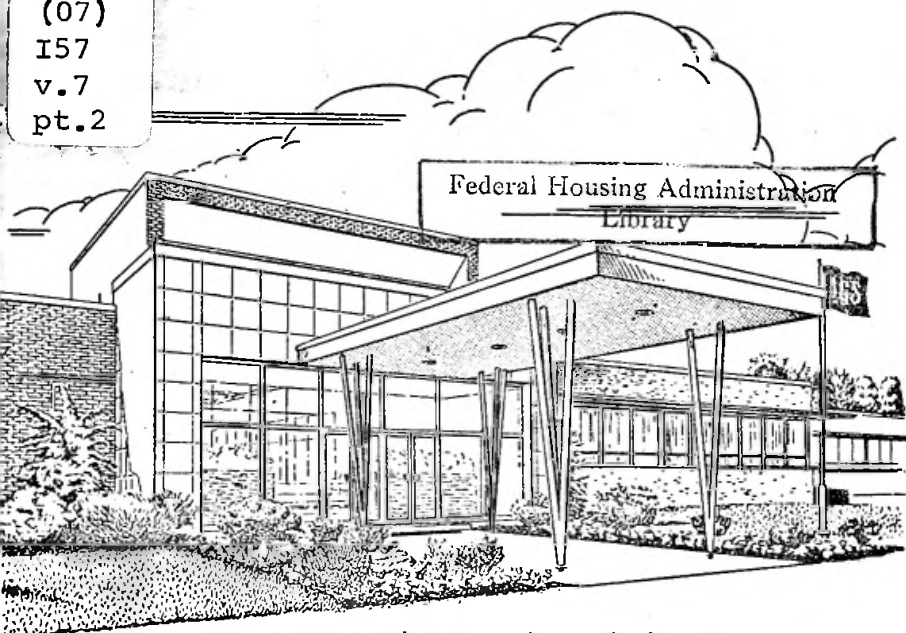


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pt.2



International Correspondence Schools, Scranton, Pa.

Elementary Architectural Drawing

Prepared Especially for Home Study

By

WILLIAM S. LOWNDES, Ph.B., A.I.A.

and

I.C.S. STAFF

5893 B-2

4 Assignments

Part 2

Edition 2

International Correspondence Schools, Scranton, Pennsylvania

International Correspondence Schools, Canadian Ltd., Montreal, Canada

"Blessed is the man who has some congenial work, some occupation in which he can put his heart and which affords a complete outlet to all the forces there are in him."

—John Burroughs

* * *

Fortunate, indeed, are you, if you've found the work you like. And if you will apply yourself in learning those things which are involved in that work . . . and if you will *keep on learning* . . . Success will surely crown your efforts.

Architecture home study course
**ELEMENTARY
ARCHITECTURAL DRAWING**

V. 7 PART 2

By

WILLIAM S. LOWNDES, Ph. B., A.I.A.

and

I.C.S. STAFF

Serial 5893B-2

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What This Text Covers . . .

LETTERING Pages 1 to 9

Most architectural lettering is done freehand. Lettering requires careful practice in order to obtain proficiency. Over the centuries many styles of letters have developed. The old Roman alphabet provides the basis for most architectural lettering. Styles for general use are illustrated. To do good lettering you must use guide lines. Mass, character, and spacing of letters are explained and illustrated.

DRAWING PROBLEMS Pages 10 to 24

Detailed instructions for the preparation of four drawing plates are given. Pencil work and ink work are explained.

5893B

ELEMENTARY ARCHITECTURAL DRAWING

PART 2

LETTERING AND DRAWING

LETTERING

1. **Work Required.**—The drawing work required by this text consists of four exercises as follows:

- Exercise I Lines
- Exercise II Geometrical Problems
- Exercise III Geometrical Problems
- Exercise IV Line Problems

2. **Care in Lettering.**—By the term *lettering* is meant drawing all the necessary letters and numerals on drawings.

Every architectural drawing should have its title, as well as all explanatory headings, notes, and dimensions, neatly and carefully lettered in their proper places. Ordinary script should not be used.

A beginner may think that care and attention should be applied only to the drawings, and that the lettering may be placed on the drawing without any particular care. This, however, is a great mistake. The lettering should be done as carefully as the drawing itself, as it is a pretty sure indication of the ability of the draftsman.

Frequent practice in lettering is necessary. The examples given in the text should be copied again and again, the letters being made consistent in style and spaced properly.

At first it may seem difficult to do good lettering, but pride in the work, combined with intelligent and persistent practice, will soon lead to satisfactory results.

3. **Styles of Letters.**—During the past centuries, a great many styles of letters have been developed, some of which are

very beautiful. Only a very few of these styles, however, are adaptable to architectural drawings. The use of specially fine

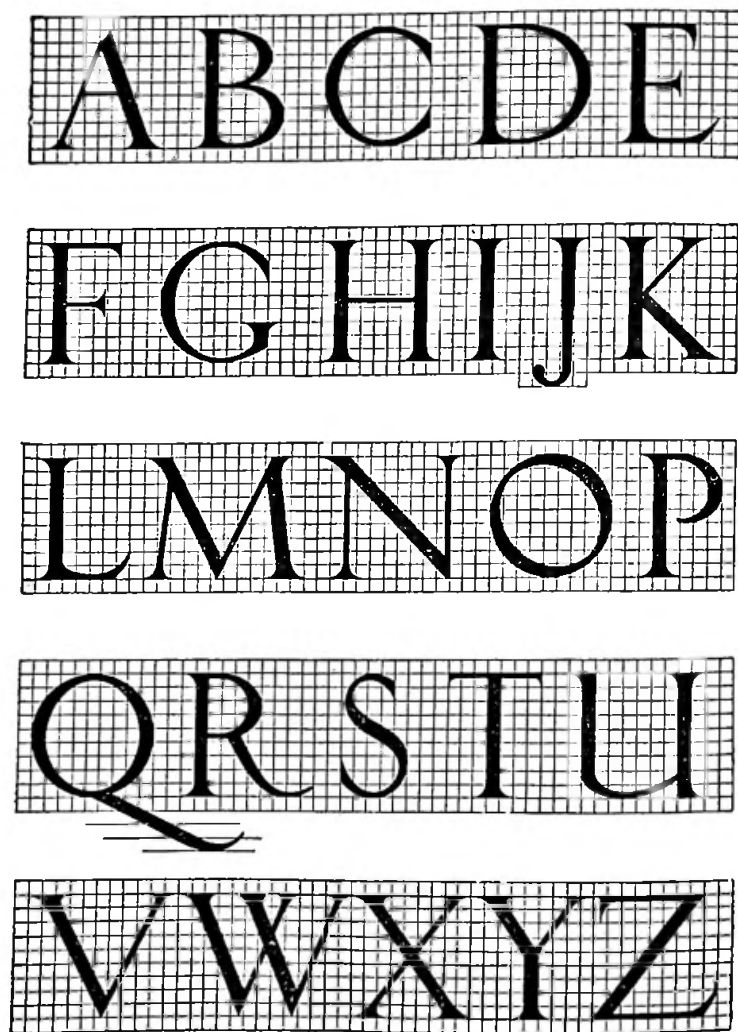


FIG. 1

letters is confined to the titles of fancy architectural drawings that are used for display purposes, competitions, etc.

