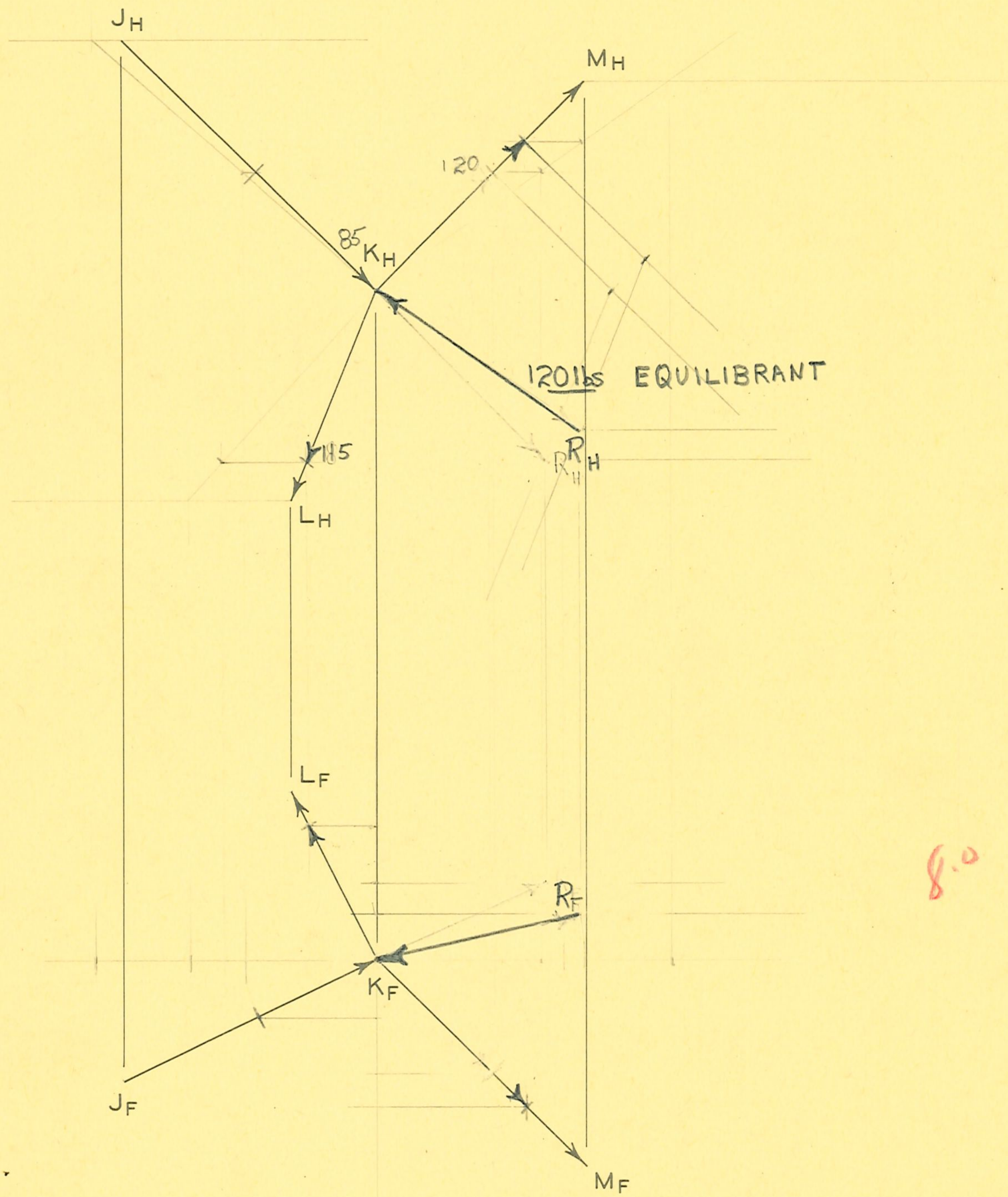
10-3	ENGINEERING DESCRIPTIVE GEOMETRY	NAME	DESK-SECTION

R, S, and T are points on the surface of an embankment which may be considered a plane. A is the lower end of a joint of irrigation pipe 20 ft. long lying on the embankment and extending upward in a northwesterly direction. Draw the front and top views of the pipe and give its bearing if it has a grade of 25%. Neglect the diameter of the pipe. Scale: 1″ = 10 ft.



D

The following forces act on point K: 85 lbs. in direction JK, 110 lbs. in direction KL, and 120 lbs. in direction KM. Find the magnitude and direction of the equilibrant. Force Scale: 1" = 80 lbs.



8.0

D

10-5	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT (NAME)	90 (DESK-SECTION)

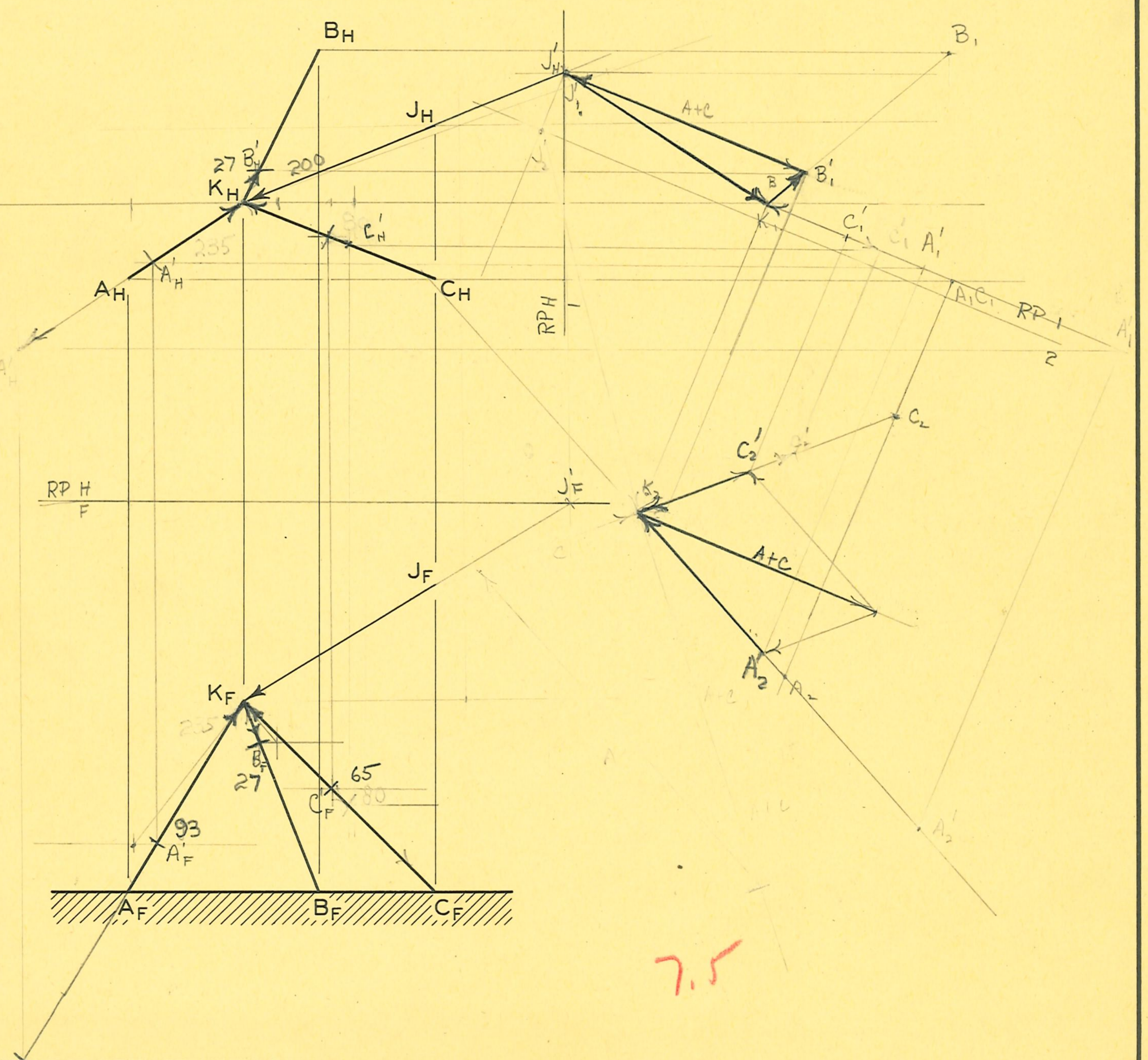
KA, KB, and KC are three members of a structure fastened to a horizontal surface at A, B, and C. Find the magnitude and direction of the force in each member if a force of 200 pounds is applied at K in the direction JK. Force Scale: 1″ = 80 lbs.

MAGNITUDES

$\overrightarrow{AK}$ = 93 LBS.

$\overrightarrow{KB}$ = 27 LBS.

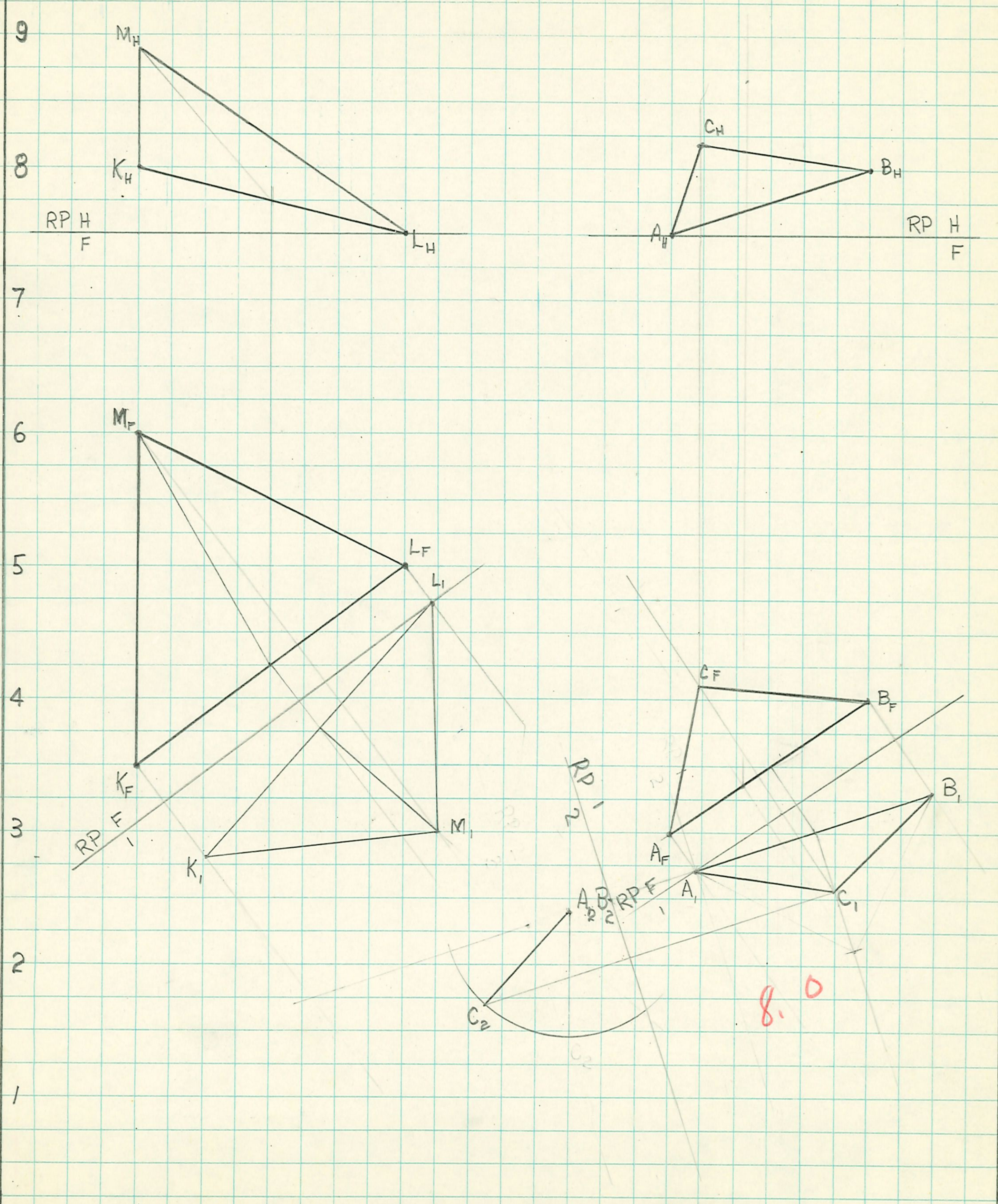
$\overrightarrow{CK}$ = 65 LBS.



