

## BASIC FREEHAND SKETCHING

### INTRODUCTION

Sketching is the creation of graphic images that are approximate graphic representations or models. Freehand sketching is manual sketching with the minimum of tools such as paper and pencil. Technical sketching is the art of creating technical drawing using freehand without special instruments. Technical sketching requires correct shape or form and more so correct size indication. Generally, drawing tools refer to the materials used as aids when creating drawings and they vary from simple to complex instruments and equipments. However, the drawing needs of today have changed dramatically due to the availability of computers. Traditional design and drafting has largely given way to computer design drafting but design sketches will always be needed.

Sketches are helpful in capturing design ideas and trying out different solutions in a fast and inexpensive way. Technical sketching is used as aid in conceptualization, spatial visualization and translating imagination into visual models. It could also be used as a means to amplify, clarify and record verbal explanations. Freehand sketching is an economic and effective means of formulating alternate solutions to a given problem so that a choice can be made on the best solution. Preliminary design studies are usually done with freehand sketches because accurate and detailed drawing of design options is expensive and time wasting at the initial stages of a project.

Basic sketching is conceived to be of two types, namely rough sketching and refined sketching. Rough sketching is the art of using freehand to create graphic images. Refined sketching creates graphic images with the aid of basic instruments. The advent of CAD has made traditional (manual) a declining skill. Drafting tables and drafting machines and equipment for traditional drafting are becoming obsolete. However, freehand sketching as an initial design activity will live on and requires the minimum tools for drawing. But refined sketches require more tools than just those for freehand drawing as some drawing instruments are usually required. The CAD computer can be used to create refined sketches.

### ***Rough Sketching Tools***

Rough or freehand sketching tools are quite few and require minimum investment. They are pencil, paper, eraser, and pencil sharpener. Fig. 1 shows sketches of pencil, eraser and pencil sharpener.

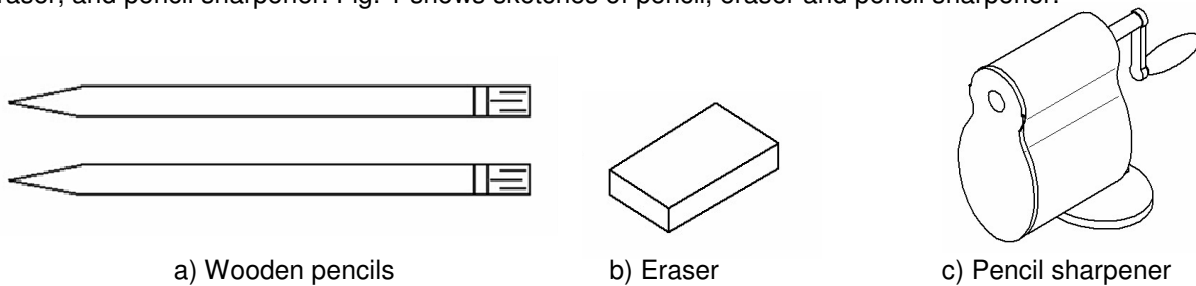


Fig. 1 Freehand sketching tools

#### *Wooden Pencils*

Fig. 1a shows wooden pencils. Wooden pencils have a lead substance encased in a wooden holder. There is a variety of wooden pencil types and designs. All are capable of being used to produce excellent lettering and linestyles. Wooden pencils come in three grades of hard, medium and soft, depending on the hardness of the lead material. Hard grade ranges from 3H to 9H, 9H being the hardest. The medium grade ranges from 2H to HB. The soft grade ranges from F to 7B with 7B as the softest. Wooden lead hardness decreases from 9H to 7B. In general, 2H and 3H are used for construction lines and H and HB are used for darkened finished lines in most technical drawings. Hence the medium grade is the most popular in practice. 2H pencil is good for sketching guide lines and preliminary construction. Guideline and constructions need sharp points for consistency. Wooden pencils are cheap but it is not easy to maintain sharp and conical points on them. So, they need a pencil sharpener to keep their points sharp and conical. Freehand lettering, visible, and darkened lines do not need very sharply pointed pencils. H and HB pencils are good for darker accents.

