# Drafting Dictionary

#### Description

In this lesson the teacher will introduce the tools and equipment specific to board drafting. *Board drafting* (also known as *manual drafting*) refers to precision drawing with specialized instruments. It is expected that as part of this Activity Plan, the instructor will demonstrate the appropriate usage of each tool.

#### Lesson Objectives

The student will be able to:

* Introduce common drafting equipment and tools
* Demonstrate appropriate and correct tool usage

#### Assumptions

The teacher will have a general working knowledge of drafting tools and equipment. The student will have minimal knowledge of drafting equipment.

#### Terminology

**Compass**: a tool used to draw circles, bisect lines, and create dividing lines. Can be fitted with pencil leads or points.

**Drafting board**: a flat, smooth surface, designed with square, parallel edges that allow a

1. square to slide easily. Most boards are covered with a vinyl material to allow for even surfaces to which paper can be affixed.

**Drafting brush**: a hand brush used to sweep away debris from a drawing to prevent smearing.

**Drafting templates** (plants, furniture, circle, appliance standards): standardized cut-outs used to draw repeated shapes to scale.

**Eraser shield**: a micro-thin piece of metal with cut-outs that allow the user to erase detailed sections of a drawing without damage to the rest.

**French curve**: a rigid plastic template used to draw irregular curves or radii.

**Lettering guide**: a plastic template designed to assist in the drawing of uniform strings of letters for consistent, evenly spaced lettering.

**Masking tape** (drafting dots): used to hold drawing paper/vellum to the drafting board so it does not shift while drawing.

**Metric and imperial scale**: a three-faced ruler with a triangular base, used to reduce or enlarge drawings. The triangular scale ruler has more than one graduated scale and is used only as a measurement instrument, not as a ruler.



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**Protractor**: a semicircular template made of transparent plastic, used to measure angles.

**Spline**: a flexible plastic or rubber template with a metal core that can be shaped into most curves.

**Steel rule**: a straightedge made of rigid material, divided into specific increments. Can be found in metric and imperial measurement divisions.

**Triangles** (right angle and isosceles): hard, clear plastic triangular templates used to draw vertical lines as well as lines at set angles: 45°–90°–45°, 30°–60°–90°

* 1. **square**: a precision drawing instrument, used as a guide for other drafting equipment. Has a 90° angle where the head and blade attach.

#### Estimated Time

40–90 minutes

#### Recommended Number of Students

20, based on *BC Technology Educators’ Best Practice Guide*

#### Facilities

Regular classroom space with desks/chairs for all students, a projector with computer and speakers, and Internet access

#### Tools

* + - T-square
    - Metric and architectural scale
    - Steel rule
    - French curve
    - Triangles (right angle and isosceles)
    - Assorted drafting templates (plants, furniture, circle, appliance standards)
    - Eraser shield
    - Drafting brush
    - Protractor
    - Compass
    - Masking tape (drafting dots)
    - Drafting board
    - Lettering guide

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#### Materials

* Handout for students with images of equipment and descriptions of each. Use printout of PowerPoint presentation as handout (also available on the Youth Explore Trades Skills website as a PPT presentation and a PDF).

• 8.5" × 11" paper

* Computer
* Projector
* Whiteboard

#### Resources

* PowerPoint presentation for Drafting Dictionary

#### Teacher-led Activity

* Introduce each tool. Visual aids could be used to show each piece of equipment, or where available the tools themselves could be presented.
* List each tool’s use and demonstrate on whiteboard.
* Students could copy notes, or a handout could be created from the PowerPoint file.
* Review any feedback and questions with students.

#### Student Activity

Students will complete a quiz activity after the introductory lesson.

#### Assessment

Students will be assessed based on discussion participation and completion of quiz.

#### Appendix Acknowledgment

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# Appendix

**Describe the drafting tools and materials used in drawing plans**

Traditionally, drafters sat at drafting boards and used pencils, pens, compasses, protractors, triangles, and other drafting devices to prepare a drawing manually. Today, however, most professional drafters use computer-aided drafting (CAD) systems to prepare drawings. Although drafters use CAD extensively, it is only a tool. Drafters and tradespersons still need knowledge of traditional drafting tools and techniques.

## Tools

Drafting tools are needed to lay out the different shapes and lines used to create drawings and sketches. A basic knowledge of the available tools and how to use them will assist you in your drawing.

### Drafting board or table

The drafting board is an essential tool. Paper will be attached and kept straight and still, so the surface of the drafting board must be smooth and true, with no warps or twists. The surfaces of most drafting boards are covered with vinyl because it is smooth and even.

The drafting board or table should have two parallel outside working edges made of either hardwood or steel.

Most drafting table tops can be set at different heights from the floor and at any angle from vertical to horizontal. Other drafting tables may not have the same adjustments and may be limited to being raised only from horizontal to a low slope.

To reduce back strain, use an adjustable drafting stool when working at a drafting table. Tables or boards should be a minimum of 1.2 m (4') in width and 0.9 m (3') in height.