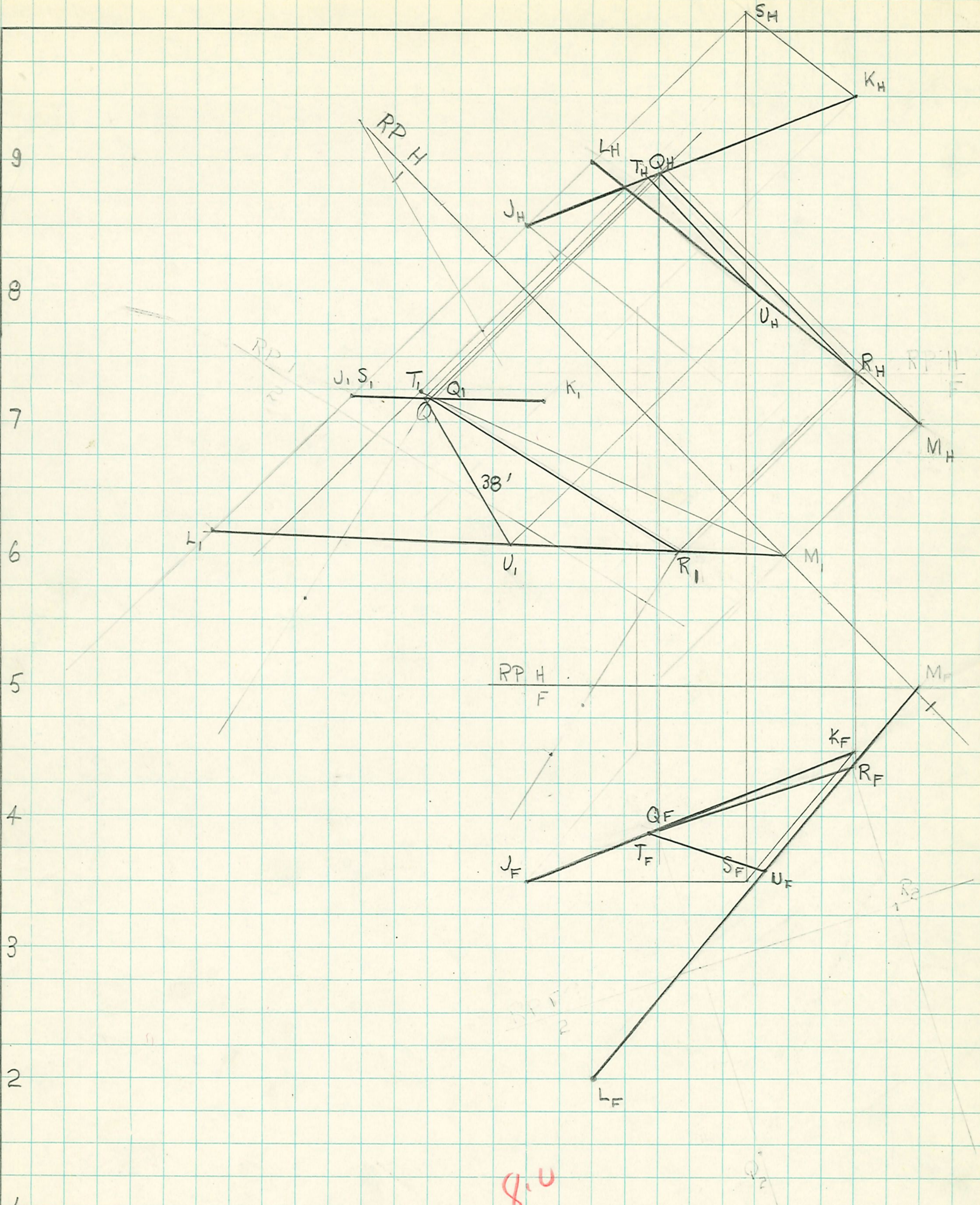
7.5

D

10-6	ENGINEERING DESCRIPTIVE GEOMETRY	STEVEN F. BELLENOT NAME	90 DESK-SECTION

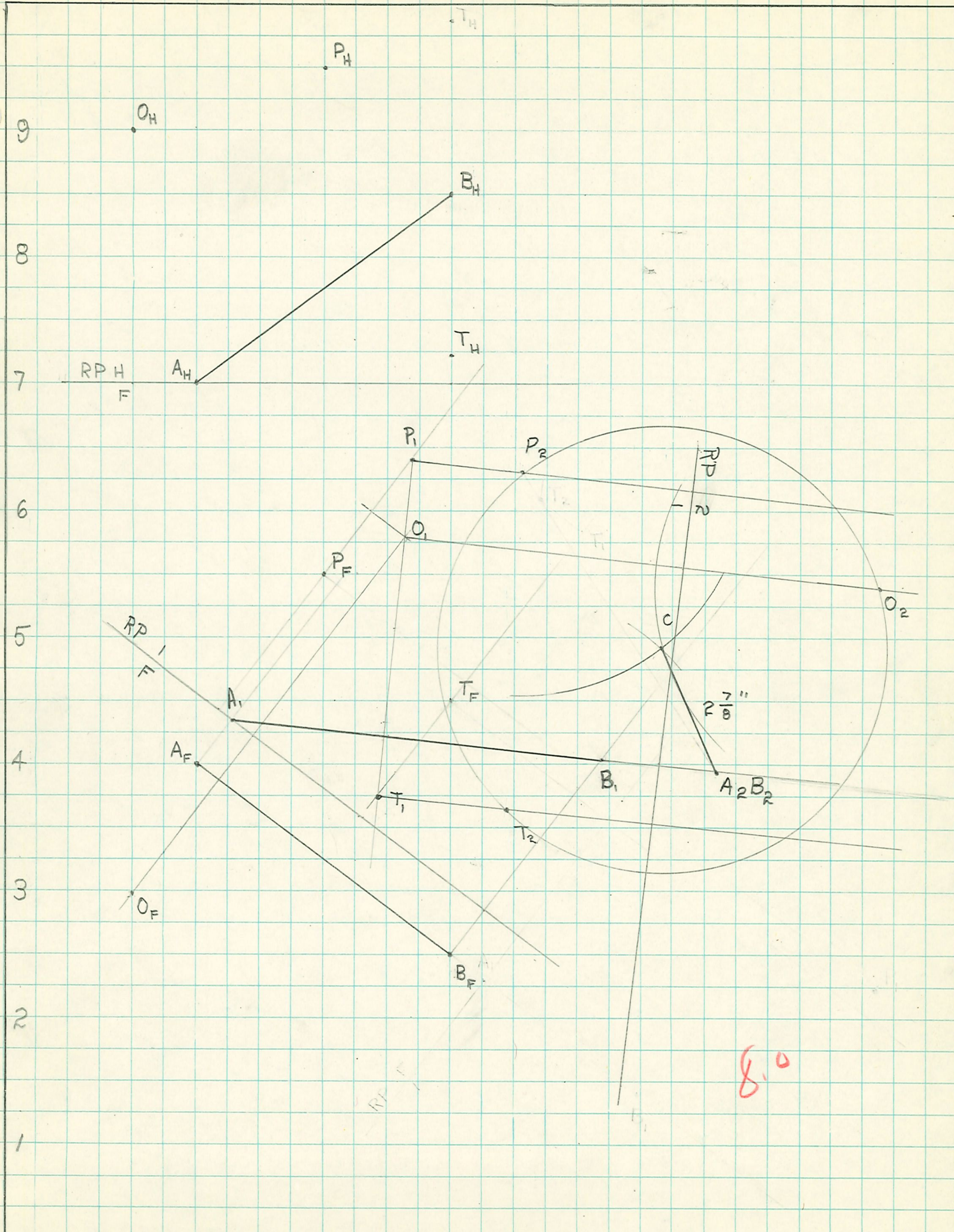


15.2.5	STEVEN F. BELLENOT	90

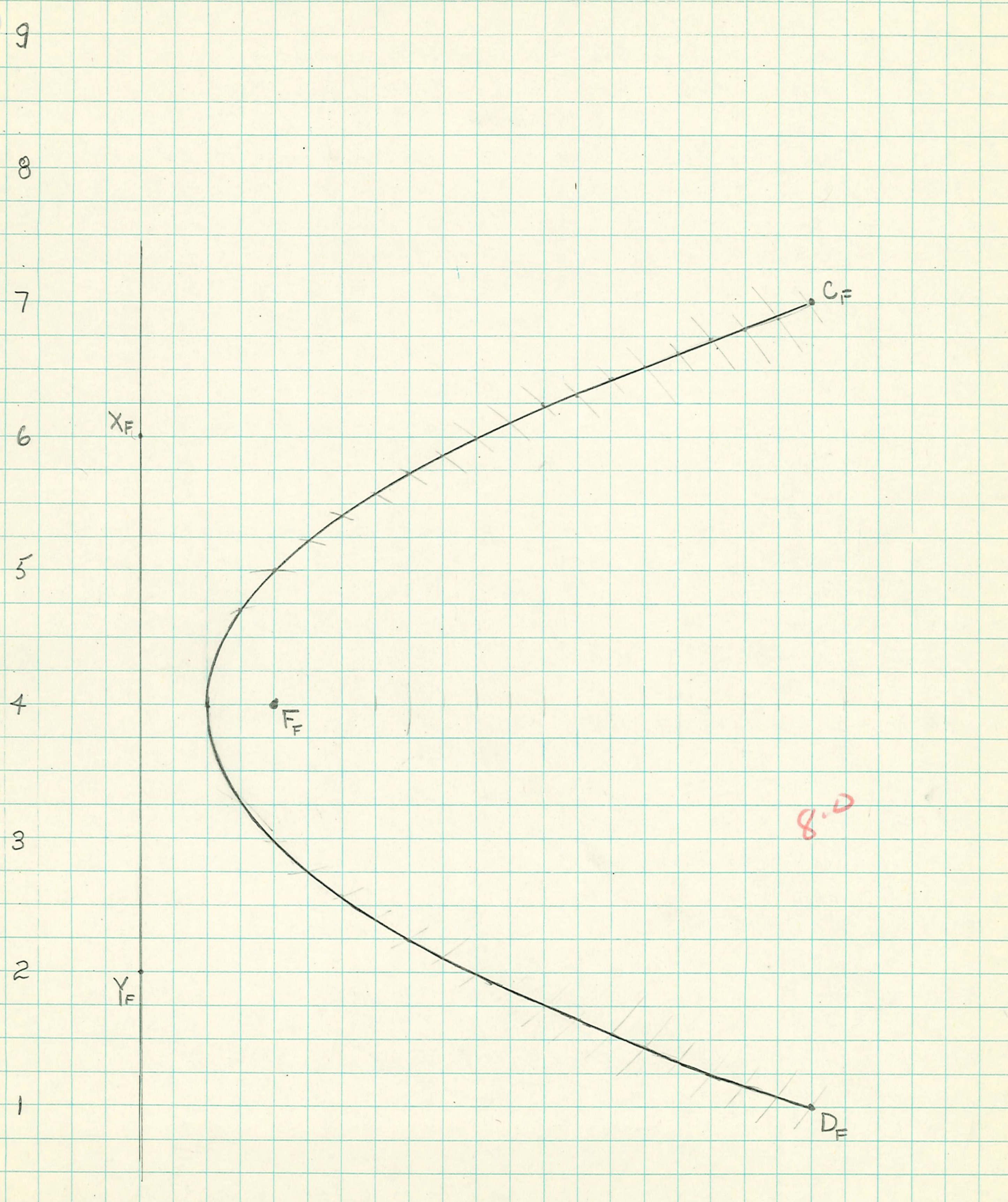


8.0

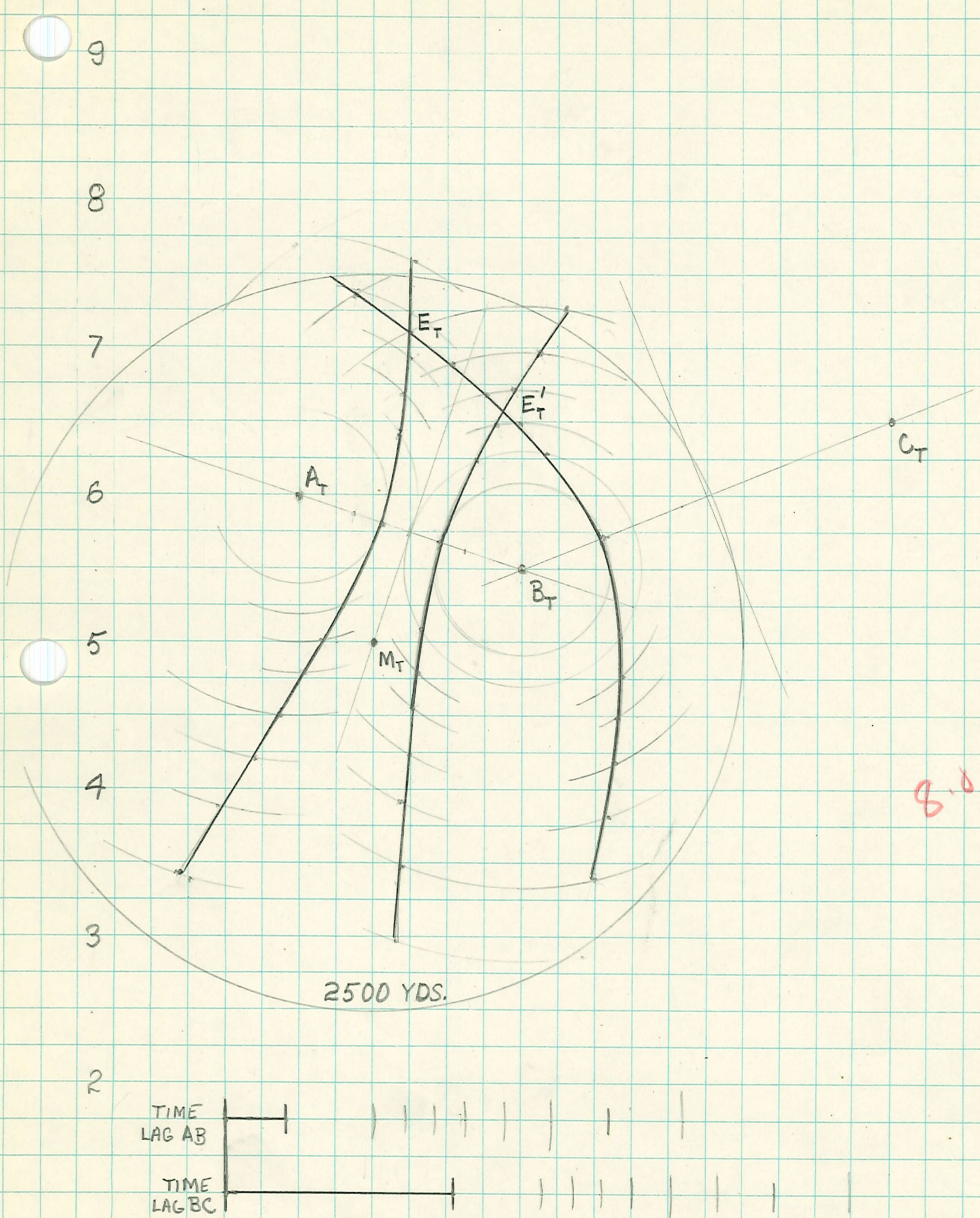
15.3.5	STEVEN F. BELLENOT	90



15.5.3 | STEVEN F BELLENOT | 90