#### *Eraser*

Fig. 1b shows an eraser. Erasers are used to erase lines or letters not needed or created in error. Manual and electric erasers are available. The manual erasers come in different shapes and sizes as well as different grades. Good quality eraser is preferred for use with drawings. Erasing is not encouraged in

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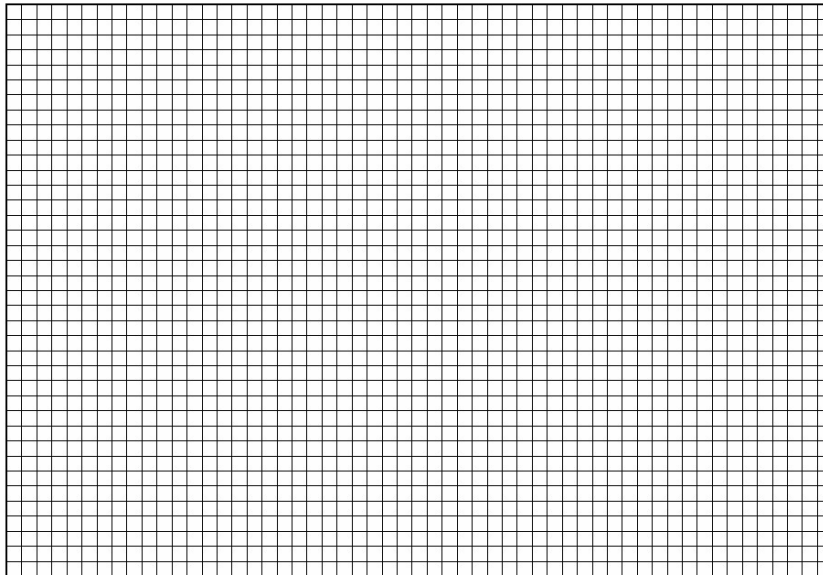
sketching but situations may and sometimes do arise when erasers are used to erase lines or letters not needed or created in error.

### *Pencil Sharpener*

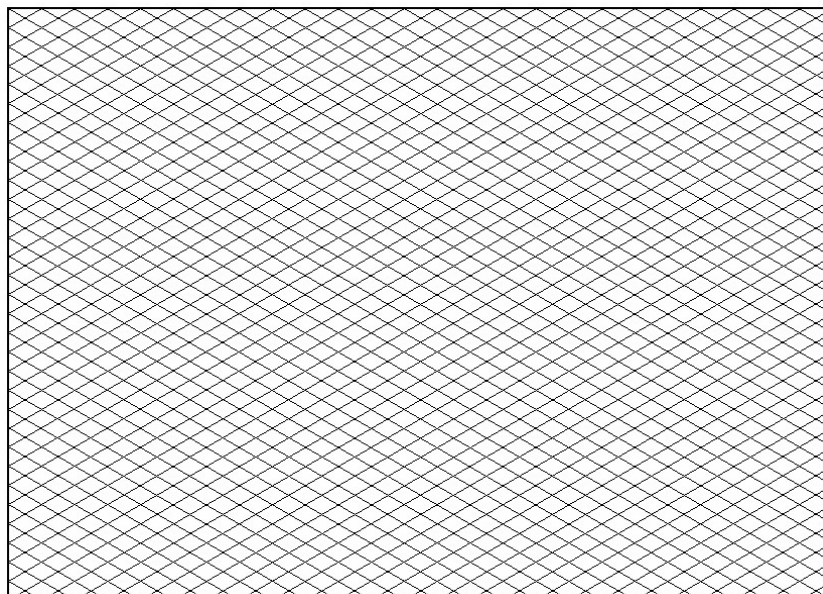
Wooden pencils and lead sticks need sharpening to keep their points sharp and conical and the pencil sharpener is used for this purpose. Pencil sharpeners of various types including electric types are available. Lettering and darkened lines do not need very sharply pointed pencils. Fig. 1c shows a type of pencil sharpener commonly used on wooden pencils. Note that mechanical pencils do not need to be sharpened.

### *Paper*

Though sketches and drawings may be done on a variety of paper media, good quality types are preferred. Plain papers are good for all types of technical drawing but should be preferably used for freehand sketches and exploratory design drawings. Grid papers are especially helpful for good alignment and proportioning of features on drawings. The orthogrid and isogrid papers (Fig. 2) are very common. The orthogrid paper depicted in Fig. 2a has guidelines at  $90^\circ$  to each other for orthographic views while the isogrid paper depicted in Fig. 2b has inclined guidelines for isometric views. Tracing paper is a translucent medium that is good when the need to reduce repetitive work is considerable. It can also be used to obtain a final sketch if the original sketch was drawn on a grid paper. The grid background is not traced in this case. Tracing is a fast and accurate method of reproducing existing drawing manually.