Where very fine lettering is required, the old Roman alphabet shown in Figs. 1 and 2 is very serviceable, as these letters, when

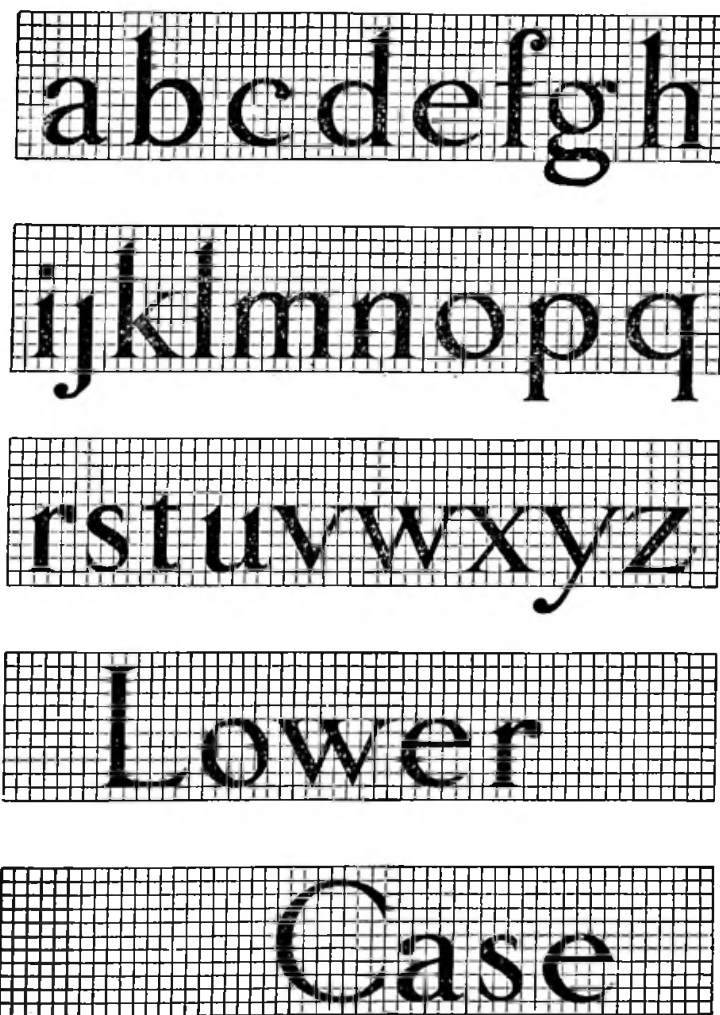


FIG. 2

carefully drawn, have a fine appearance and will harmonize with most drawings. They are here shown blacked in, but they are

equally effective when drawn in outline, particularly if the letters are large.

4. **Description of Roman Alphabet.**—The Roman alphabet shown in Figs. 1 and 2 consists of typical examples of Roman letters, being derived from the letters on the Column of Trajan in Rome. In Fig. 1 are shown the capital, or *upper-case, letters*, and in Fig. 2 are the small, or *lower-case, letters*. By first laying them off on a network of small squares, as shown, the letters can be drawn in their correct proportions. Thus, the height of the capitals may be made equal to the sides of nine small squares, and the general height of the lower-case letters may be made equal to the height of five of the same squares.

These letters are best drawn by means of the T square and triangles. The compass, especially the bow compass, can be used for some of the curves; other curves must be drawn freehand.

It will be well for the beginner to practice drawing these letters, as it will prepare him for making fancy titles to plates, and will familiarize him with a standard style of letters from which many modern styles have been derived.

5. **Styles for General Use.**—For working drawings and details, plain neat letters that can be drawn freehand should be used. In Fig. 3 are shown letters that are based on the Roman Style, also variations of this style which can be used on various parts of the drawing.

At *a* is a set of vertical capital letters that may be used for titles of drawings. The heights of these letters should vary according to the size of the drawing. At *b* are numerals, or numbers, that correspond with the style of letters shown at *a*.

At *c* are letters that are similar to those at *a*, but that have short straight lines at the ends of the lines of which the letters are formed. These short lines are called *serifs* and give a style and finish to the letters. At *d* are numerals that correspond to the letters at *c*. At *e* is an alphabet similar to that shown at *a*, but the letters all have a uniform slant. Corresponding numerals are shown at *f*. These slanting letters can also be finished with



FIG. 3

serifs if desired. At *g* are shown small, or lower-case, letters, and at *h* slanting small letters.

The letters shown in Fig. 3 may be used in combinations, as shown at *i*, where vertical capitals and small letters are used in the customary manner. At *j* is a combination of large and small capitals, which is a favorite arrangement. At *k* are shown cramped or narrowed letters that are adapted to positions where space is scarce.

The vertical lettering is recommended in preference to the slanting, as it harmonizes with the prevailing lines in most architectural drawings, which are vertical and horizontal.

6. Process of Lettering.—The first step in lettering is to draw guide lines that limit the tops and bottoms of the lines of letters. Guide lines are shown in Fig. 3. All the letters should be drawn so as to touch both lines.

When the lettering is to be drawn in pencil, the guide lines should be drawn very faintly, as it is difficult to erase them. If the letters are to be inked in, the guide lines may be made of stronger pencil lines, as these can be erased after the letters have been inked in.

Vertical guide lines are drawn by some draftsmen to assist in making the letters vertical. Slanting guide lines are also sometimes used, and are all made at the same angle with the horizontal, thus helping to give a uniform slope to the letters.

No matter where or how letters are to be drawn, horizontal guide lines must be used. Even when tracing lettering through from a well-lettered drawing, it is necessary to draw guide lines to obtain good results.

7. Inclination.—If the letters are of the vertical style all the upright lines should be absolutely vertical, as at *a*, *b*, and *c*, in Fig. 3. If the letters slant, they should slant uniformly, as at *e* in Fig. 3.

8. Similarity in Mass and Character.—There should be a similarity in the general mass and character of letters. By this is meant that one letter should not be broad and full and the next one narrow and cramped as in Fig. 4 (*a*), in which are

shown the great differences that may occur in drawing the same letter. In Fig. 4 (*b*) all the letters are made broad and full in outline so as to create a sense of uniformity in size. Of course, the letter *I* is necessarily very narrow, whereas the letters *W*, *M*, *C*, *Q*, etc., are wide. By slightly narrowing these wide letters and broadening others, a similarity in mass and character will be obtained. A careful inspection of the lettering in (*b*) will show how to remedy the faults that are obvious in (*a*).

9. Spacing Letters.—An extremely important point in lettering is that of spacing letters properly. In Fig. 5 are shown lines of letters that are poorly spaced, some of the letters being



FIG. 4

too far apart and others too close together, as indicated by check marks; while below them are lines of the same letters spaced properly so as to produce an appearance of uniformity. Special care should be taken in the case of the letters *A*, *C*, *F*, *G*, *J*, *L*, *O*, *Q*, *T*, *V*, *W*, and *Y*, which are so shaped that they form spaces within themselves.

In Fig. 6 the letters that should be considered carefully in spacing are shown. The unsatisfactory spaces in the letters themselves are marked by check marks in the upper line. In the second line the *J* is pushed forwards until part of it is under the *F*. The horizontal stem of the *L* is made short and the *M* almost touches it. The *O* is moved over toward the *M* and the *N* toward the *O*. The horizontal part of the *T* is made small and almost touches the letters *N* and *V*. The letters *V* and *W*

almost touch, so as to make the space between them as small as possible. The round letters O, C, G, and Q must almost touch

abc d e f g h i j k l m n o p q r s t u v
 abcdefghijklmnopqrstuv
 A B C D E F G H I J K L M N O P
 ABCDEFGHIJKLMNOP
 A B C D E F G H I J K L M
 ABCDEFGHIJKLMNOP

FIG. 5

the letters on each side of them in order to neutralize the bad effect of their shapes.