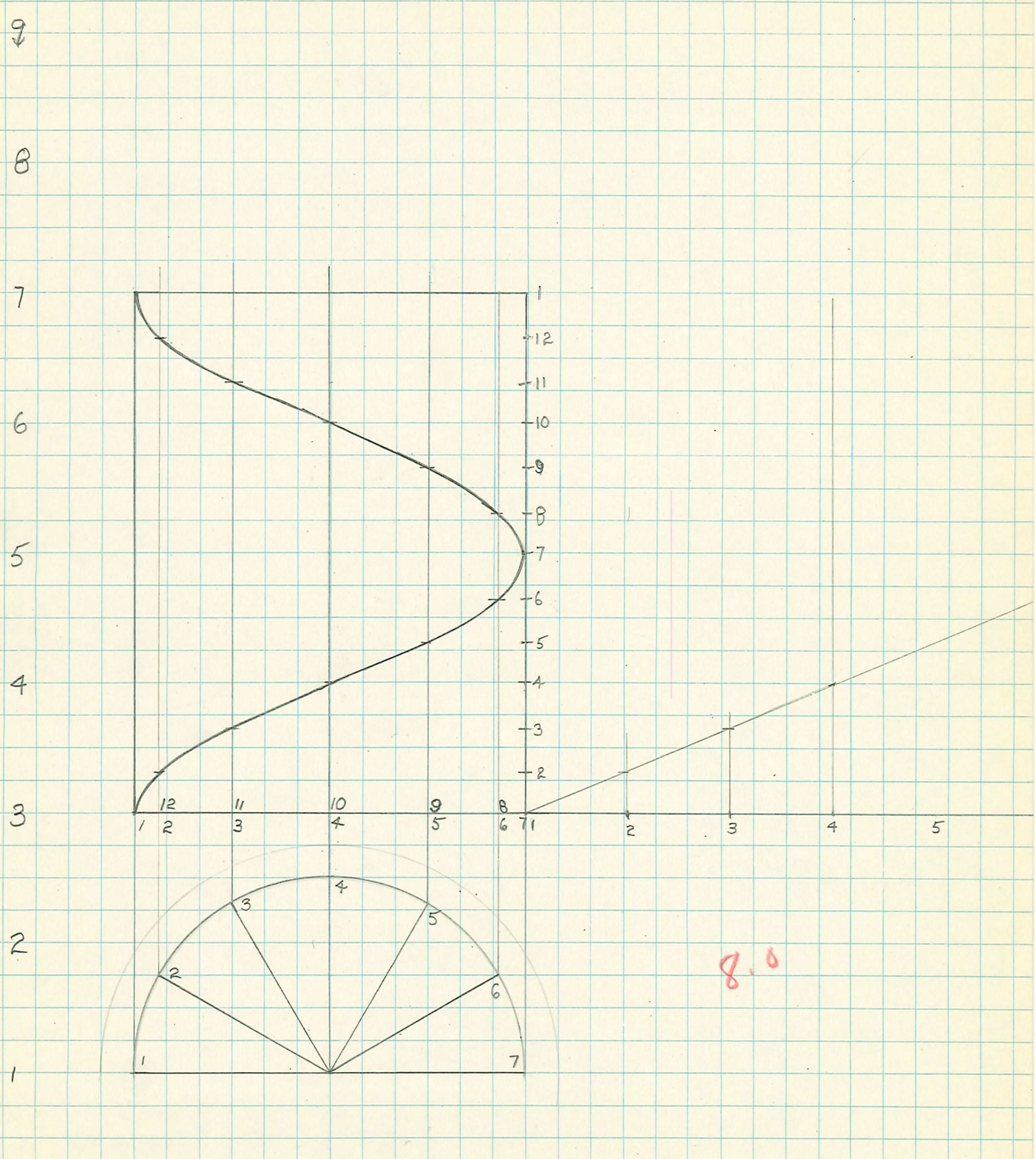


16.5.1	STEVEN F. BELLENOT	90

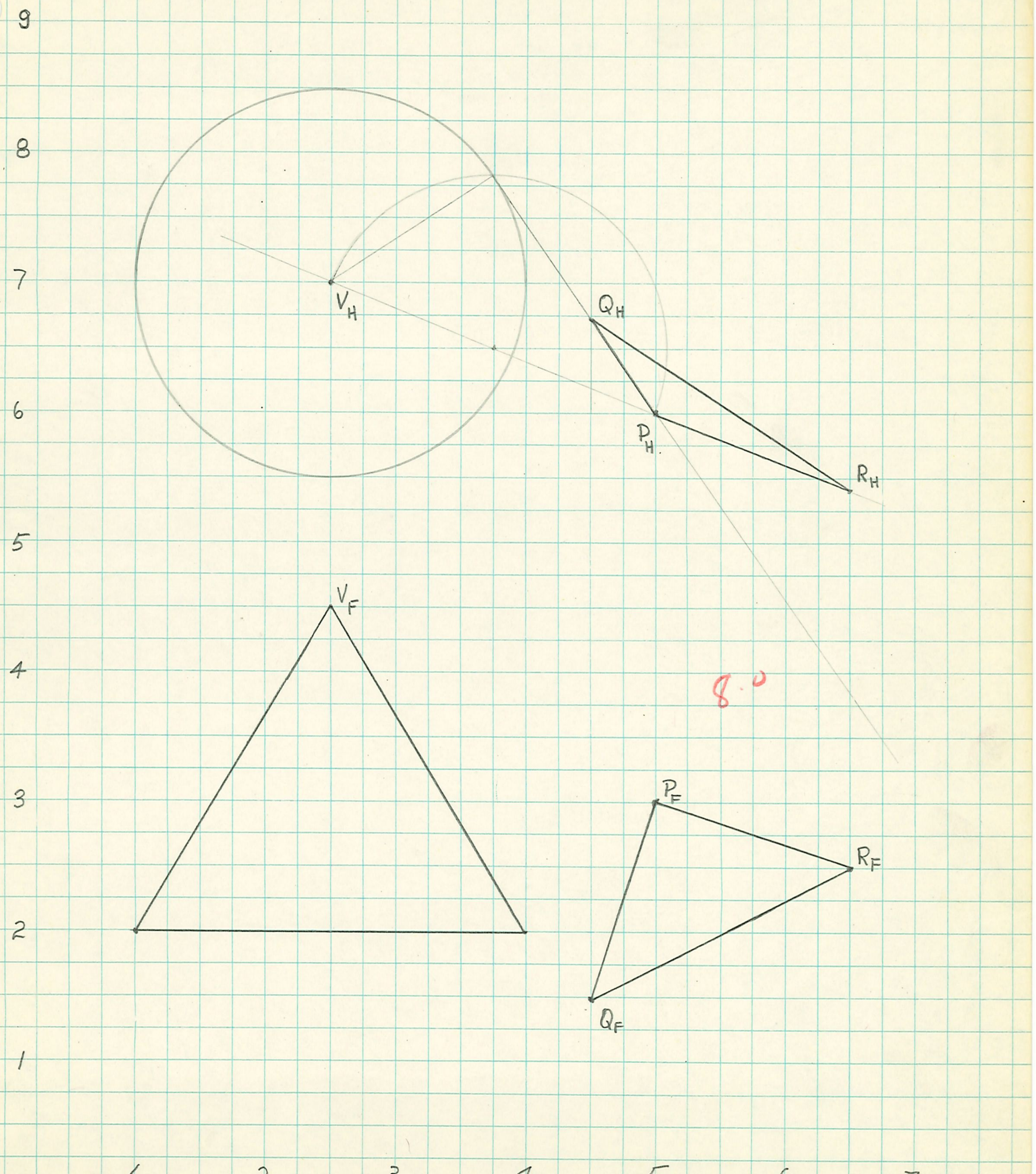


ENEMY POSITIONS ARE AT E AND E'

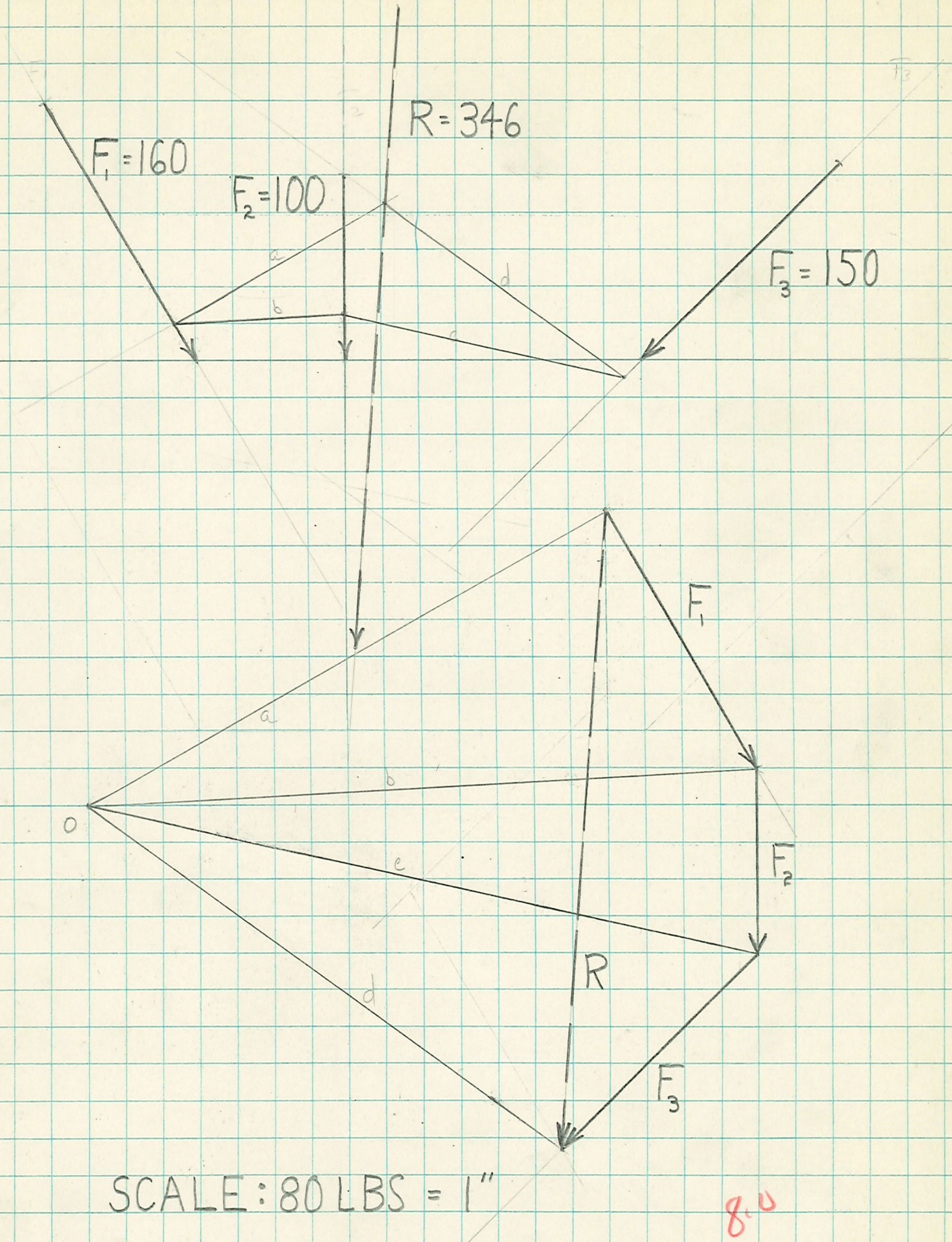
16.6.4	STEVEN F. BELLENOT	90



16.7.1	STEVEN F. BELLENOT	90



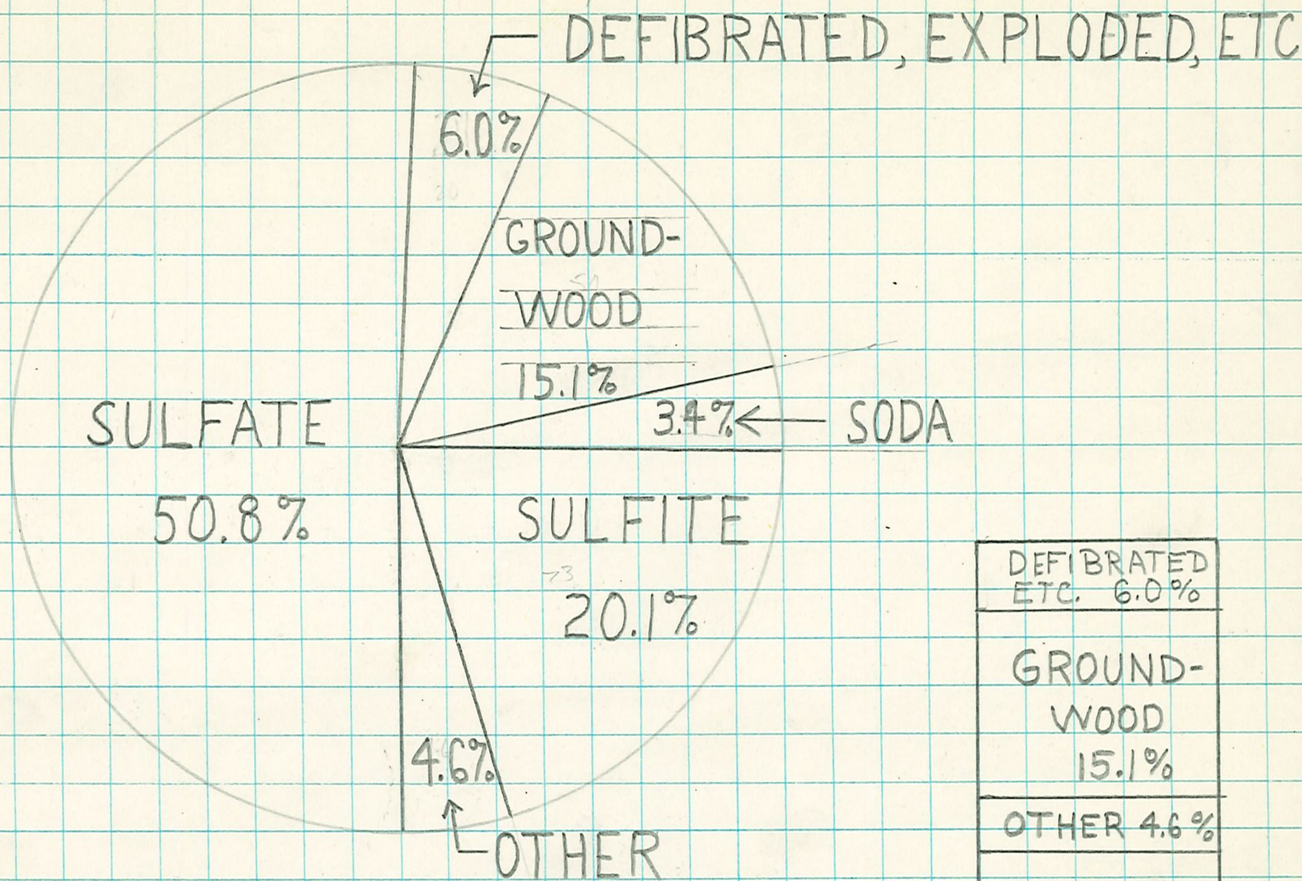
172.5	STEVEN F. BELLENOT	90



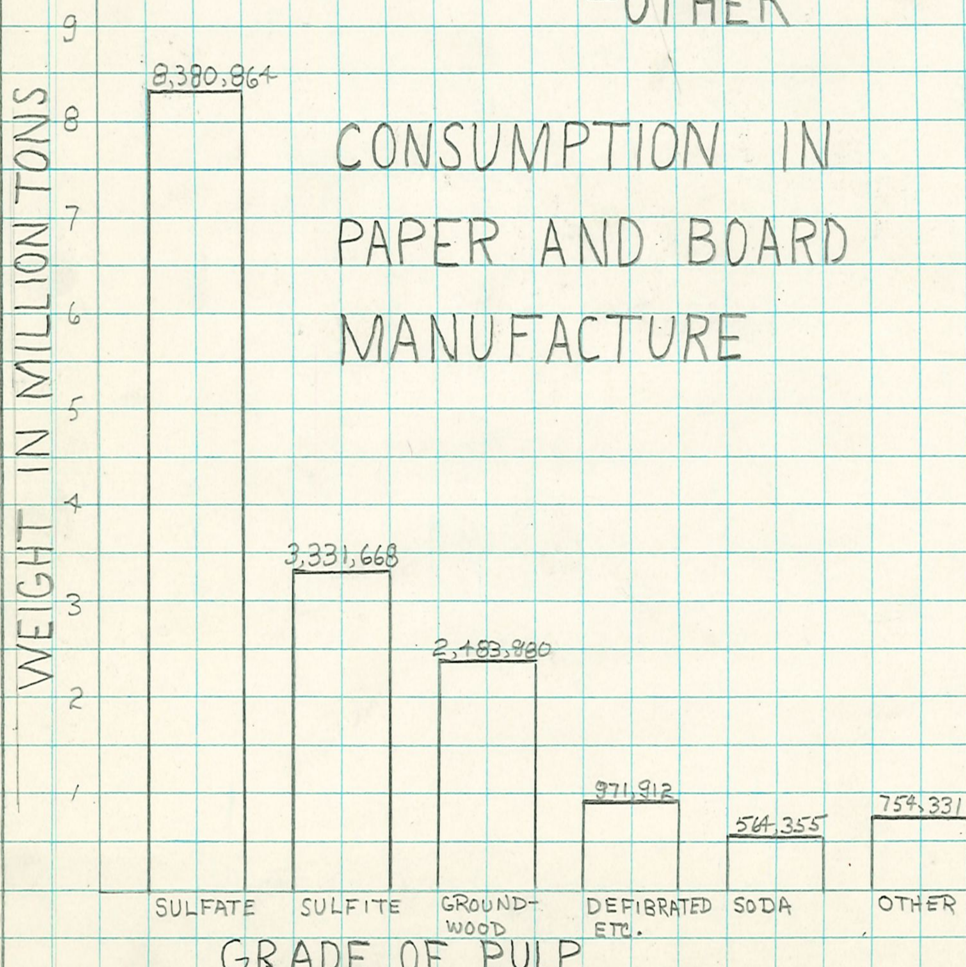
SCALE : 80 LBS = 1"