a) Orthogrid paper



b) Isogrid paper

Fig. 2 Grid papers

### SKETCHING TECHNIQUES

The ability to execute quick, accurate and clear sketches of ideas and design is a desirable skill for everyone. Engineers and designers use sketches at the early stages of design to organize and record their ideas when solving design problems and to indicate changes and modifications to existing designs. Most engineers use freehand sketches to communicate with designers and drafters. Drafters use it to clarify designs and offer suggestions for changes in design to engineers. Executives use freehand sketches virtually everyday to explain their ideas to their assistants. The ability to create sketches with good proportions quickly is a necessary skill for all technical professionals.

Sketches may be good for several uses such as 1) capture ideas or mental images; 2) explore, clarify and solidify ideas; 3) emphasize design details; 4) communicate ideas; 5) record/document ideas; and 6) as historical and legal document.

#### **Freehand Lettering**

Creating characters or letters with freehand is called manual lettering. Sketches often need notes for clarity and notes are created by combining characters into words, and words into sentences. Good freehand lettering is an important skill for drafters, designers, architects, and engineers. This is because good lettering enhances the attractiveness and quality of technical documents. First impressions are lasting and good lettering is a means to making good first impression. Good lettering helps better communications and some of the important factors in freehand lettering that can lead to better communications are:

- Aspect ratio is the ratio of character height to width. Common values are 5/6, 1, and 4/3.
- Character spacing is the gap between characters. It should appear equal.
- Word spacing is the gap between words. It should be roughly equal to character height.
- Line spacing is the gap between lines. It should be half to full character height.
- Sentence spacing is the gap between sentences. It should be about twice the character height.
- Guidelines should be used for refined lettering.
- Inclined letters should be at 68° from the horizontal.

Fig. 3 shows the strokes for freehand lettering of the alphabets and numbers. Practice lettering using these strokes as guides.



Fig. 3 Strokes for freehand lettering

#### **Types of Technical Sketches**

There are two types of sketches, namely rough and refined. A rough sketch is an informal sketch is created freehand and is used to capture design idea or essence of thought. This is sometimes called ideation sketch and may be annotated. A refined sketch is created with the aid of some basic instruments and it is sometimes called document Sketch. It is a formal sketch that is neat and is used for communication and documentation purposes. Sketching packages are available in CAD and are great tools for creating refined

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sketches. CAD is the focus in a later next chapter. A rough sketch may be converted to a refined sketch by using tracing paper, pencil, ruler, and compass. Table 1 compares rough and refined sketches.

Rough Sketch	Refined Sketch
Created freehand	Often created with aid of instruments or grid paper
Captures design ideas	Documents design ideas
Records design evolution	Communicates design ideas
Approximate proportion	Neat with correct proportions
Mainly for personal use	Suitable for public use

Table 1: Rough and refined sketching

Technical sketching skills should include the ability to 1) sketch graphic elements and shapes; 2) complete partial drawings; 3) sketch multiviews and pictorials from physical object; 4) sketch multiviews and pictorials from existing drawings; and 5) Sketch multiviews and pictorials from imaginations. This chapter focuses on freehand sketching of graphic elements and basic shapes. This is because, the ability to create these entities is fundamental for the preparation of orthographic and pictorial sketches and drawings. Freehand sketching is used in the field very often and also in taking notes from existing drawings or verbal instructions from a client. Sketching skills in orthographic and isometric drawings are expected to be developed as these topics are treated in later chapters. It is therefore, strongly encouraged that assignments in these areas should preferably start with sketching. Technical sketching skills may be assessed by the level of mastery in 1) line quality (black, crisp, consistent, 2) use of linestyles; 3) quality of lines and curves; 4) precedence of lines; 5) location of axes; 7) location and alignments of multiviews; 8) proportion and feature placement.

### Sketching Graphic Elements and Shapes

Freehand sketching is a very useful skill that one can develop. This is because very few guidelines need be practiced to acquire good freehand sketching. With a sharp pointed pencil (H or HB grade) and paper, freehand sketching may be done quickly after some good practice. The pencil should rest on the second finger while being held loosely with the thumb and index finger about 20 to 25 mm from the point. Using guidelines is encouraged for beginners. If grid papers are available, then they should be used as the grid lines form needed guidelines. When sketches begin to take good shapes with sharp lines and arcs, the use of grid paper may be discontinued.