In the word JAMES on the left are spaces that may be minimized by packing the letters together as on the right.

A F J L M O N T V W Q C G
 A F J L M O N T V W Q C G K B
 J A M E S . . & . . . J A M E S

FIG. 6

10. **Mastery of Lettering.**—Lettering can be learned only by careful practice. By keeping in mind the general principles just explained and by studying and imitating good models the student should become able to letter his drawings so as to add distinction to them. Poor lettering is as bad as poor drawing,

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 STUVWXYZ & 1234567890
 A B C D E F G H I J K L M
 N O P Q R S T U V W X Y
 Z & 1234567890

Building	SCHOOLHOUSE
Location	CLAYTON, N.Y.
Owner	TOWN OF CLAYTON
Job No.	21
Drawing No.	
Scale	$\frac{1}{4}'' = 1'-0''$
Date	June 10/19-
Drawn By	F.R.
Traced By	E.H.
Checked By	C.S.
JAMES A. BROWN, Architect 100 MAIN ST., SCRANTON, PA.	

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 abcdefghijklmnopqrstuvwxyz &
 1234567890 Leroy Lettering

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 abcdefghijklmnopqrstuvwxyz &
 1234567890 $\frac{1}{2}$ Freehand Lettering

FIG. 7

and neither is acceptable in the drafting room of the architect's office.

In Fig. 7 are some examples of lettering that are in actual use on architects' drawings. The three lines of lettering following the title block have been done using the Leroy lettering set, one of the mechanical lettering sets that are available. While the use of mechanical guides is increasing, in the majority of offices lettering is still done freehand. The use of the mechanical guide should not be attempted by the beginner until he has become proficient in freehand lettering. The lettering on drawings submitted to the Schools should be done freehand.

DRAWING PROBLEMS

WORK REQUIRED

11. Character of Work.—The instructions here given start with the elementary parts of the subject such as a beginner requires. A complete drawing outfit, as described in *Elementary Architectural Drawing*, Part 1, is necessary; also a supply of suitable drawing paper.

The work required consists of a series of Exercises, including simple forms that lead up to architectural drawing. Ideas pertaining to architecture will be introduced at every opportunity, so that the student will receive training that will be applicable to advanced architectural drawing.

12. Lettering, Exercises, and Sheets.—All exercises should be carefully lettered, the lettering following the models shown on the Exercises given in this text. In grading the papers, the quality of the lettering will be considered. It will be excellent practice to lay out an Exercise as described later, and fill in the proper space with lettering such as is shown in Fig. 3.

Each Exercise consists of a single sheet. No drawing should be done until the directions have been carefully read.

PLAN OF THE SHEET

13. Kind of Paper.—The exercises in this text are to be executed on sheets of transparent bond paper. All the sheets are to be $10'' \times 13\frac{1}{2}''$ in size. Two such sheets can be obtained from one $15'' \times 20''$ sheet.

14. Laying Out the Sheet.—Cutting lines extending all the way around the sheet are to be drawn $\frac{3}{8}$ inch within the edges of the sheet, making a rectangle $9\frac{1}{4}'' \times 12\frac{3}{4}''$ in size. The sheet will be cut along these lines and sent to the Schools when the drawing is completed.

Inside the cutting lines, border lines are to be drawn, these lines being kept $\frac{3}{8}$ inch in from the cutting lines. One inch down from the upper border line, and $\frac{5}{8}$ inch above the lower border line, two horizontal lines are to be drawn, one in each position. The words "Elementary Architectural Drawing" and the title of the exercise are to be lettered in the upper rectangle. In the lower rectangle, the exercise number, the sheet number, the date, the time required for making the exercise, the word "Grade," the name of the student, and his class letters and number are to be placed. The problem number should appear beside or under each problem.

The remaining space will be $8\frac{1}{2}'' \times 10\frac{3}{8}''$, which will contain the drawing.

METHOD OF PROCEDURE

15. Placing the Board.—Place the drawing board in a position so that the light will come from the left. The board should be raised an inch or more at the back edge as shown in Figs. 1 and 2 of *Elementary Architectural Drawing*, Part 1. It is desirable to place the board on a table that is larger than the board, so that there will be space to hold the instruments, instruction papers, pencils, erasers, and other items that may be required while drawing.

16. Covering the Board.—It is advisable to cover the surface of the board with a cover sheet of stout smooth paper, such as a sheet of buff detail paper. Tack this paper to the surface of the board.

17. Finishing Sheet.—Upon the cover sheet stretch a sheet of paper upon which the finished drawing is to be made. First tack one corner. Move the paper until the edges are parallel with the edges of the drawing board. Then place a tack in the diagonally opposite corner, and finally put tacks in the remain-

ing corners. The paper should lie perfectly flat. Sometimes it is necessary to take out the tacks, one at a time, and pull the paper until all unevenness disappears.

MAKING THE DRAWING

18. **Lines.**—The first lines to be drawn are the cutting lines, then the border lines, and finally the rectangles for the lettering. In drawing these lines the pencil should be properly sharpened, and an endeavor should be made to produce firm black lines of even thickness. The pencil should be sharpened frequently. As it is drawn along the T square or triangle, the pencil should be rotated slightly between the thumb and forefinger. This will wear the pencil point down uniformly and will produce an even line. The point should be applied to the paper with pressure. This pressure, however, should not be sufficient to dent the paper. If the lines are too thick, sharpen the pencil. If the lines are too faint, use a softer pencil.

19. **Covering Exposed Paper.**—In order to keep the paper as clean as possible, the surface should not be touched by the hand more than is actually necessary. Dust and lint that may be floating around in the air will fall on the surface of the drawing. To protect the surface of the paper, it should be covered by a sheet of tracing paper or other cheap paper, except the part where drawing is being done. When no work is being done on the drawing, the paper should be entirely covered by a newspaper or cloth.

20. **Dust Brush.**—A small dust brush is a very convenient thing to use in dusting off a drawing, especially after an erasure has been made. The drawing should never be dusted off with the hand.

21. **Pencil Work.**—The sheets are to be drawn as shown and directed, and are to be completed first in pencil. When changes or improvements are necessary, they should be made in the pencil drawing. The drawing should be compared carefully with the models in the instruction paper and an endeavor made to produce work equal to that shown in these models. The

pencil lines should be clear, black, and uniform in thickness. The intersections of the lines should be clean and sharp. The lettering should be carefully done in freehand.

22. **Ink Work.**—When there is no further room for improvement, the drawing may be inked in. Clean, sharp, black lines of uniform thickness should be made. The date of completion, the time required to make the drawing, the name, and the class letters and number should all be neatly lettered on the plate as shown on the model exercises.

While not required as in former years, ink drawings are still used frequently for important work and for certain types of drawing. It is an advantage to be familiar with this phase of architectural drawing since at some time the student may be required to do elaborate ink drawings.

Exercise I is to be submitted in ink. Exercises II, III, and IV may be submitted in pencil.

23. **Cleaning Drawings.**—When the drawing has been inked in and the ink is dry, the drawing should be cleaned with a soft eraser such as art gum or sponge rubber. Lines that cannot be removed by the use of these soft rubbers may be erased by the use of a pencil eraser. Ink blots or false lines may be removed by the ink eraser and the shield.

24. **Cutting Off Drawings.**—When the plate has been thoroughly cleaned, it may be removed from the board and cut along the cutting lines. The drawing should then be sent to the Schools in an envelope provided by the Schools.