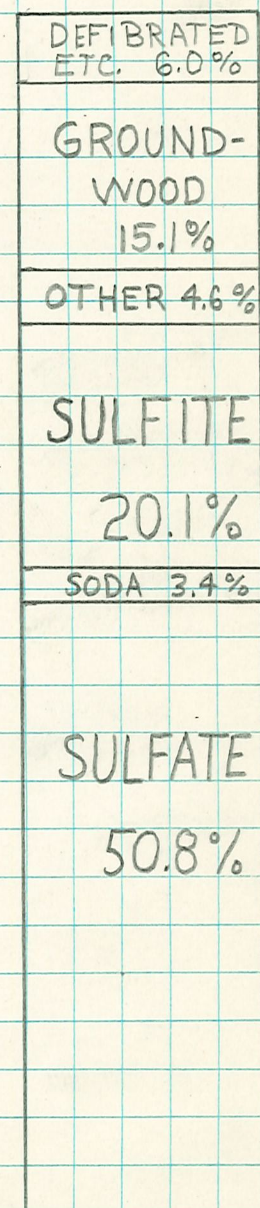
8.0

19.1.7	STEVEN F. BELLENOT	90



CONSUMPTION IN PAPER AND BOARD MANUFACTURE

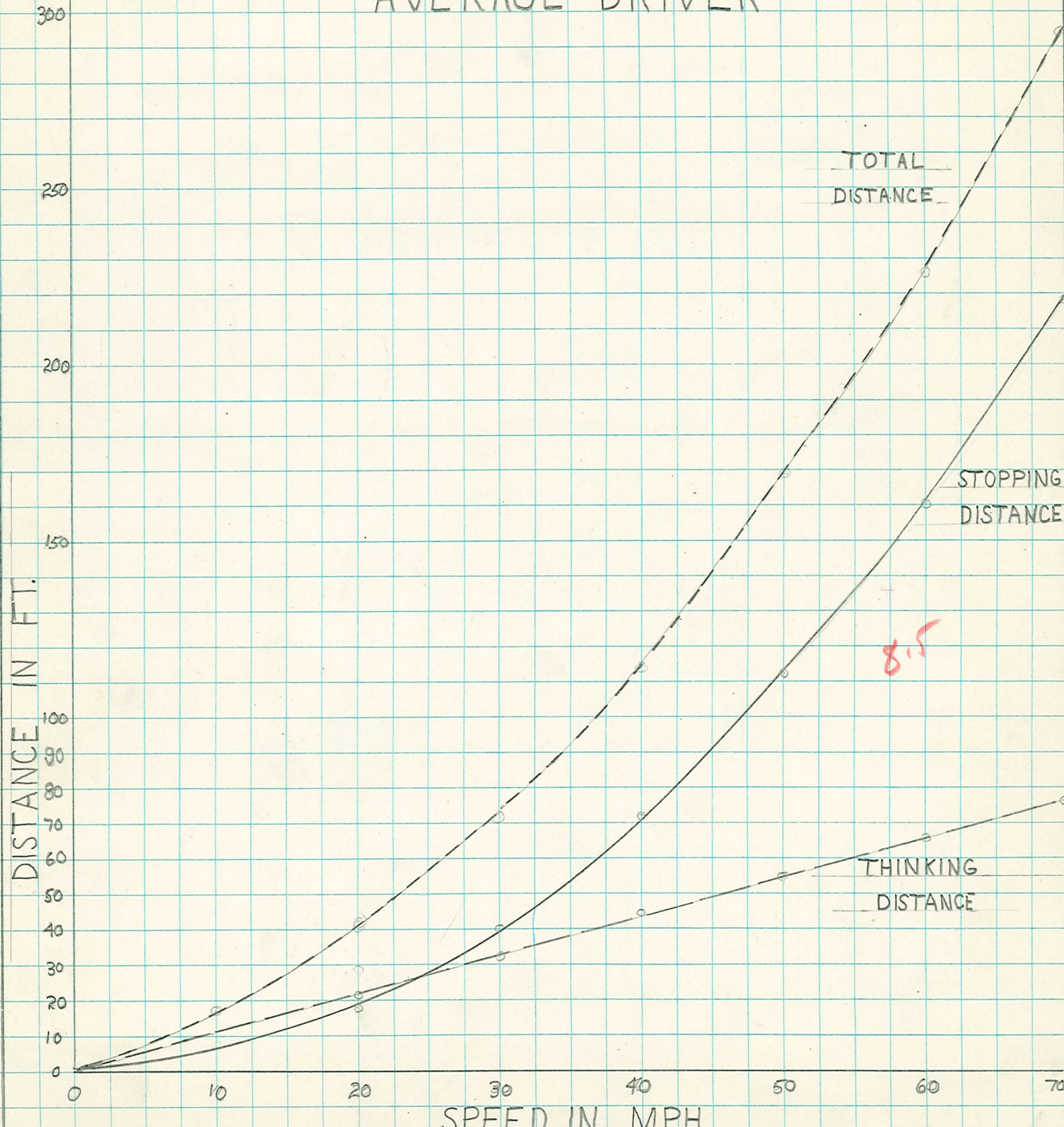




8.0

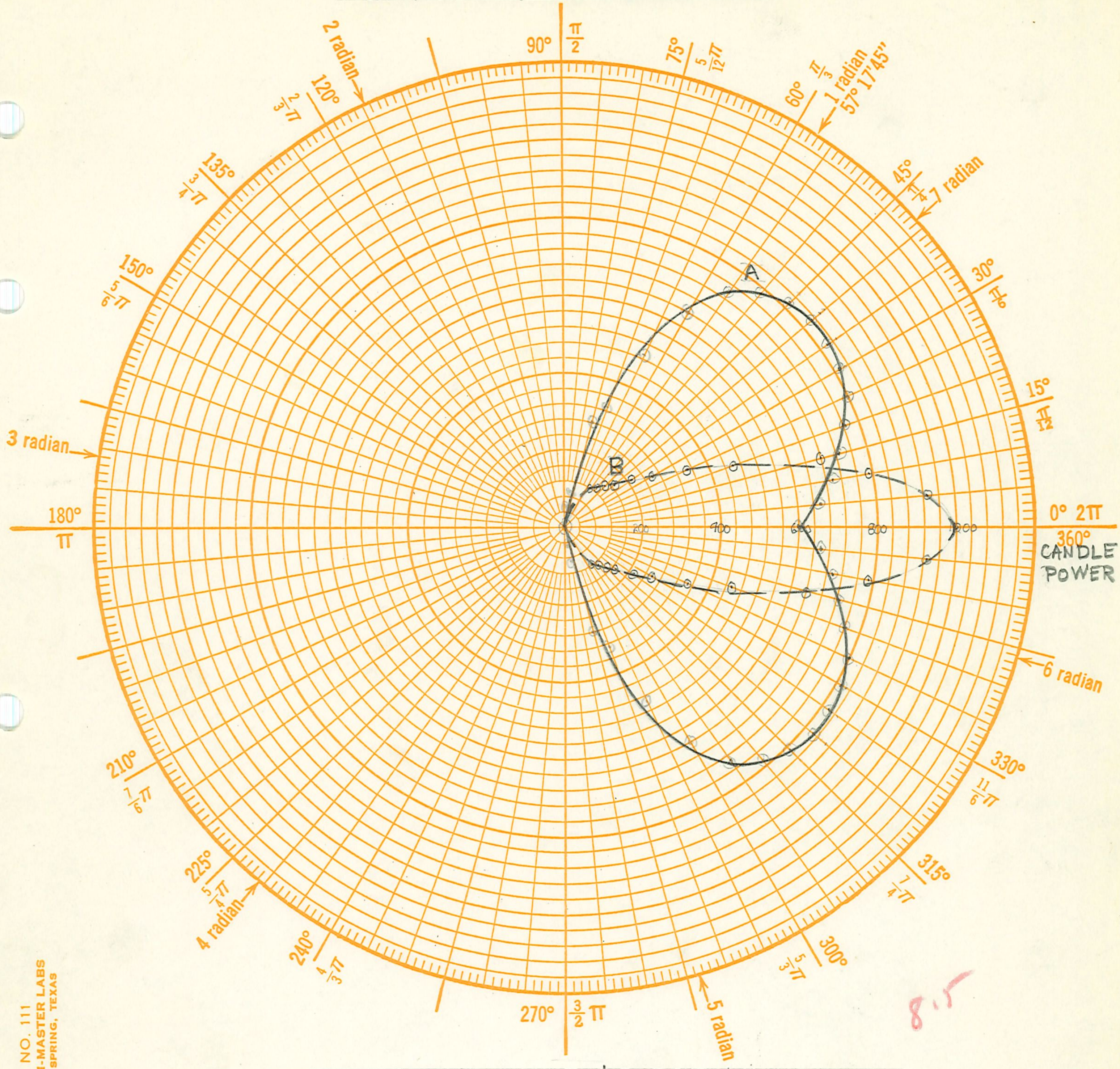
20.1.5	STEVEN F. BELLENOT	90

AUTOMOBILE MINIMUM TRAVEL DISTANCES WHEN STOPPING AVERAGE DRIVER



20.1.9	STEVEN F. BELLENOT	90

LAMPS & REFLECTORS



8.5

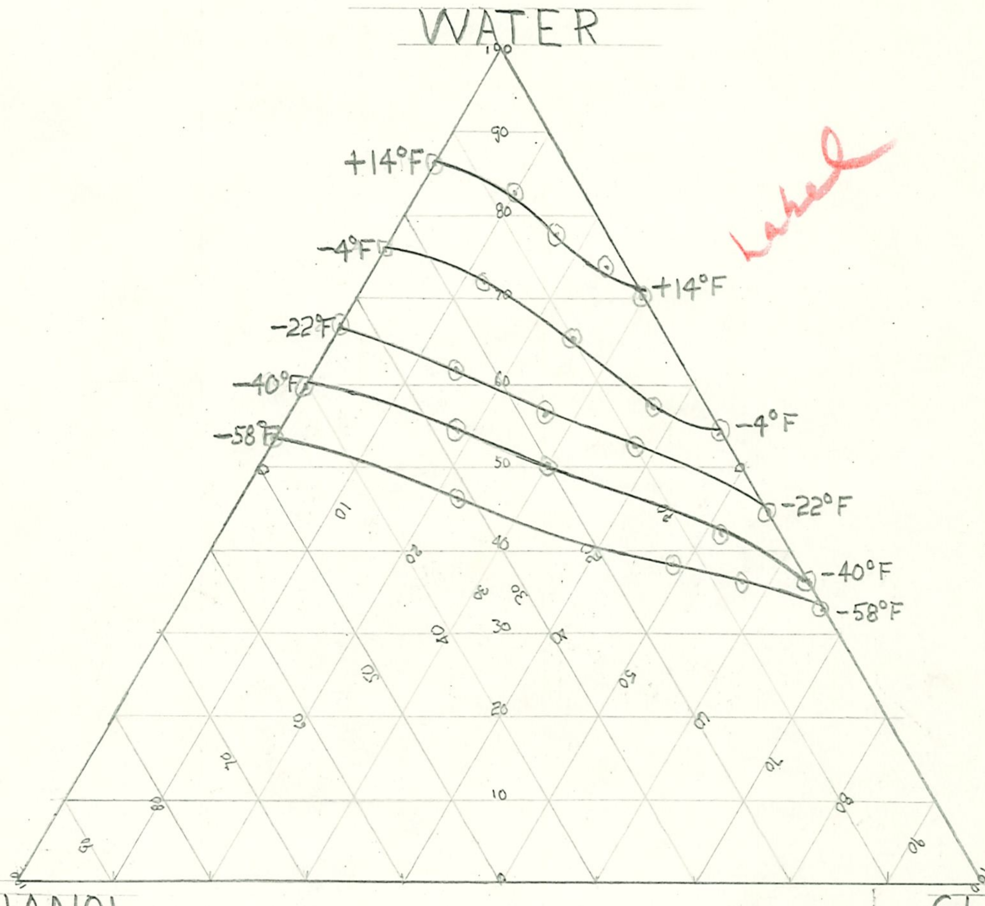
A: MAZDA LAMP & PORCELAIN
ENAMELED REFLECTOR
B: TYPE S-1 SUN LAMP