Developing freehand sketching skills may be enhanced by the use of the rule of 2 or the rule of 3. The rule of 2 is a stepwise division of a distance or angle by 2. For instance in Fig. 4a, the distance between point A and point B is first divided into 2. Then the resulting half distances are each divided by 2. This process may be continued until one reaches a gap considered satisfactory. The rule of 3 is applied in the same manner as the rule of 2, except that two points instead of one are added to the previous gap each time. Fig. 5b illustrates this concept.

#### Sketching Lines

Fig. 4 illustrates freehand sketching of horizontal, vertical, and inclined lines. The start point is A and the end point is B. The rule of 2 is used in adding more points between points A and B. The steps involved are:

1. Place paper on portable board or table surface.
2. Create start point and end point.
3. Add more points using the rule of two till points are about 3" – 4" (75 mm – 100 mm) apart.
4. Use the pencil to draw light strokes from point to point beginning from start point to end point.
5. Use last point as visual guide when stroking.
6. Make the line dark.

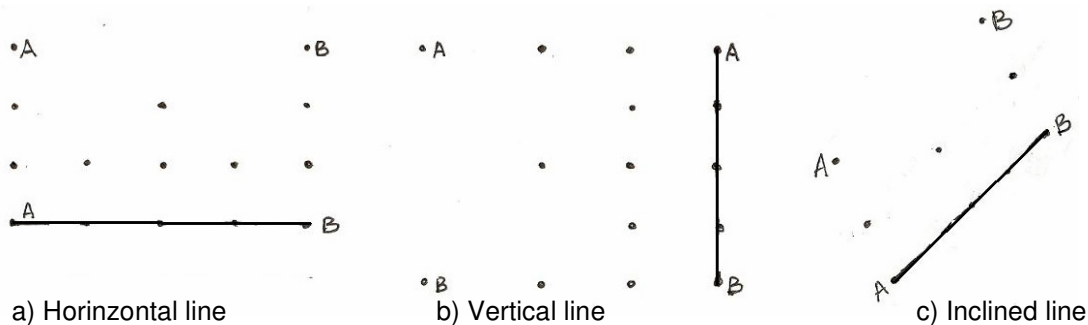


Fig.4 Line sketching

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### Sketching Angles

Fig. 5a illustrates freehand sketching of  $45^\circ$  and  $22.5^\circ$  angles. The starting vertical and horizontal lines are guidelines with known angle of  $90^\circ$ . Since  $45^\circ$  is half of  $90^\circ$  and  $22.5^\circ$  is half of  $45^\circ$ ; the rule of 2 is used. Fig. 5b illustrates freehand sketching of  $30^\circ$ . The starting vertical and horizontal lines are guidelines with known angle of  $90^\circ$ . Since  $30^\circ$  is a third of  $90^\circ$ ; the rule of 3 is used. Note  $10^\circ$  can be estimated from  $30^\circ$  using the rule of 3. Also  $15^\circ$  can be estimated from  $30^\circ$  using the rule of 2. Thus combining the rule of 2 and the rule of 3 gives more options. The steps involved in the sketching are:

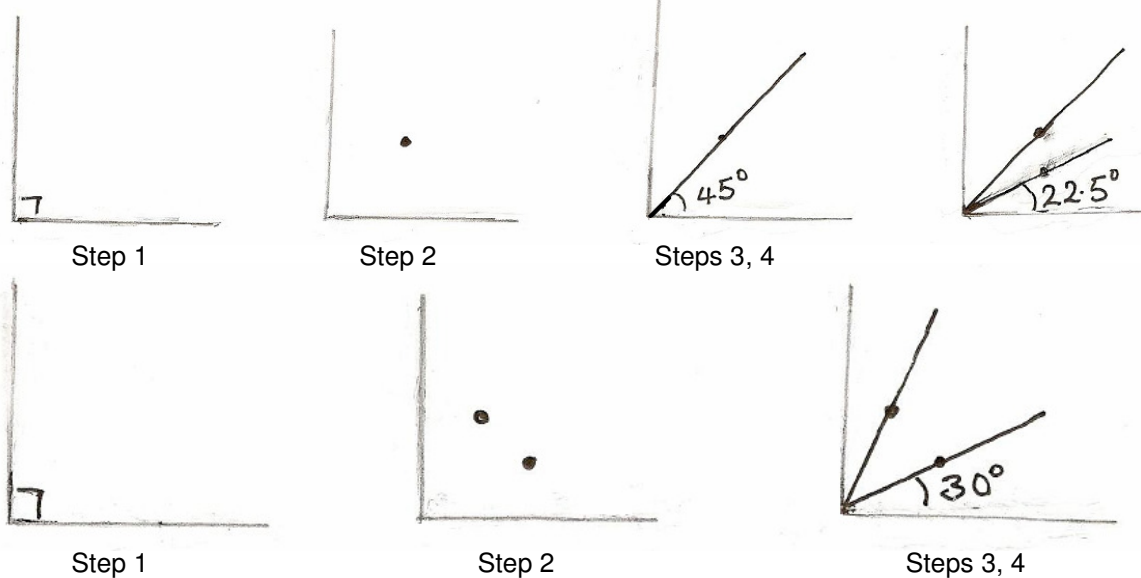


Fig. 5 Angle sketching

1. Sketch vertical and horizontal guidelines. The intercept is the origin.
- 2a. For angles of  $45^\circ$  or fractions of  $45^\circ$ , use the rule of two to create points between guidelines.
- 2b. For angles of  $30^\circ$  or fractions/multiples of  $30^\circ$ , use the rule of three to create points between guidelines.
3. Draw lines through the origin and the points created.
4. Darken the lines for the desired angle(s).

### Sketching Arcs

Arcs are often tangent to lines and other arcs or circles. Fig. 6 illustrates sketching an arc tangent to a horizontal line and a vertical line. The rule of two is used to locate an intermediate point between the start and end points of the arc. The steps for sketching the arc are:

1. Sketch vertical and horizontal guidelines. The intercept is the origin.
2. Draw an inclined dash line between the ends of the arc.
3. Use the rule of two to create a point between the inclined line and the origin.
4. Use light strokes to sketch the arc through the three points.
5. Darken the arc.

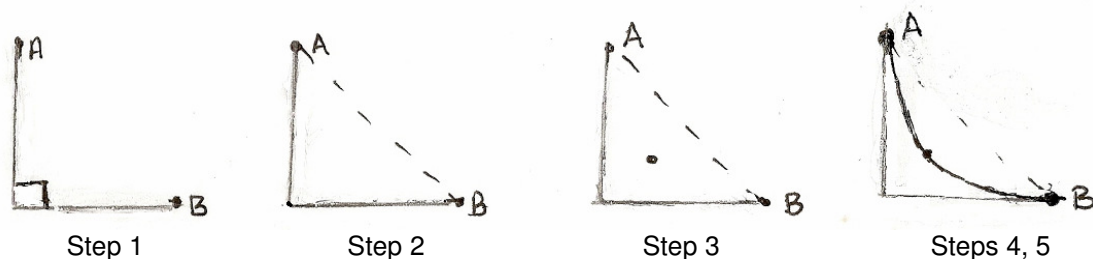


Fig. 6 Arc sketching

### Sketching Irregular Curves

Irregular curves like parabola, spiral, involute, etc are used in creating shapes or profiles of some components. For instance modern gear teeth have involute profiles. Hence sketching them is sometimes

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necessary. One can start by creating the start, in-between and end points. Then the rule of 2 can be used to add other points. With a comfortable number of points created, stroking and darkening of the curve can be done. Fig. 7 illustrates a technique with the following steps.

1. Create start point A, point B, and end point C.
2. Add more points using the rule of 2 till points are about 75 mm – 100 mm (3" – 4") apart.
3. Use the pencil to draw light strokes from point to point beginning from start point to end point.
4. Make the line dark.