CORRECTIONS

25. The best results will be obtained by submitting only one exercise at a time to the Schools for correction. While one exercise is being corrected, the next one may be studied and prepared. The corrections on the exercises that are returned should be carefully studied. This procedure will allow you to profit by your mistakes and will hasten your progress.

If the work does not receive a passing grade it will be returned with a request to make a new drawing on the same subject. This

will mean that further practice in this subject is necessary and that much benefit will be derived from the study of the corrections made on the work. The new drawing should be made cheerfully with the realization that this additional work affords valuable practice.

All work sent to the Schools is criticized liberally, especially the first exercises, so that full benefit of the advice given may be obtained. The criticisms are made solely to help the student to become a good draftsman. The *number* of criticisms that we make is no indication of our appreciation of the merits of the drawing.

26. It is often advisable to carry along two subjects at a time, such as one drawing subject and one mathematical or trade subject, so that no time will be lost in waiting for returned work.

EXERCISES

EXERCISE I

27. **General Directions.**—Exercise I will consist of one sheet of six straight-line drawings. These drawings are to be made as indicated in the plate showing this sheet.

Fasten a $10'' \times 13\frac{1}{2}''$ sheet of transparent bond drawing paper on the board. Two of these sheets can be cut from one $15'' \times 20''$ sheet. This sheet is to be set with its edges parallel with the edges of the drawing board.

Draw the cutting lines *A* about $\frac{3}{8}$ inch inside the edges of the paper, making a rectangle $9\frac{1}{4}'' \times 12\frac{3}{4}''$ in size. Inside this line draw the border lines *B*, which should enclose a rectangle $8\frac{1}{2}'' \times 12''$ in size. Draw the horizontal lines *C* at the top and bottom to form the rectangles that will contain the title and other lettering. In laying out these lines learn to use the scale so as to become familiar with that instrument.

Draw a faint line *ab* down the middle of the sheet. One-half inch from each side of this line draw faint lines *cd* and *ef*. Draw faint lines *gh* and *ij* $\frac{3}{4}$ inch from the side lines *B*. The spaces *gc* and *ei* should be 3 inches each. Lay off the dimensions, still

using the scale, marked on the line *ab*, and draw faint horizontal lines through the points. There will be six rectangles formed, which are the boundaries of the figures. These boundary lines may now be drawn in firmly.

Cover the sheet with a piece of paper, leaving the top rectangle $1'' \times 8\frac{1}{2}''$ exposed. This paper will keep the sheet clean until it is time to draw on it. The hand should not touch the drawing any more than necessary, as the hand is sometimes moist and may soil the paper.

Lay out all the letters as shown, making them of proper shape, of uniform height, and spaced properly as described under the heading, Lettering. This lettering will include the general title of all the drawings, *Elementary Architectural Drawing*, and the title of the sheet, *Lines*.

When the lettering is completed satisfactorily, cover the title and expose the area for Figs. 1 and 2. Scale off all the dimensions given in the model. The two rectangles will each be $2'' \times 3''$ in size, and each will contain groups of horizontal lines. These are to be drawn with the aid of the T square. The vertical lines are drawn with a triangle. Place the $\frac{1}{4}$ -inch scale along the edge of the figure and with a sharp pencil point off marks $\frac{1}{4}$ inch apart. There will be seven of these marks. With the T square draw lines through the marks across the figure. The lines in the figure should all be uniform in thickness and blackness. Sharpen the pencil point frequently to obtain good results, using the scratch block freely.

Fig. 2 is drawn similarly. The figure is divided horizontally into 4 equal parts by using the $\frac{1}{2}$ -inch scale. There will be 4 bands $\frac{1}{2}$ inch wide as shown. The object in drawing this figure is to make these bands uniform in width, which can be done only by the careful use of the scale and accurate pointing off with the pencil. This figure should be carefully inspected to see whether the lines are firm, black, and uniform, and whether the lines meet accurately. You should form a habit of judging your work continually. You should endeavor to find any mistakes you have made and should be sure your work is as nearly perfect as you can make it before you decide to send it in for correction.

Cover up the work already finished and expose Figs. 3 and 4. The rectangles bounding these figures are $3'' \times 3''$ in size, and are divided into six equal parts on each edge. Each part is therefore $\frac{1}{2}$ inch long. After pointing off carefully with pencil and scale the divisions on two adjacent sides, draw, in the case of Fig. 3, horizontal lines with the aid of the T square, and vertical lines with the aid of the triangle. Complete the figure. In Fig. 4, draw diagonal lines by placing a 45-degree triangle on the T square and drawing diagonal lines. Continue to make all lines black, sharp, and uniform, and have them meet neatly.

Cover up the completed work and start Figs. 5 and 6. Fig. 5 consists of a combination of Figs. 3 and 4. If this figure is accurately drawn, the diagonal, vertical, and horizontal lines will meet accurately in points. If they do not meet accurately, the drawing should be carefully laid out once more to correct errors. Draw the lines lightly when first laying out the figures, so that they can be easily erased if wrong. Fig. 6 is a modification of Fig. 5. Smaller rectangles $\frac{1}{4}'' \times \frac{1}{4}''$ in size are to be drawn and centered inside the $\frac{1}{2}$ -inch squares at alternate intervals. Complete the figure by drawing the diagonal lines to intersect the corners of the $\frac{1}{4}$ -inch squares.

The completed work should be covered up, and the lettering at the bottom of the sheet begun. It is desirable that the student practice the lettering on a sheet of tracing paper over the $1'' \times 8''$ space until the right size and arrangement are obtained. After this the lettering may be drawn on the final sheet.

Uncover the entire drawing and compare it with the model in the book. Make sure that it is correct in all particulars before inking it in.

28. Inking In the Drawing.—With a suitable freehand pen, ink in the lettering first. Then with the ruling pen draw all the lines in the drawing. Mark the ruling pen so that the lines shall be all of the same thickness. Do not ink in the dimensions. They are to be used only in laying out the drawing.

Follow carefully all the instructions given concerning the use of the pen. Before making any lines on the final drawing tack a sheet of tracing paper over the pencil drawing, and practice

making the entire drawing in ink, if necessary. When confident that the ink work will be well done start work on the final drawing. After the inking has been completed, the entire drawing may be cleaned with the eraser.

Take plenty of time in doing this work. It is more important that the student learn to work neatly and accurately than it is to save time. After experience has been gained, the work can be done more quickly. Do not try to hurry.

If you desire to submit your work in pencil for suggestions, you may do so, and later submit the work inked in; or you may complete the exercise; that is, ink it in, and send it in to the Schools for criticism. Grades will not be given on pencil work, but only on completed work in ink.

The sheet is to be cut at the cutting lines, making it $9\frac{1}{4}'' \times 12\frac{3}{4}''$ in size.

EXERCISE II

29. General Directions.—Exercise II will consist of a sheet of line drawings that will illustrate solutions of geometrical problems.

In drawing these problems three thicknesses of lines will be used. One kind will be *given lines*, such as *ab* in Problem 1. These are thin lines. Others are the *required lines*, such as *cd* in Problem 2. These will be drawn about twice as thick as the given lines. A third kind of line will be construction lines that are used in constructing the figures, but are not necessary parts of the completed figures. These are broken lines; that is, they consist of short equal lines with short equal spaces between them, as shown in *ff* in Problem 4.

In laying out the sheet, the dimensions are to be measured by the scale.

When drawing a line through two points, the line should pass exactly through the points, and not to one side. If a line is to end at a certain point it should be made to end at that point exactly. It should not be drawn beyond the point or short of it.