θ	nθ	r	θ	nθ	r	θ	nθ	r	θ	nθ	r	θ	nθ	r

20.1.11	STEVEN F. BELLENOT	90

NO. 111
MATH-MASTER LABS
BIG SPRING, TEXAS

FREEZING POINTS OF SOLUTIONS OF GLYCERAL AND METHANOL IN WATER



SCALES: PER CENT BY WEIGHT

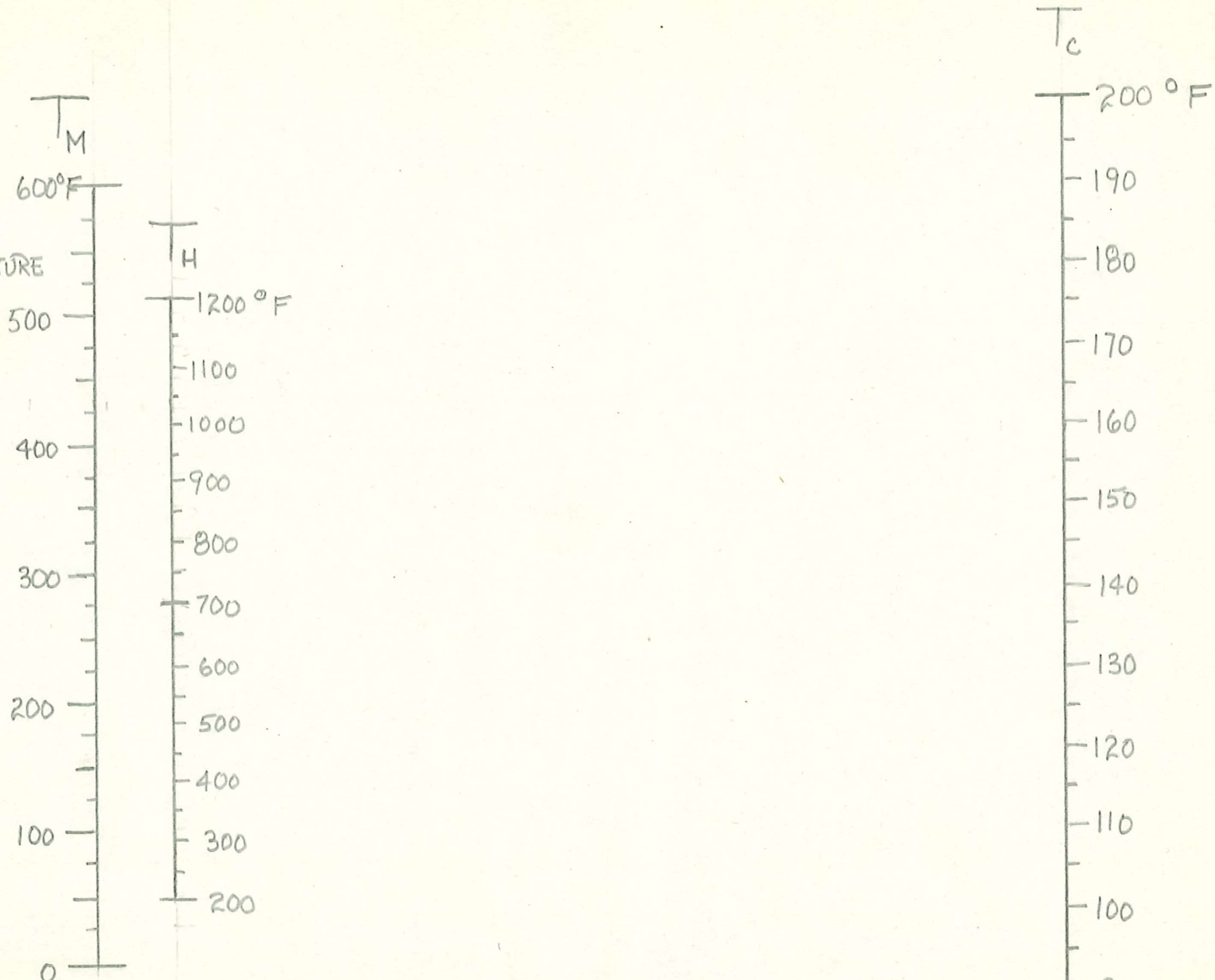
8.0

20.1.12	STEVEN F. BELLENOT	90

T_M = MEAN TEMPERATURE

T_H = TEMPERATURE, HOT SIDE

T_C = TEMPERATURE, COLD SIDE

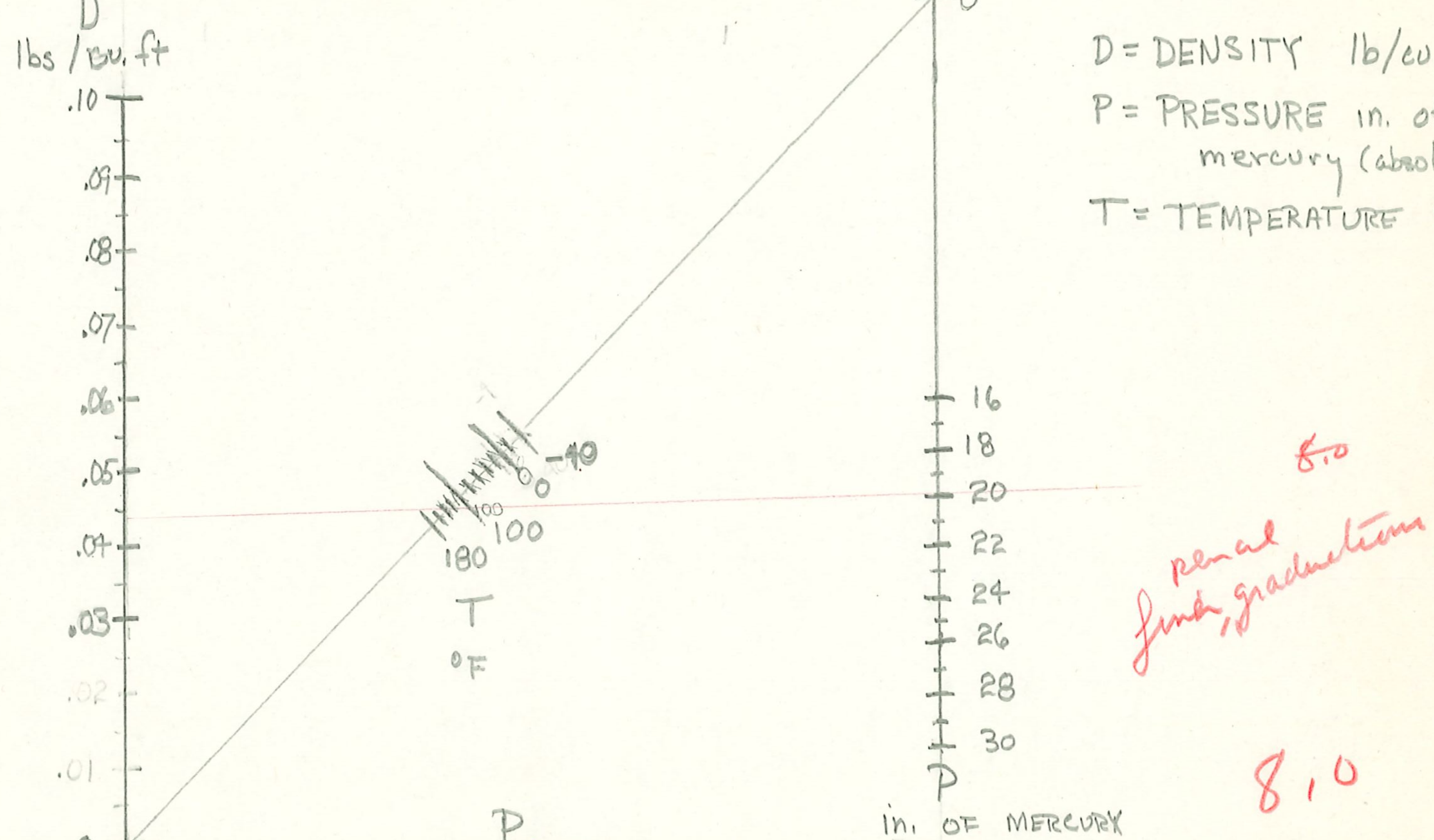


NOMOGRAPH FOR

$$T_M = \frac{T_H - T_C}{2}$$

8.5

21.3.8 STEVEN F. BELLENOT 90



D = DENSITY lb/cu. ft.

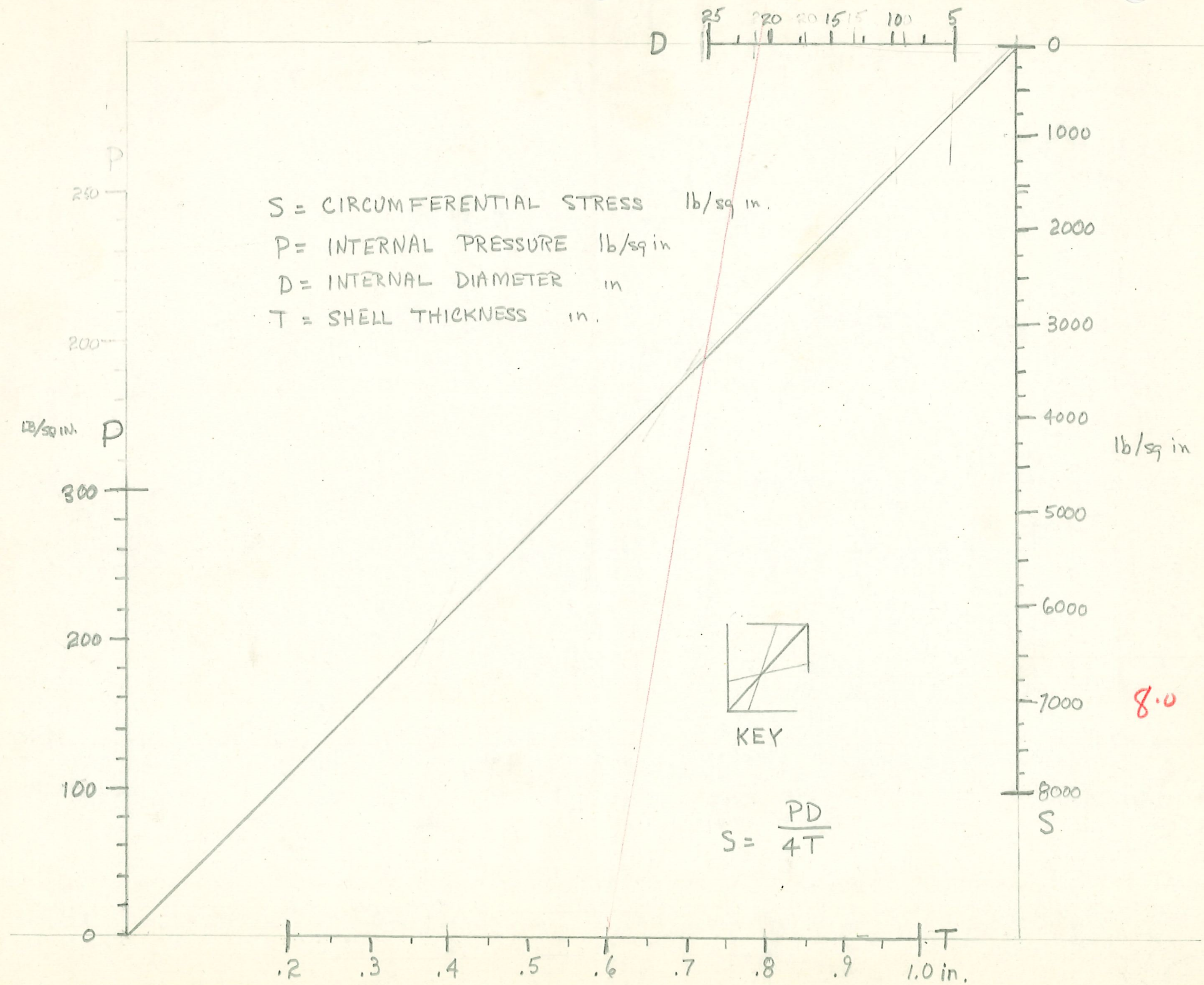
P = PRESSURE in. of mercury (absolute)