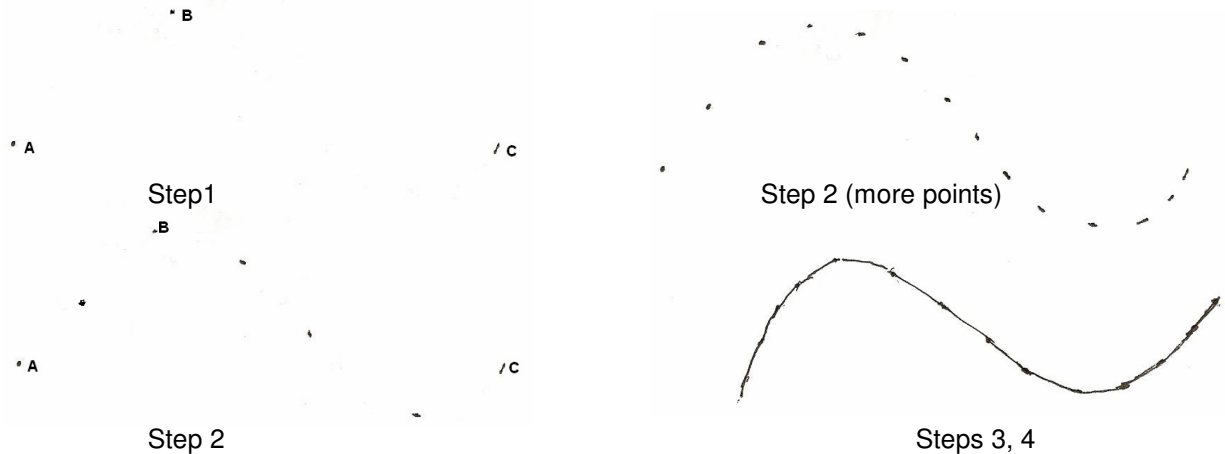


Fig. 7 Curve sketching

### Sketching Circles

Circles are common features in mechanical and non-mechanical products. Circles can be sketched in several ways but the technique for sketching an arc may be extended to the circle. This becomes the square-triangle technique and is illustrated in Fig. 8. The following steps are involved:

1. Sketch a square for the circle. Size of square is equal to diameter of circle.
2. Draw center lines on the square.
3. Draw diagonals in the four new squares.
4. Use the rule of two to create points between diagonals and outer square corners.
5. Use light strokes to sketch circle.
6. Darken the circle.

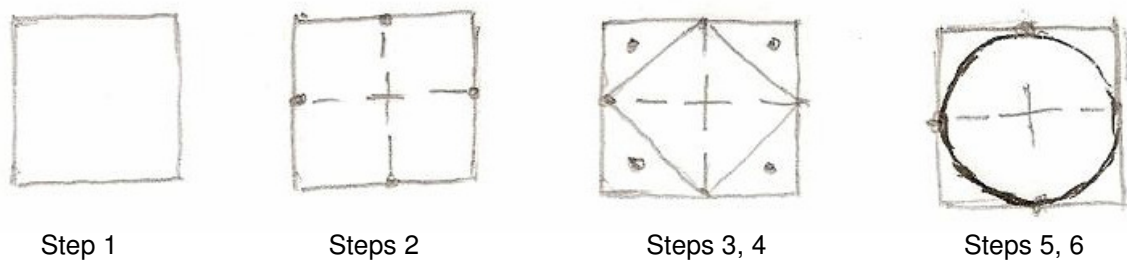


Fig. 8 Circle sketching

### Sketching Ellipses

Like circles are common features in component drawings, especially in isometric views. Ellipses sketched using the square-triangle technique as illustrated in Fig. 9. The following steps are involved:

1. Use the line sketching technique to draw a rectangle for the circle.
2. Draw horizontal and vertical lines through the center of square.
3. Use the rule of two to create more lines to intersect the diagonals.
4. Use light strokes to sketch ellipse.
5. Darken the ellipse.

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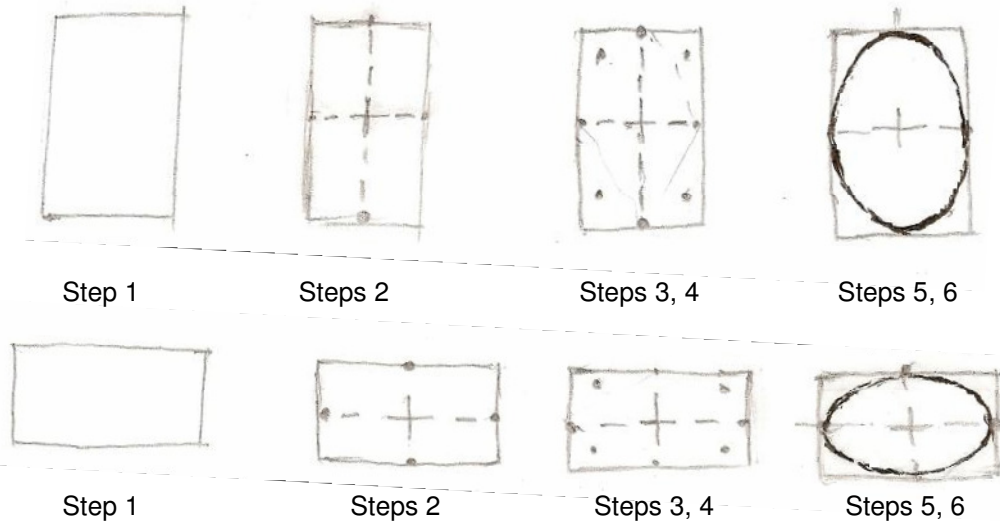