The work should not be hurried. The student should take time to think carefully about every line or mark that is put on the sheet. There should be a good reason for every mark or line made on the drawing.

30. **Laying Out the Sheets.**—Exercise II is to be laid out exactly as described for Exercise I. The $8\frac{1}{2}'' \times 10\frac{3}{8}''$ drawing space included within the border lines is shown in Exercise I. This space will be divided into six equal spaces, two spaces being included in the width, each $4\frac{1}{4}$ inches wide. The height, $10\frac{3}{8}$ inches, will be divided into three equal spaces. Each of the spaces will contain one problem or figure.

31. All six figures are to be centered on the horizontal width of each space. This will make the sheet appear neat and symmetrical. Sufficient space is to be left for the lettering above and below the drawing, as shown in the model.

The entire sheet is to be completed in pencil. When the sheet appears to be perfect in pencil, it may be inked in or it may be submitted in pencil.

32. **Drawing the Problems.**—Problem 1. *To bisect a straight line.*

The given line ab , which is to be bisected, is drawn 3 inches in length. With the end a as a center, and a radius greater than one-half the length of the line ab , draw an arc on each side of the line ab . This is done by means of the compass. With b as a center and with the same radius, draw arcs cutting the first two arcs at c and d . Draw the straight line through the points c and d , cutting the line ab at e . The distances ae and be are equal and the line ab is bisected at e . The line cd is perpendicular to ab at the point e .

Problem 2. *To draw a line perpendicular to the middle point of a given straight line.*

Draw the given straight line ab 3 inches in length. Lay off ad equal to $1\frac{1}{2}$ inches. The point d will be the middle point of the line. With d as a center, and a radius of 1 inch, draw two arcs as at e and f . This is done with the compass. With e and f as centers and any radius greater than df , draw two arcs intersecting at c . Draw the line cd and it will be perpendicular to ab at its middle point d .

Problem 3. *To bisect a given angle.*

Let bac be the angle that is to be bisected. Draw ab and ac each 3 inches long. With the vertex a as a center, and any convenient radius, draw the arc de cutting ab at d , and ac at e . With d and e as centers and a radius greater than one-half of de , draw two arcs intersecting at f . A line drawn through a and f will bisect the angle bac , and the angle baf will equal the angle caf .

Problem 4. *To divide a given straight line into any required number of parts, by the use of dividers.*

Draw a line ab 3 inches long. It is to be divided into five equal parts. Through a point a in the line ab draw a line ac at an angle with ab . Set the bow dividers at a distance of about $\frac{1}{2}$ inch, and lay off 5 of these divisions from a along the line ac .

First, put one point of the dividers at a and make a very fine hole in the paper. Then put the other point on the line ac at d . Make a slight hole at d . Turn the compass so as to bring the first point at the point e in the line. Make holes at the points f , g , and h . These holes should be just large enough to be seen plainly, and so that lines can be drawn through them.

Take two triangles and set them as shown in Fig. 10, in *Elementary Architectural Drawing*, Part 1, with the edge of one triangle through the points h and b , and draw hb . Through the points d , e , f , and g draw lines parallel with hb . These lines will intersect ab at i , k , j , and l , thus dividing the line ab into five equal parts.

Instead of using the bow dividers to mark five equal spaces on the line ac , the scale and a sharp pencil may be used with equal success. Using the $\frac{1}{2}$ -inch scale, place the scale with the 0 mark at a against the line ac , and mark off five $\frac{1}{2}$ -inch spaces ad , de , etc. Draw lines from these marks as before.

Problem 5. *To draw an equilateral triangle, one side being given.*

The length of one side of the triangle being $2\frac{1}{2}$ inches, lay off the line ab equal to $2\frac{1}{2}$ inches as the base of the triangle. With a and b as centers, and with a radius of $2\frac{1}{2}$ inches, draw arcs intersecting at c . Connect point c with a and b . The triangle abc will be the equilateral triangle required. All the sides are to be drawn in heavy lines.

Problem 6. *To draw a five-pointed star.*

Describe a circle with a radius of $1\frac{1}{4}$ inches and mark its center o . Draw a vertical diameter ab and a horizontal diameter cd . Bisect the right half od of the horizontal diameter, locating the point a' . Using the point a' as a center and the distance $a'a$ as a radius, describe an arc that will intersect the horizontal diameter at b' . The distance from the point b' to the point a is the length of one side of the pentagon. Step off the distance $b'a$ five times on the circle starting at the point a . The end of the fifth step will coincide with the point a if your construction is accurate. Draw light lines to opposite points of the pentagon. Starting at the intersections of these lines, draw other lines which will pass through the center o and intersect the points opposite.

Finish the drawing as shown on the sample sheet. Erase the unnecessary construction lines and draw the outline of the star in firm black lines.

33. **Sending in Work.**—Check up the pencil work on this sheet, as on all sheets, and make sure that the work has been accurately and neatly done. Complete all lettering, border lines. Exercise number, your name, class letters and number, and so forth.

Do not be afraid to check, correct, or redraw the work if it is necessary. Architectural drawing is a vital subject since it provides the means of communication between the men engaged in building construction. Too much care cannot be expended on the preparatory training.

When your drawing is completed clean it thoroughly and mail it to the Schools.

EXERCISE III

34. **General.**—Ellipses are frequently used in architectural design, hence the importance of understanding the methods of drawing them. This Exercise illustrates one of the many methods that may be used in drawing an ellipse.

35. **Problem 1.** *To draw an ellipse, approximately, by means of circular arcs.*

Lay off ab $4\frac{1}{2}$ inches, and cd 3 inches in length. Draw ac parallel with and equal to bc . Divide ac into three equal parts, ai , ij , and je . Divide ah into three equal parts ag , gf , and fh . Draw cj and ci , and from d through f and g draw lines cutting cj and ci at k and l . Bisect kc by a perpendicular line mn that cuts cd prolonged. Draw nk . Draw kl and bisect it with a perpendicular intersecting nk at o . Draw ol cutting ah at p .

Then, with n as a center draw the arc ck . With o as a center draw kl , and with p as a center draw the arc la .

The opposite quarter of the ellipse is drawn similarly.

This method of drawing an ellipse may be used in laying out an elliptical arch in brick or stone.

Problem 2. *To draw an elliptical Brick Arch.*

First draw the major axis ab and the elliptical curve acb . These lines are to be drawn in the same manner and of the same size as in the preceding problem. The centers n , o , and p and the corresponding centers on the other side of nc will be located for use in drawing the elliptical curves and the joints between the bricks. The drawing of the arch will be made at a scale of $1\frac{1}{2}$ inches equals 1 foot. The span ab will be made 3'0" in width. The distance cd will be made 1'0". The width of the arch be will be 8".

With p as a center and a radius of pf , draw the arc fg . With a radius of og and with o as a center draw the arc gh . With n as a center and a radius of nh , draw the arc hi . Draw a similar curve ei on the other side of the arch.

Set the bow dividers at a distance apart of $2\frac{1}{2}$ inches at the $1\frac{1}{2}$ -inch scale. Starting at f , lay off spaces along the line $fghi$, $2\frac{1}{2}$ inches apart by scale. Draw lines from the points between f and g to p ; from the points between g and h to o ; and from the points between h and i to n . The portions of these radiating lines between the two elliptical curves will represent the joints between the bricks. Make the keystone about 6 or 8 inches in width to meet the brick joints nearest to that width. Draw the other side of the arch in a similar manner and finish up the drawing as shown.