T = TEMPERATURE °F

$$D = \frac{P}{0.754(T+460)}$$

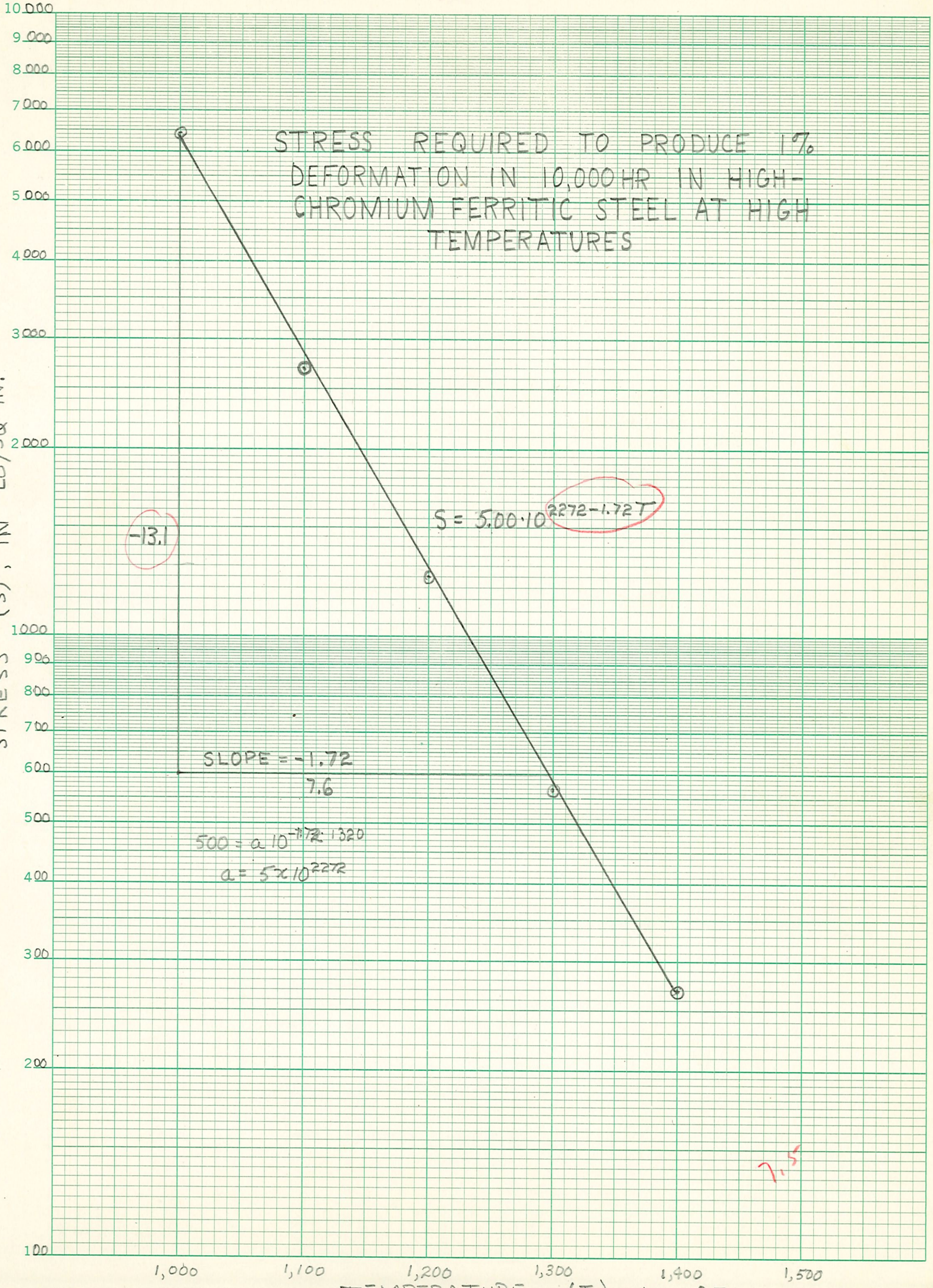
21.3.11 STEVEN F. BELLENOT 90

21, 4, 5 STEVEN F. BELLENOT 90



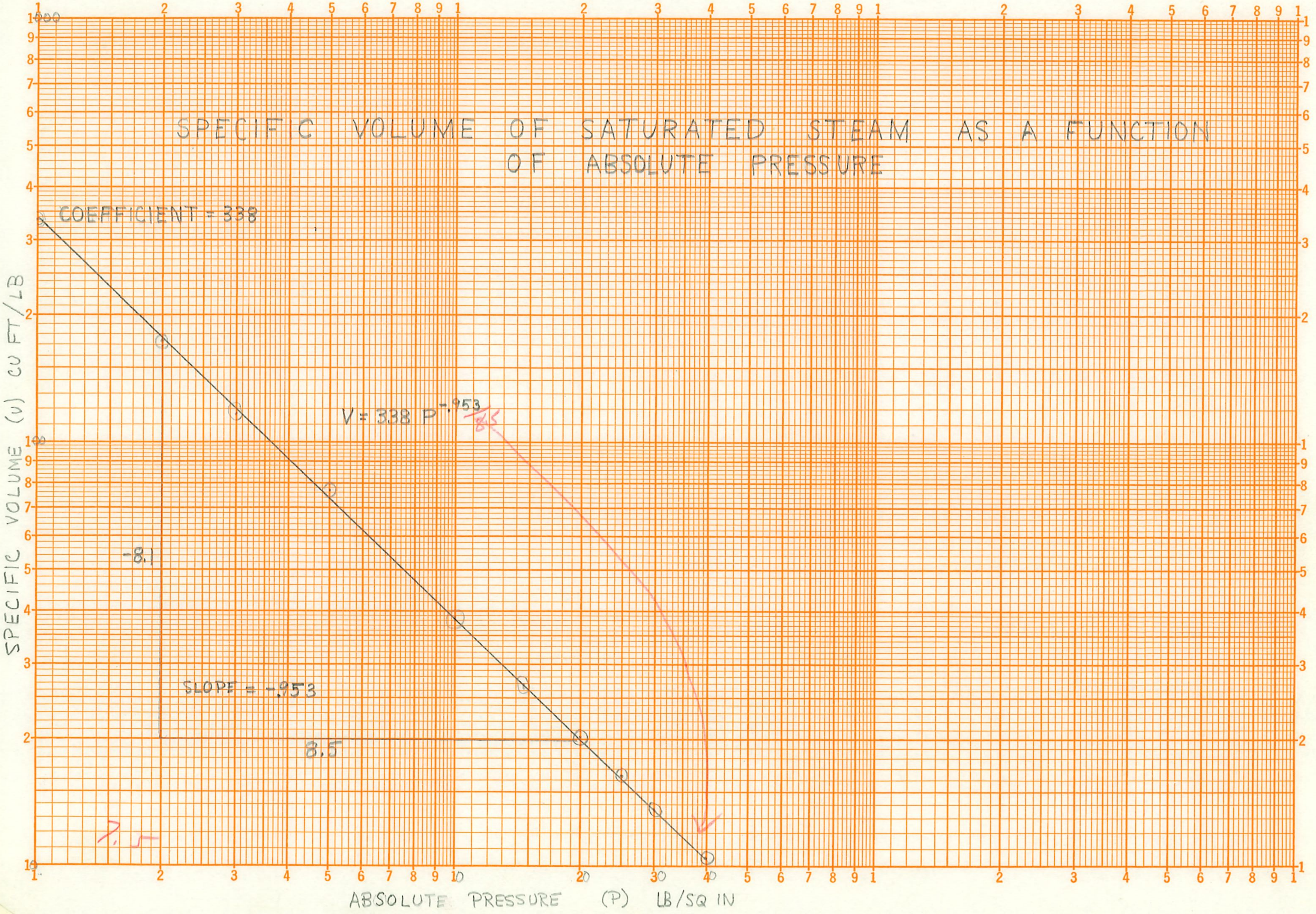
8.0

22.1.3 STEVEN F. BELLENOT 90



Semi-Logarithmic
2 Cycles x 10 to the inch
R 2470-SL-2
VERNON ROYAL LINE

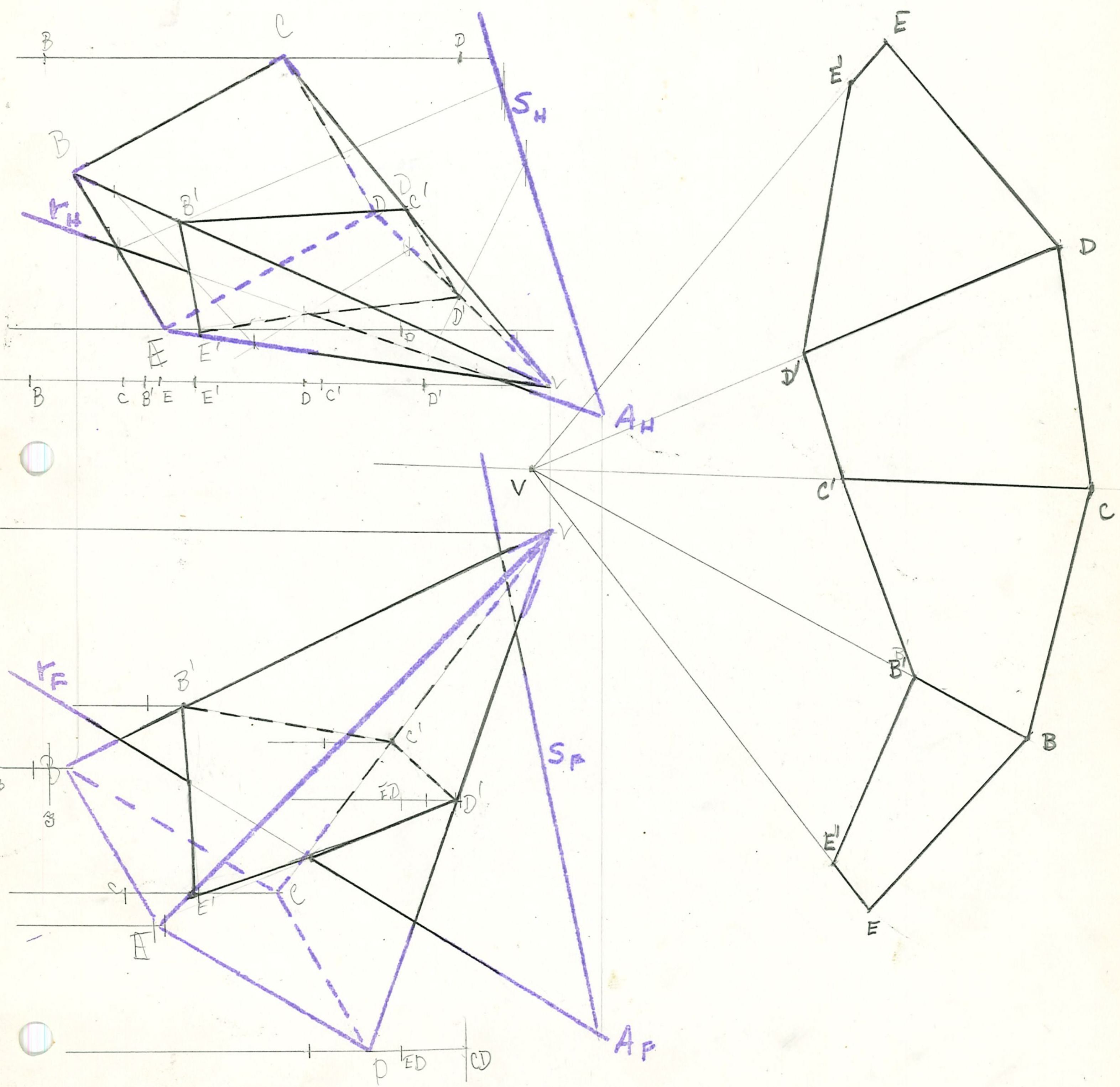
22.2.6 STEVEN F. BELLENOT 90 75



STEVEN F BELLENOT

Find the interaction of the plane with the pyramid in both the front and top views. Develop that portion of the pyramid below the plane.

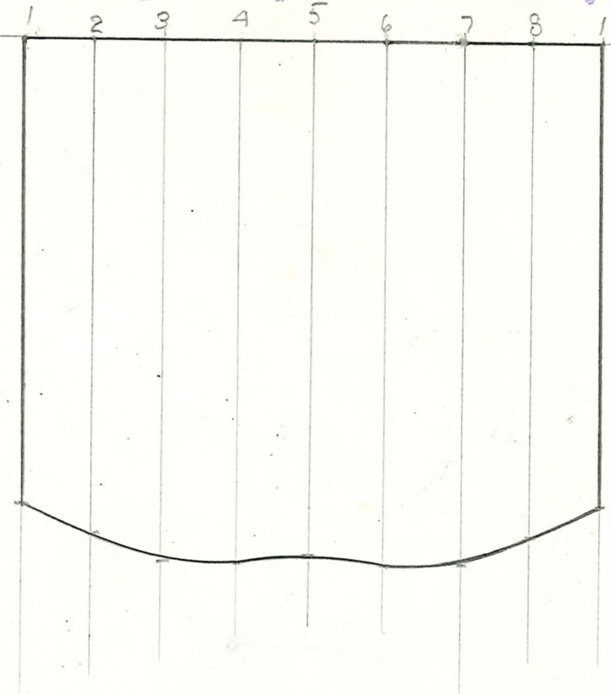
100

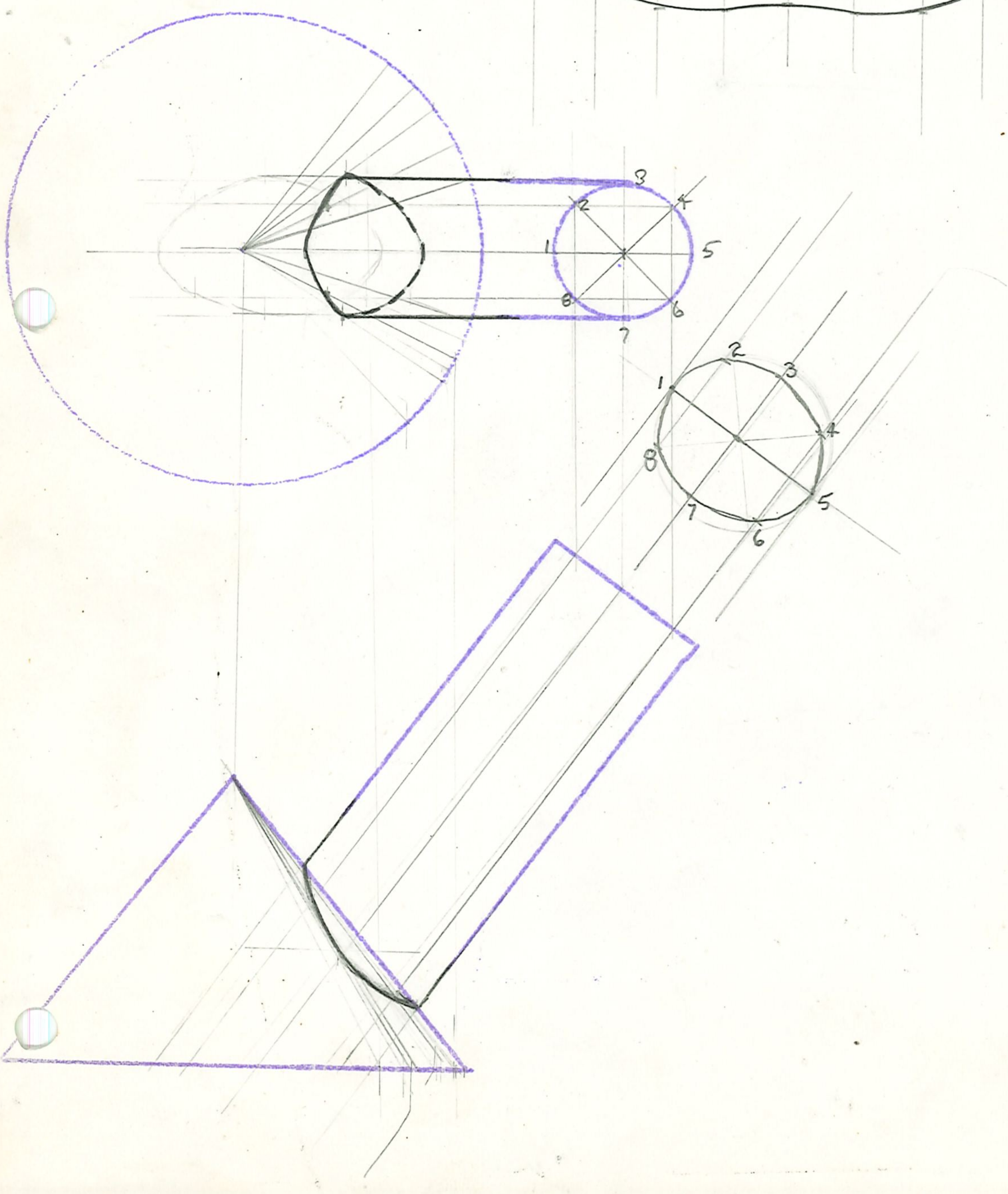


SHOWING VISIBILITY
AS IF AR & AS WERE LINES

STEVEN F BELLENOT

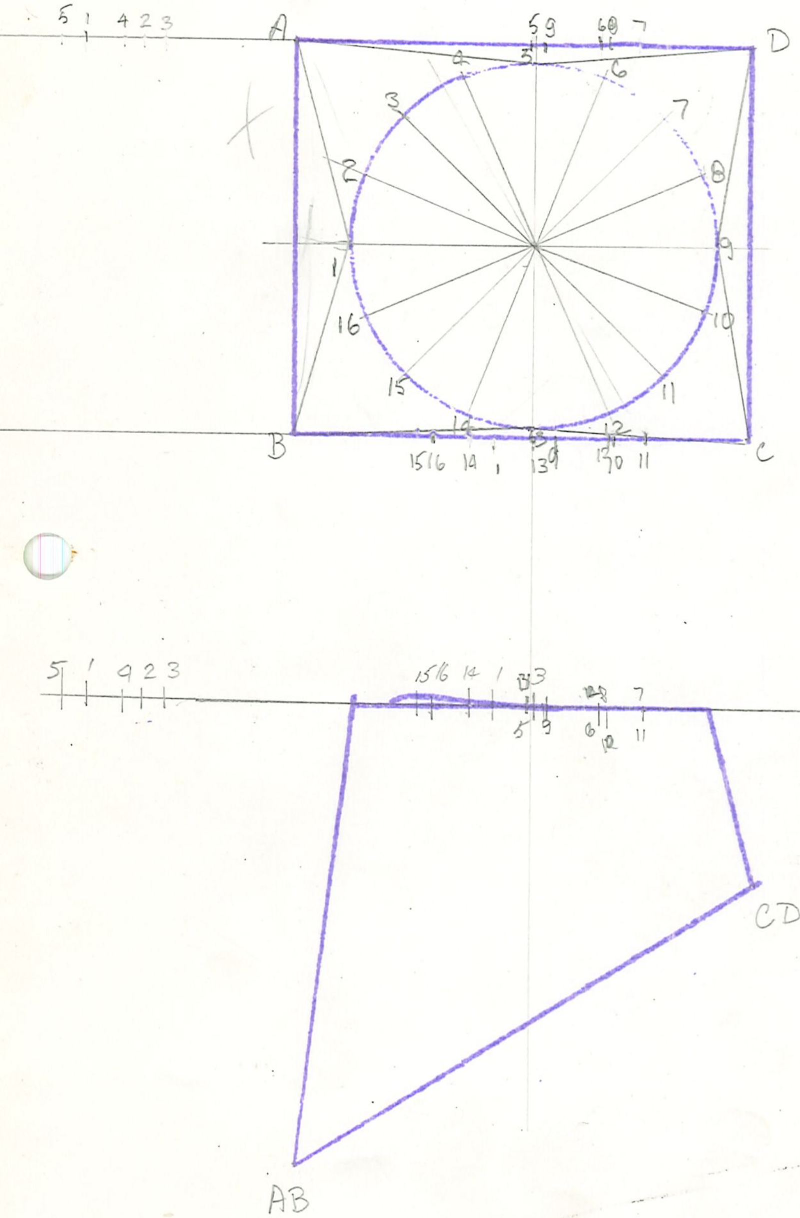
Show the intersection of the cone and cylinder below in both the front and top views. Develop that portion of the cylinder outside of the cone.