Fig. 9 Ellipse sketching

### Proportional Sketching

Sketching seeks to create images with visual appearance closely matching that of the intended object, though the size may be largely different. To ensure appropriate visual appearance, good proportion in feature sizes is very important. Hence the most important rule in basic sketching is “keep the sketch in proportion”. The overall or principal dimensions of object should be in the right proportion approximately for a good visual sketch model. Bad sketches are often the result when this rule is not kept. A sound approach is first to establish the aspect ratio, the proportion of the overall height to the overall width. Objects that are tall have high aspect ratios and objects that are wide have low aspect ratios. Once the relative proportion of overall width and height is established, the other features of the objects should be compared to these established sizes and sketched accordingly. The pencil may be used as a measuring tool to establish relative proportion for picture objects and old drawings. In field work, measurements can be made with appropriate instruments and proportions can be established from them. Where measurements are not possible, then visual comparison must be made to judge proportion. On the sketch paper, blocking is a common technique to creating proportional sketches. This is very helpful in sketching irregular objects. In the blocking technique, first give attention to the main proportions (main external outline), next to the general sizes of the features, then the direction of flow of shapes and curves and finally to the details of lines and arcs. Fig. 10 shows an application of blocking and proportioning techniques in sketching an irregular object.

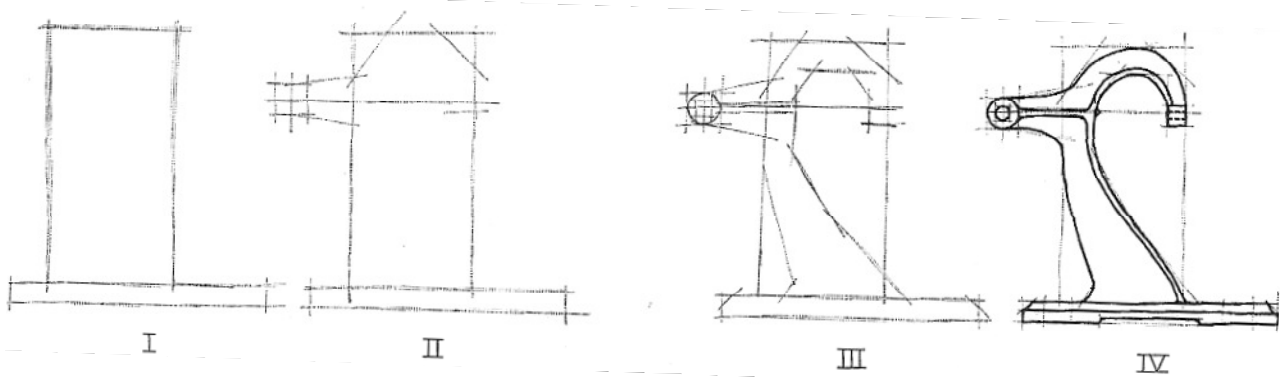


Fig. 10 Blocking and proportional sketching

## Summary

- Freehand or rough sketching is one of the essential skills that a design drafter, architect, or engineer should master and use effectively.
- Freehand sketching is a fast and easy for capturing design ideas.
- Freehand sketching helps in design visualization and problem solving.
- Sketches can be used to emphasize design details and communicate ideas.
- Sketches can be used to record/document ideas or as historical and legal document.
- Freehand sketching tools are minima: pencil, paper, pencil sharpener, and eraser.
- Mastering sketches of graphic elements and basic shapes is essential.
- The rule of 2 and the rule of 3 help in creating graphic elements.
- Using the square-triangle technique facilitates better sketches of shapes.
- Freehand sketches should have good proportions but not created to a scale.
- Develop the habit of starting a drawing with a freehand sketch.
- Grid papers are good and helpful for freehand sketching.
- The most important rule in basic sketching is “keep the sketch in proportion”.
- Basic drawing instruments can be used to create refined sketches.
- The computer is the best tool for refined sketching.

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