When this sheet is completed in pencil and checked, it should be mailed to the Schools.

EXERCISE IV

36. Exercise IV will include six problems in which the compass will be freely used. The principal feature to be observed in these problems is the joining of the lines, which should meet with absolute accuracy. All the figures on this sheet should be drawn first in light pencil lines until it is found that the lines join perfectly and the centers of all circles are accurately located, after which the work may be put in with firm black lines, as shown in the instruction paper.

The chief aim in Problems 1 and 2 is to have all the lines equal in thickness and to locate all the intersections accurately. The ends of the arcs must meet without one line passing another. In using the compass, the point should be pressed into the paper as lightly as possible, so as to allow for any change.

Problems 4 to 6 inclusive contain conventional representations or indications of plumbing fixtures that are commonly shown on architectural drawings. These indications are drawn on architectural plans generally at the scale of $\frac{1}{4}'' = 1'0''$ or $\frac{1}{8}'' = 1'0''$. For this Exercise they are drawn at larger scales. When the student has become familiar with these larger drawings, he may practice making the indications at smaller scales.

Problem 1. *Spiral of Archimedes.*

Draw a circle with a radius of $1\frac{1}{2}$ inches, with the center at *a*. Divide this circle into 12 equal parts by radial lines, as *ab*, *ac*, etc. Divide the radius *ab* into 12 equal parts as *a1*, *a2*, etc. With *a* as a center and with *a1* as a radius, draw an arc between the lines *ab* and *ac*. With *a2* as a radius draw an arc between the lines *ab* and *ad*. With *a3* as a radius draw an arc between the lines *ab* and *ae*. Where the arcs intersect, mark points. When 12 of these points have been located, draw a line through them with the aid of a French curve or by freehand drawing. This curve is the Spiral of Archimedes.

Problem 2. *To draw a plan of a spiral stair newel.*

This diagram is to be drawn at the scale of $3'' = 1'0''$. The handrail *a* will be $3\frac{1}{2}$ inches in width. The spiral will begin at the line *bc*. Draw the vertical line *de* 4 inches away from and parallel to the handrail *a*. The lines *bc* and *de* intersect at 1.

With 1 as a center and *I-I'* as a radius, draw the arc 1-2'. The point 2 is $2\frac{1}{2}$ inches below 1 on the line *de*. With 2 as a center and 2-2' as a radius, draw the arc 2'-3'. Draw the square 2-3-4-5, measuring $1\frac{1}{2}$ inches on each side. From point 3 with the distance 3-3' as a radius, draw the arc 3'-4'. With point 4 as a center and with 4-4' as a radius, draw the arc 4'-5'. With point 5 as a center and a radius equal to 5-5', draw the arc 5'-6'.

Draw the inner curves of the rail, using the centers 1, 2, and 3 as shown. The point 5 will be the center of the newel below.

Problem 3. *To draw a rake mold.*

This diagram is to be drawn at the scale of $3'' = 1'0''$.

First draw lightly two horizontal lines $3\frac{3}{8}''$ apart. Inside each of these lines and $\frac{3}{8}''$ away draw a parallel line. Through these horizontal lines draw lightly two vertical lines $1\frac{1}{2}''$ apart. Using a 30° — 60° triangle draw lines at 30° with the horizontals through the upper three points of intersection between the horizontal and the vertical lines. Through the two intermediate points of intersection draw a freehand curve as shown. This establishes the profile of your cornice mold.

The rake mold will have the same projection as the cornice mold; that is $1\frac{1}{2}''$, although as you can determine from your drawing the height of this mold will be approximately $3\frac{3}{4}''$ instead of the $3\frac{3}{8}''$ for the cornice mold. To draw the profile of the rake mold you must first establish points *a* and *b*; $1\frac{1}{2}''$ apart. To draw the curve for the rake mold you must establish some points on this curve.

The middle point *x* on the crown mold is on a vertical line midway between the inner and outer edges of the mold.

The middle point *x'* on the rake mold is on a 60° line that is midway between the inner and outer points *a* and *b*. It is also on a 30° line that is midway between the top and bottom members of the rake mold. Other points may be found in a similar manner. For instance, third points on the crown mold and rake mold would be $\frac{1}{2}''$ apart between the inner and outer points, and also on 30° lines between the top and bottom members of

the rake mold. The curve may be completed by connecting the points established.

Problem 4. *An indication of a water closet.*

Draw this problem at the scale of $1'' = 1'0''$ and in accordance with the dimensions shown. The problem includes the drawing of an ellipse-like figure and requires accurate work.

Problem 5. *An indication of a kitchen sink and drain boards.*

This diagram is to be drawn at a scale of $\frac{1}{2}'' = 1'0''$ and in accordance with the dimensions shown. The problem is to make good joints between the rounded corners and the straight lines.

Problem 6. *A diagram of a urinal fixture located in a marble, slate, or glass stall.*

In drawing Problem 6 the dimensions shown are to be followed carefully, and the drawing made at the scale of $\frac{3}{4}'' = 1'0''$. The principal difficulty in drawing this problem is to get all the arcs of the circles to meet neatly. The French curve may be used to complete the curves at *a* and *b*.

All these problems are to be studied carefully and completely. The student should remember that the problems are elements of architectural drawings and will be useful in the future.

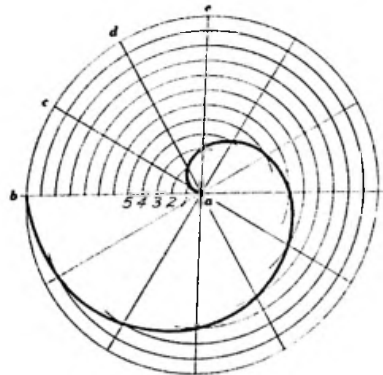
When the sheet of drawings has been carefully drawn, checked, cleaned, and lettered, it should be sent to the Schools for criticism.

KEY TO CRITICISM

The following symbols are used to indicate criticisms and suggestions on the student's drawings in Elementary Architectural Drawing, Freehand and Ornamental Drawing and Architectural Drawing. When a letter is placed on the corrected plate the meaning of this letter can be found in the following list.

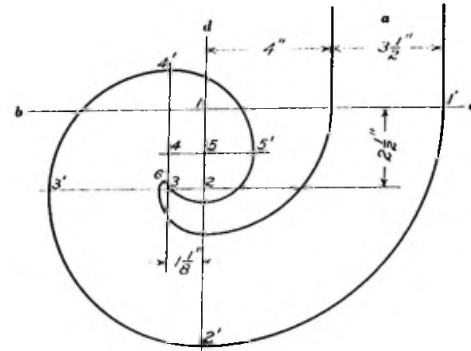
- | | |
|--|--|
| a. Inclination of letters not uniform. | (5) Practice use of French curve. |
| b. Letters not well formed. Study Arts. 2 to 10, 5893B. | (6) Use black drawing ink. |
| c. Letters not uniformly spaced. | (7) Not enough contrast in weight of line. |
| d. Practice lettering frequently. | (8) This is good work but you can do better if you take more time. |
| e. Sizes of spaces unequal. | (9) Excellent work. |
| f. Compare your work with model in text. | (10) Facility in freehand drawing comes with practice. |
| g. Height of letters irregular. Use guide lines. | |
| h. Letters too large. | A. Dimension lines omitted. |
| i. Letters too small. | B. Dimensions incorrect. |
| j. Use vertical guide lines for your letters. Guide lines should be drawn at random. | C. Dimension arrows incorrectly placed. |
| k. Numerals should be printed not written. | D. Lines not parallel. |
| l. Numerals not well formed. | E. Intersections poor. |
| m. Foot and inch marks not well formed. | F. Compass work poor. |
| n. Line too heavy. | G. Line should be dotted as it represents a part not seen. |
| o. Line too light. | H. Line should be dotted, as it represents a part cut off. |
| p. Line uneven. | I. Wrong symbol used. |
| q. Line not black enough. | J. Carelessly drawn. |
| r. Line should be drawn with instruments. | K. Size too large. |
| s. Line should be dotted. | L. Size too small. |
| t. Line should be broken. | M. Not projected properly. |
| u. Broken or dotted lines uneven. | N. Section lines omitted. |
| v. Should be full line not broken. | O. Section lines not evenly spaced. |
| w. Freehand curved lines not well drawn. | P. Lines omitted. |
| x. Arrow heads not well formed. Use closed type arrow heads. | Q. Dimensions omitted. |
| y. Lines are to be drawn freehand, without the use of instruments. | R. Incomplete. |
| z. Compare your work with attached drawing. | S. Drawing not to scale. |
| (1) You can do better work. | T. Similar lines should have the same thickness. |
| (2) All sides of figure should be equal. | U. Symbol omitted. |
| (3) Not required. | V. Lettering omitted. |
| (4) Erase blots. | W. Use single line. |
| | X. Avoid flat spots when drawing curves. |
| | Y. Avoid angles when drawing curves. |
| | Z. Quality of line should be clean, crisp and uniform. |