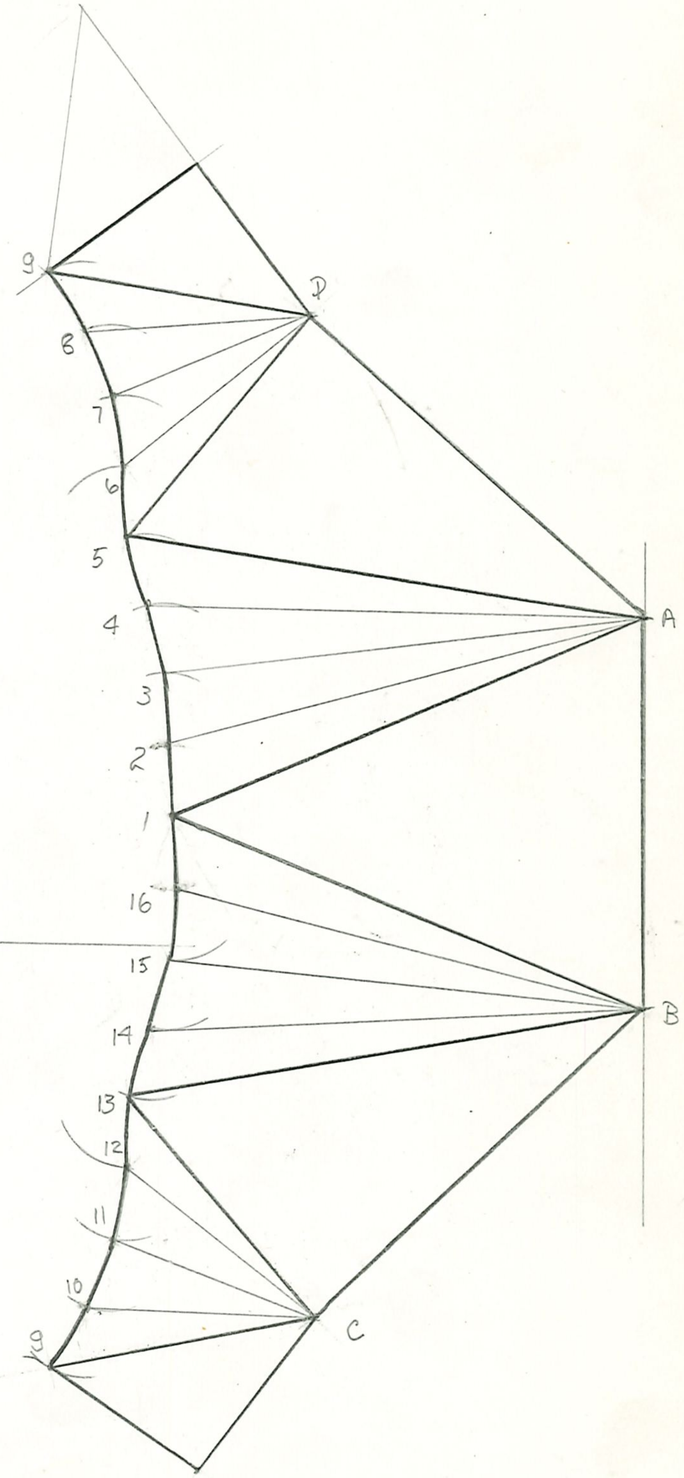




STEVEN F BELLENOT

Develop the transition piece shown below.



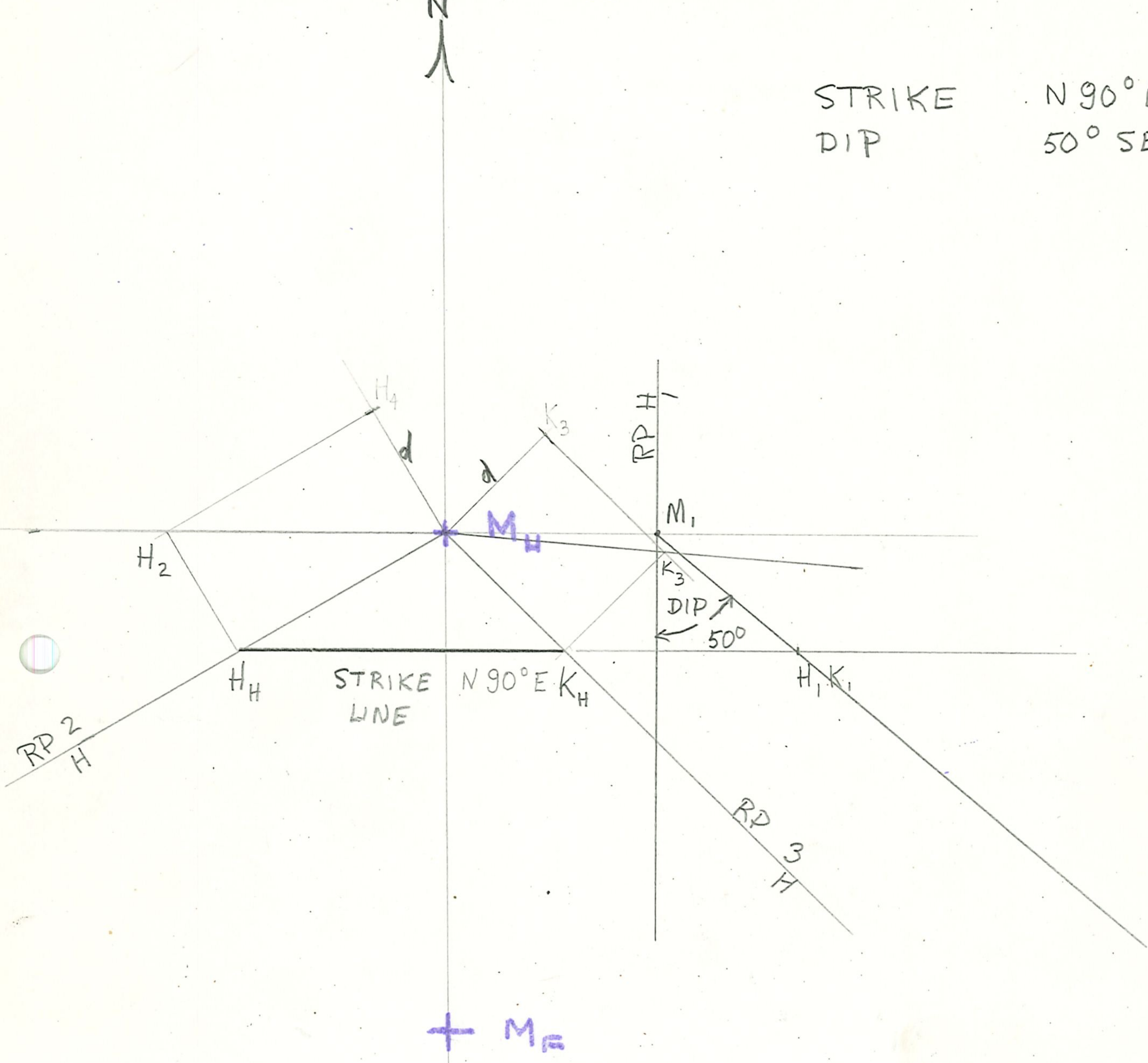


STEVEN F BELLENOT

Borings are made to détermine the position in the earth of the upper surfsce of an ore stratamx with the point "M" as a reference, The point "A" is S 60deg. W from "M" and indicates a dip of 30 deg. The point "B" is s 45deg. E from and indicatesa dip of 40 deg. What is the strike and dip of the upper surface of the ore vein?