ELEMENTARY ARCHITECTURAL DRAWING LINE PROBLEMS



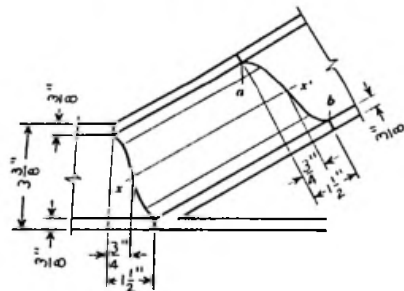
PROBLEM 1

To Draw a Rake Mold



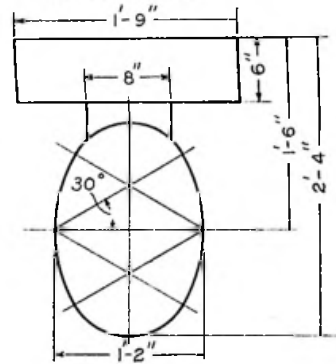
PROBLEM 2

Water Closet



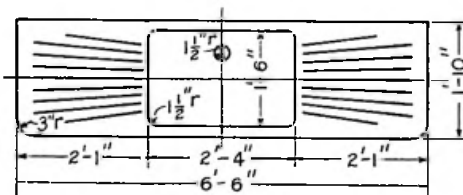
PROBLEM 3

Kitchen Sink and Drain Board

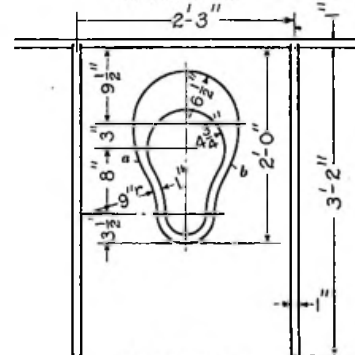


PROBLEM 4

Urinal Stall



PROBLEM 5



PROBLEM 6

EXERCISE IV

DATE
TIME

GRADE

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Ex. IV

ELEMENTARY ARCHITECTURAL DRAWING LINES

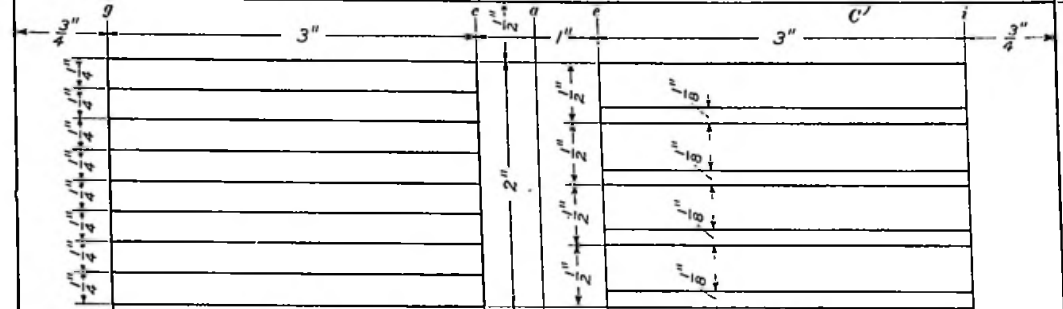


FIG. 1

FIG. 2

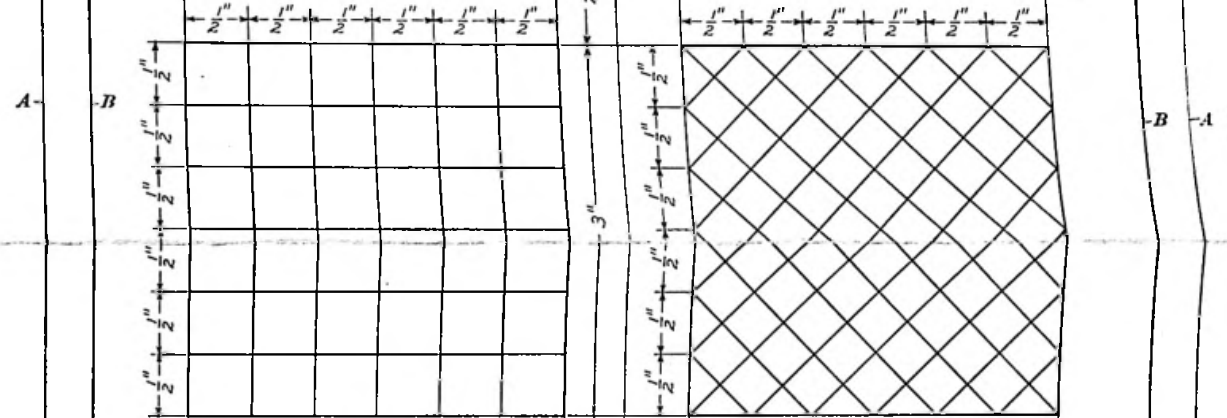


FIG. 3

FIG. 4

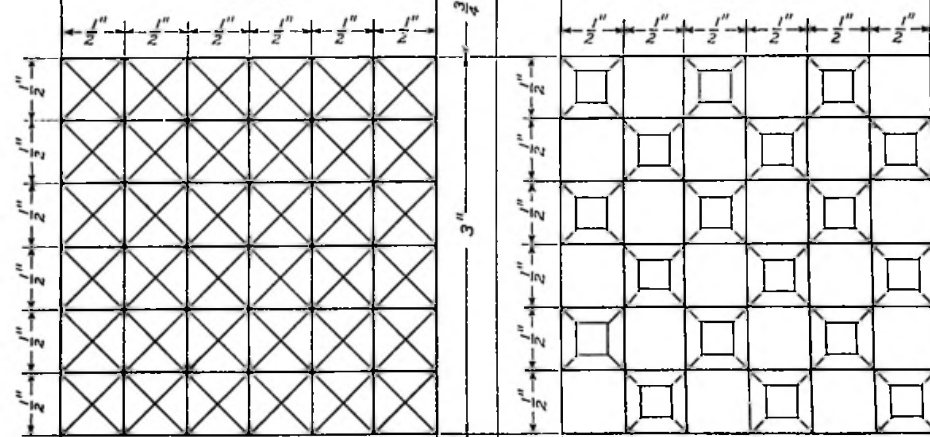


FIG. 5

FIG. 6

EXERCISE I
SHEET I

DATE
TIME

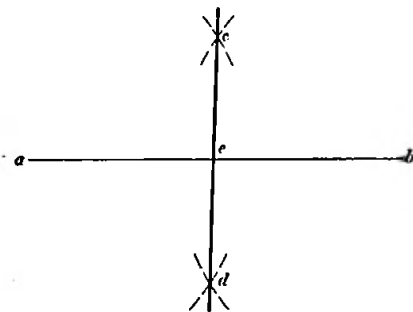
GRADE

JACOB B. JONES

Ex. I, Sh. I

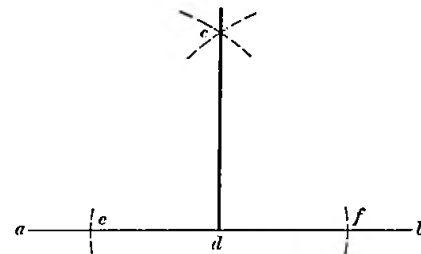
ELEMENTARY ARCHITECTURAL DRAWING GEOMETRICAL PROBLEMS

To bisect a straight line.



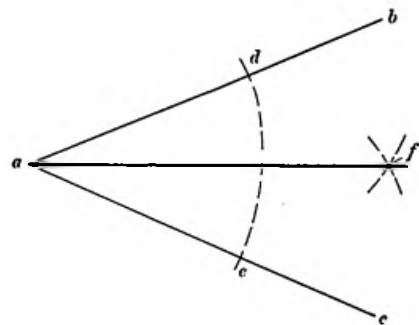
PROBLEM 1

To draw a line perpendicular to the middle point of a given straight line.