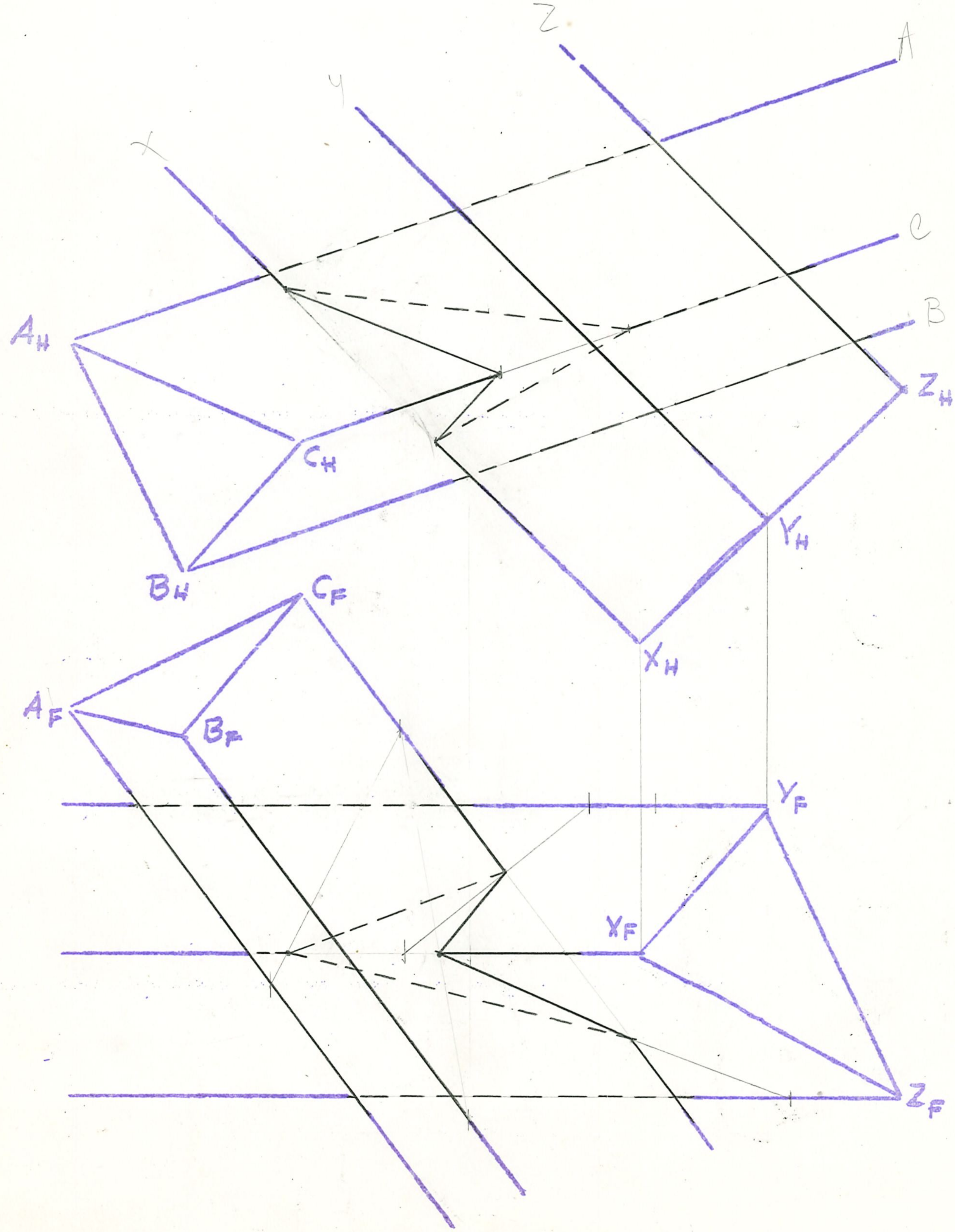
STRIKE N 90° E

DIP 50° SE



STEVEN F BELLENOT

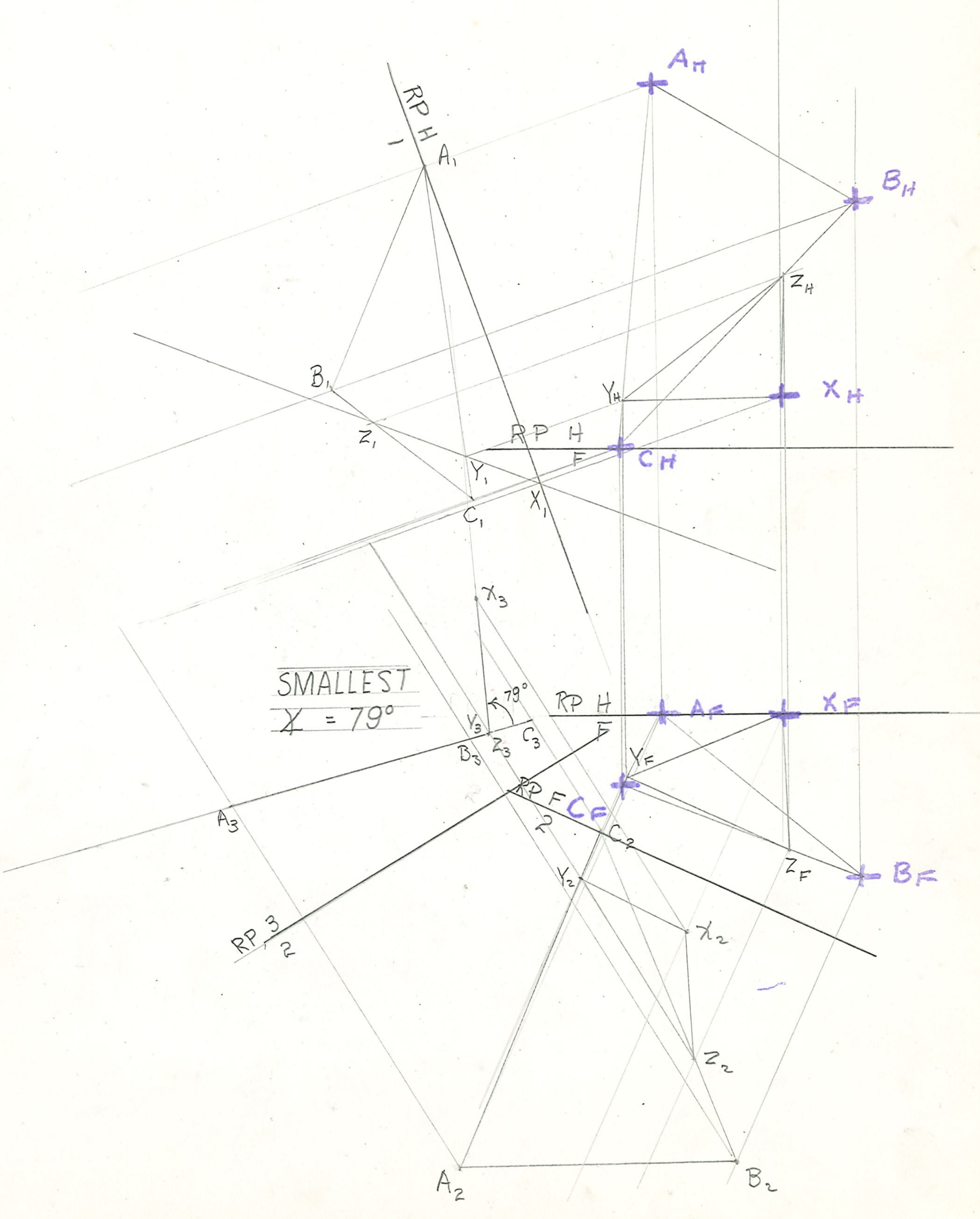
Find the intersection of the two prisms in both views. Assume a single casting in determining visibility.



STEVEN F. BELLENOT

1. Find the angle between the plane ABC and a plane through X with a strike of S 70 deg. W and a dip of 50 deg. to the NW.

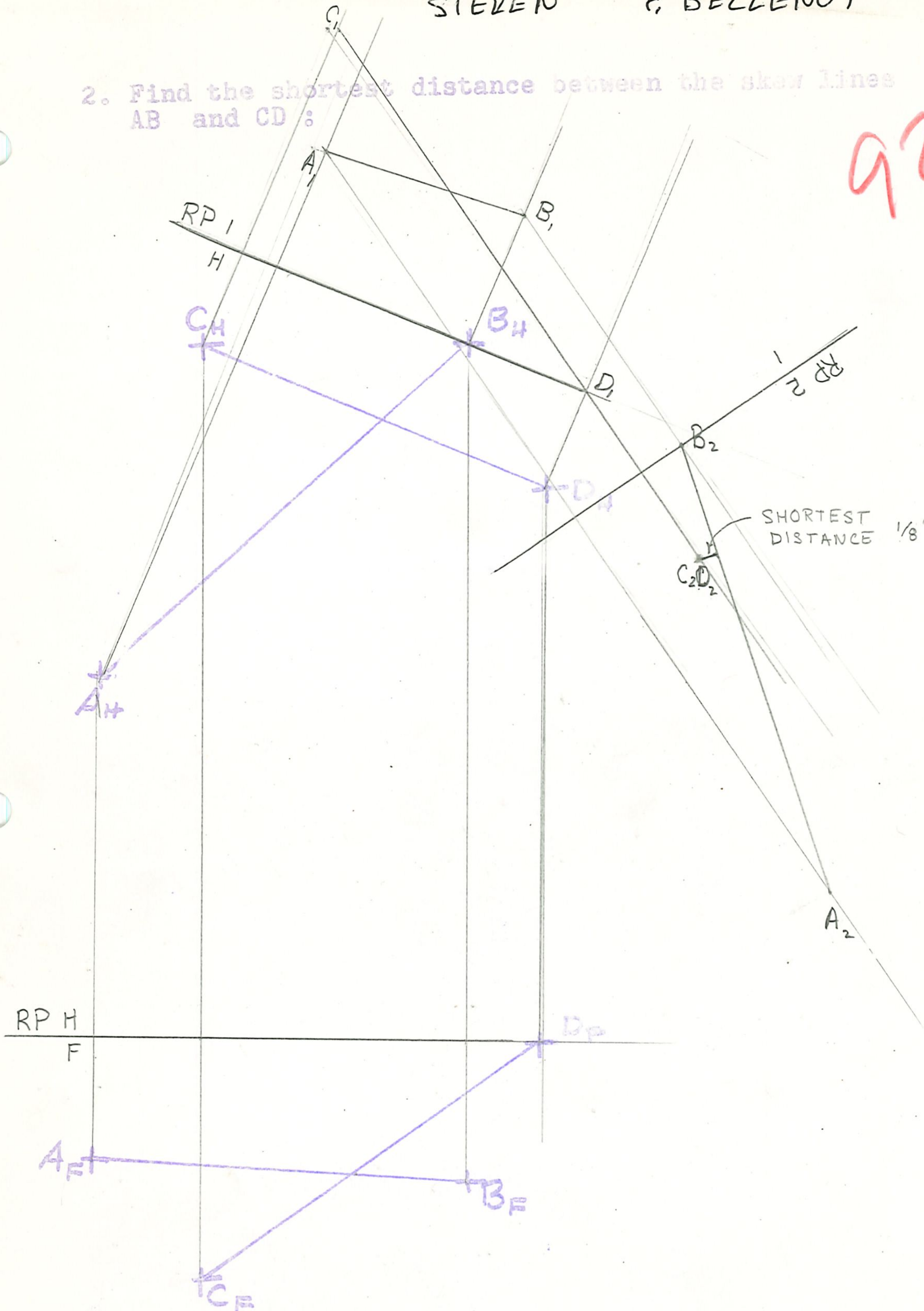
92



STEVEN F. BELLENOT

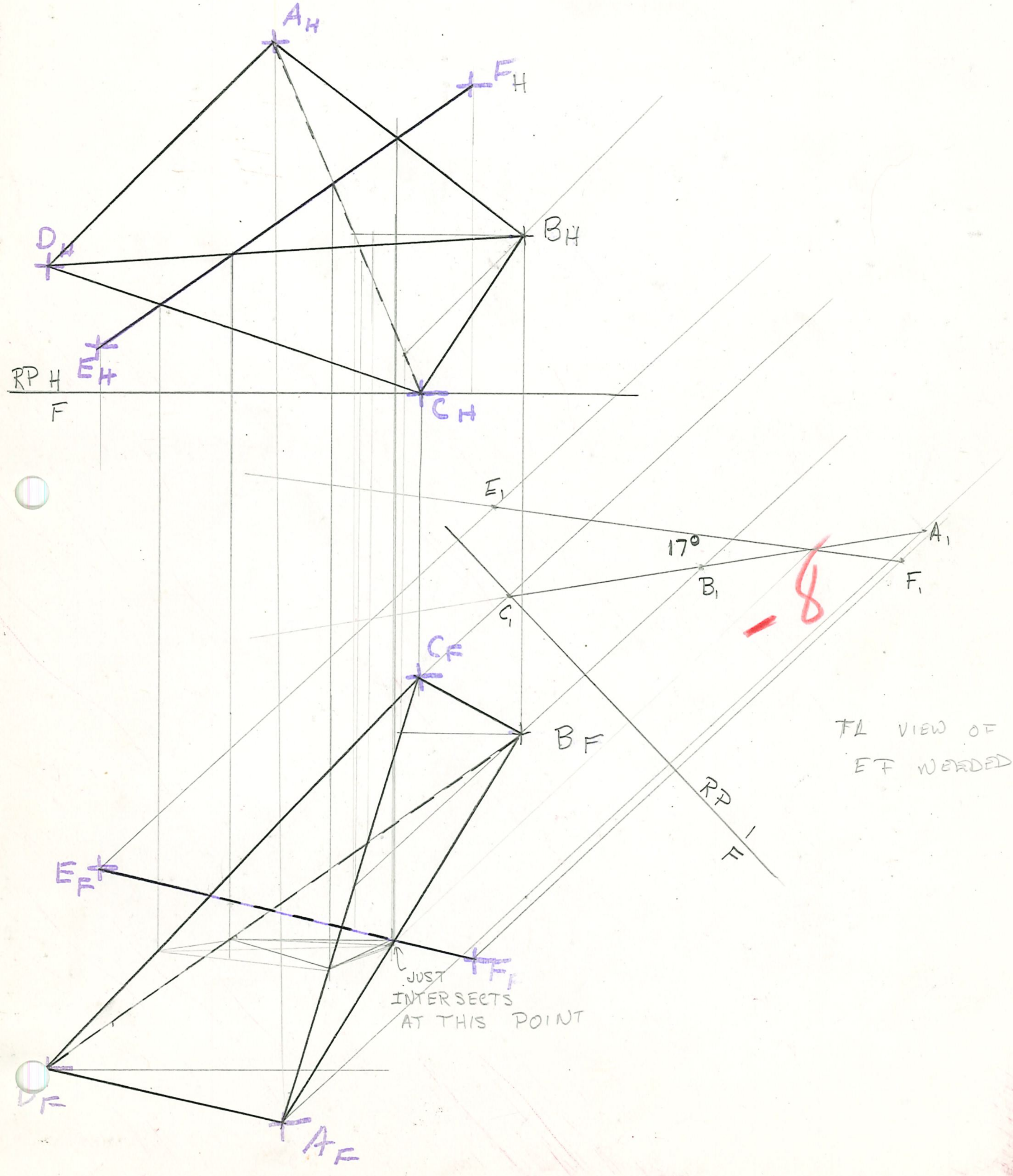
92

2. Find the shortest distance between the skew lines AB and CD:



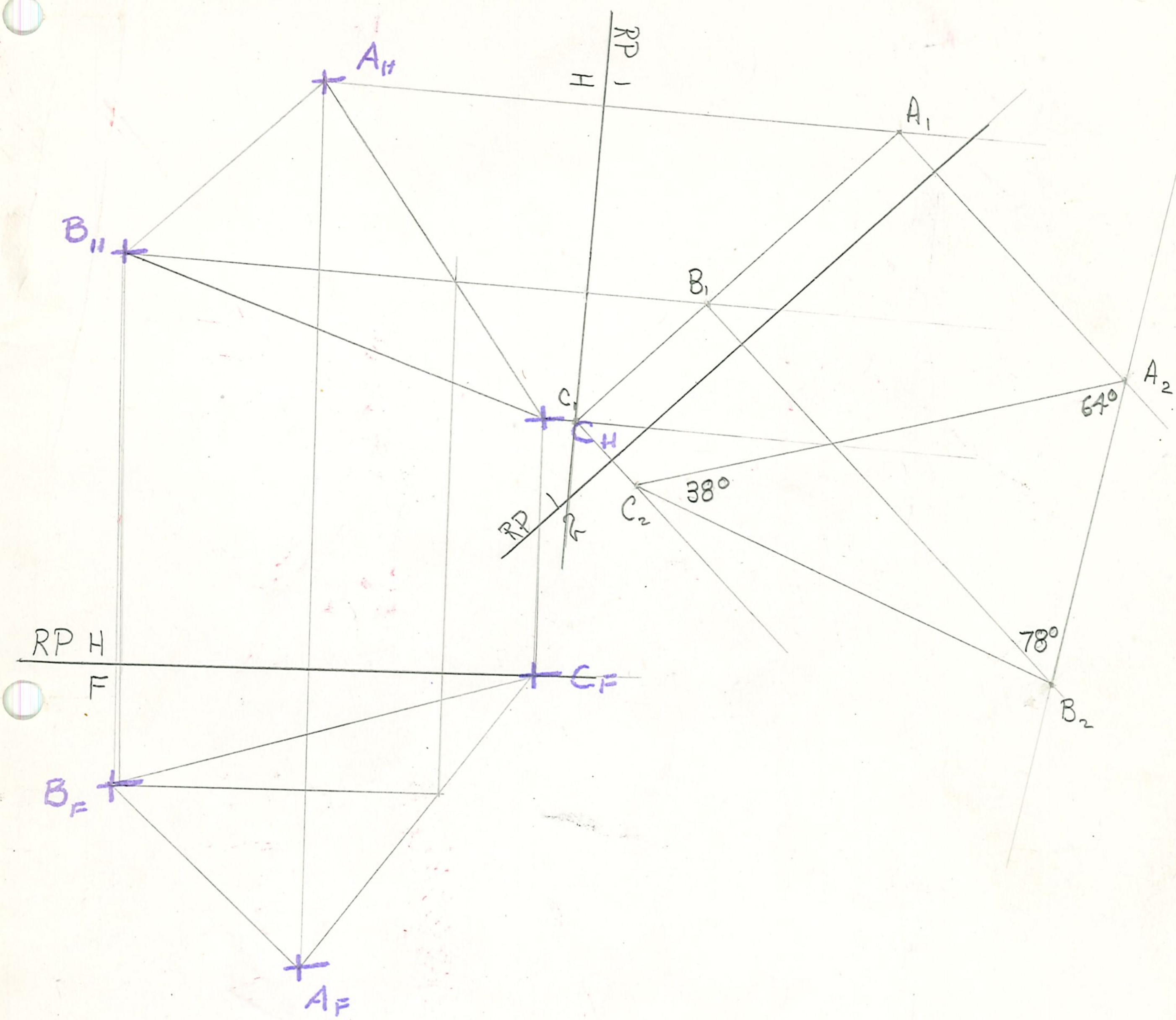
STEVEN F. BELLENOT

3. A B C and D are the corner[illegible]
Find the intersectionof th[illegible] tetra[illegible]dron and
shwwit in the Top and Front [illegible] visi[illegible]lity
leave offthe portion of the [illegible] [illegible]etrahe[illegible]on.
Find the angle between the [illegible] E F [illegible] of the [illegible]lanes.



STEVEN F. BELLENOT

4. Find the true angles of the triangle A B C .



STEVEN F. BELLEMOT

5. J K is the axis of a right prism. The bases as equilateral triangles that may be inscribed in 2 inch diameter circles. The rear side of each base is frontal. Draw the front and left profile viewsx and any other views that are needed.