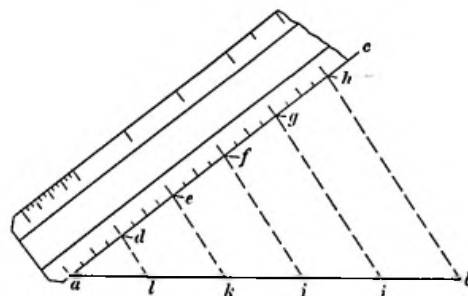
PROBLEM 2

To bisect a given angle.



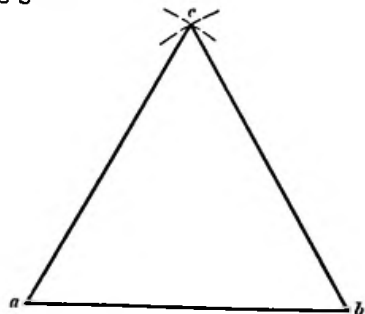
PROBLEM 3

To divide a given straight line into any required number of equal parts.



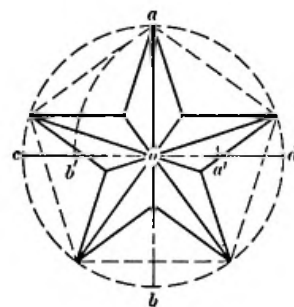
PROBLEM 4

To draw an equilateral triangle, one side being given.



PROBLEM 5

To draw a five-pointed star



PROBLEM 6

EXERCISE II

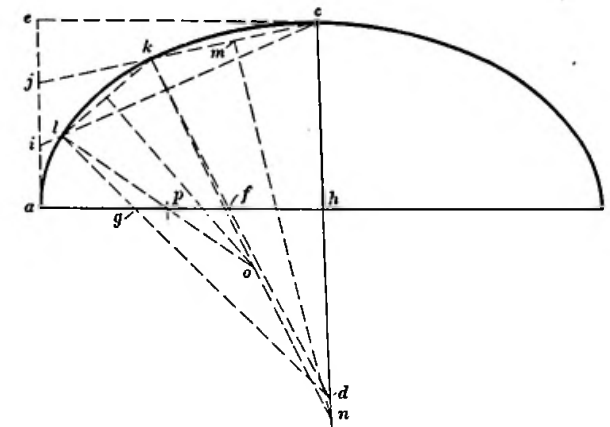
DATE
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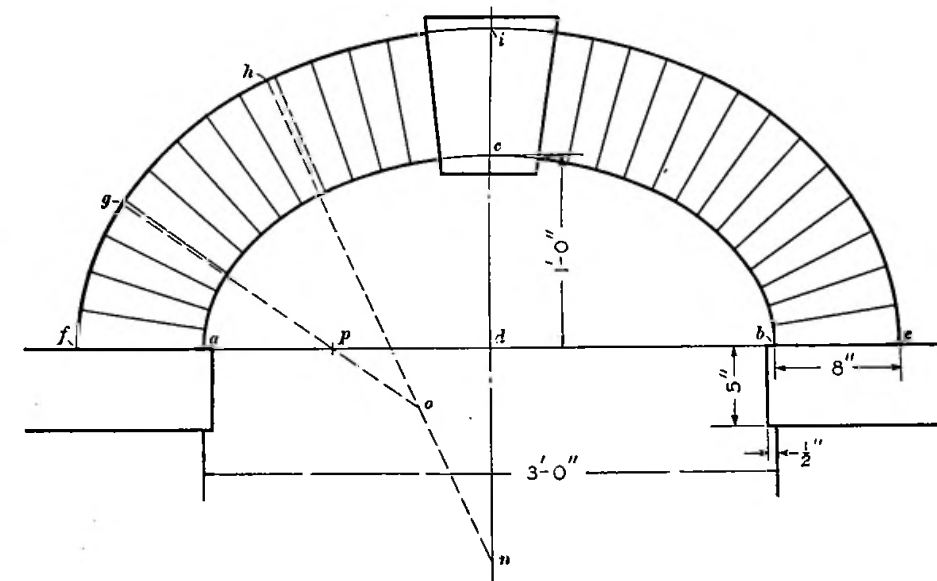
ELEMENTARY ARCHITECTURAL DRAWING GEOMETRICAL PROBLEMS

To draw an ellipse, approximately, by means of circular arcs.



PROBLEM 1

To draw an elliptical Brick Arch.



PROBLEM 2

EXERCISE III

DATE
TIME

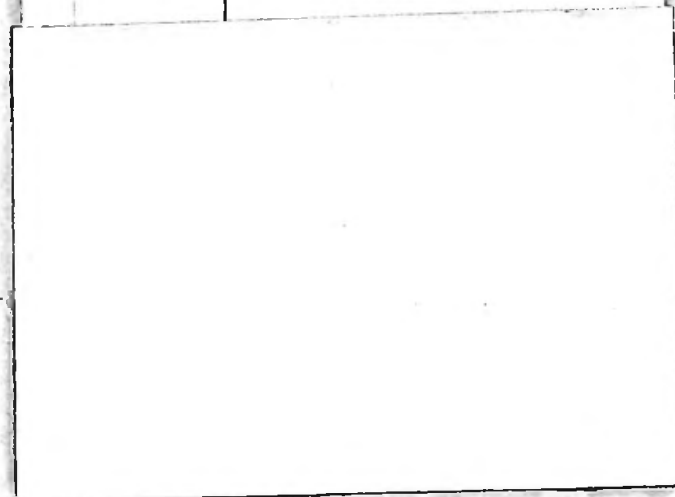
GRADE

JACOB B. JONES

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International Correspondence
Schools, Scranton, Pa.
Architecture home study
course. v.7 pt.2.

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