### T-square

The fixed head T-square is used for most work. It should be made of durable materials and have a transparent edge on the blade. To do accurate work, the blade must be perfectly square and straight; this should be checked regularly.

The T-square is used to draw horizontal lines and to align other drawing instruments. If you are right-handed, you hold it tight against the left edge of the drawing board and move it up

and down as required. When you make close adjustments, your fingers should be on top of the square and you should use your thumb to control the T-square’s movement (Figure 1).

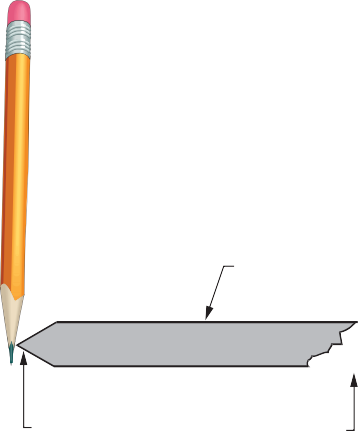


**Figure 1 —** Using a T-square

When drawing horizontal lines, incline your pencil in the direction you are drawing the line. Hold the pencil point as close as possible to the blade. Roll the pencil between your fingers to prevent the point from becoming flat on one side.

### Triangle

A triangle (set-square) is made of a clear plastic. Some triangles have rabbeted edges (Figure 2), so that when you draw lines, the corner of the edge is set away from the paper to help prevent smudges and ink blotches.



Triangle

Rabbeted edge

Paper

**Figure 2 —** Rabbeted edge

Triangles are available in 45°-90°-45° or 30°-60°-90° combinations. For most work, triangles should be about 200 mm to 250 mm (8" to 10") long. Triangles should be stored flat to prevent warping, and not stored underneath other objects to prevent any pressure from causing them to deform.

Check a triangle for accuracy by drawing a perpendicular line, then reversing the triangle and drawing another perpendicular line (Figure 3).

Twice the error

**Figure 3 —** Testing a triangle

Triangles are used to draw vertical lines and other lines at set angles. Rest the triangle on the T-square blade and slide it along the blade to the desired location. Draw the full length of the

vertical line in one pass if possible. Hold the blades of the T-square and the triangle together to prevent any movement when you are drawing, and hold the pencil point as close as possible to the triangle. You can also draw 15° and 75° angles by using both a 45°-90°-45° and a 30°-60°-90° in combination. Figure 4 shows how triangles are placed to draw angles that are every multiple of 15°.

90º

75º

60º

45º

30º

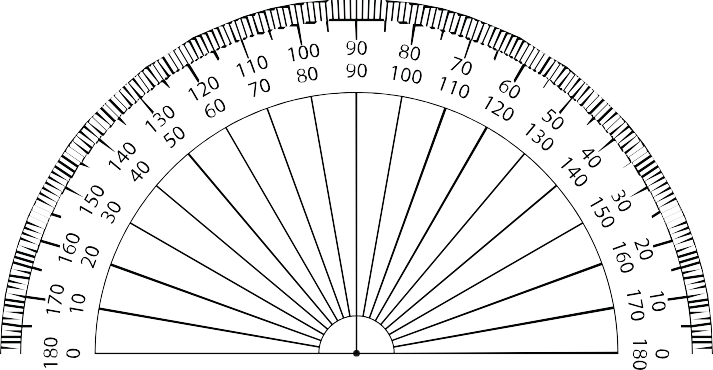
15º

0º

**Figure 4 —** Drawing angles with one or two triangles

### Protractor

A protractor (Figure 5) is an instrument used to measure angles. It is typically made of transparent plastic or glass. Protractors can be used for checking and transferring angles to and from a drawing sheet.



**Figure 5 —** Protractor

### Drafting machine

A drafting machine (Figure 6) is a device that is mounted to the drawing board. The drafting machine replaces the T-square and triangles, as it has rulers with angles that can be precisely adjusted with a controlling mechanism. A drafting machine allows easy drawing of parallel lines over the paper. The adjustable angle between the rulers allows the lines to be drawn in a variety of accurate angles. Rulers may also be used as a support for separate special rulers and letter templates. The rulers are replaceable and can be replaced with scale rulers.



**Figure 6 —** Drafting machine

### Drawing pencils

Both wood and mechanical pencils are used for drafting (Figure 7).

Manufacturers grade drawing pencils using numbers and letters. These range from 6B (very soft and black) to 9H (the hardest). From 6B the pencils progress through 5B, 4B, 3B, 2B, B, and HB, and then to F, the medium grade. After that they move to the harder graphite: H, 2H, 3H, 4H, 5H, 6H, 7H, 8H, and finally 9H. The softer grades are used for sketching and rendering drawings. The harder grades are used for instrument drawings.

Mechanical pencils do not require sharpening and are made to hold leads (they are actually made of graphite) that are bought separately. Thin-lead mechanical pencils, with leads as small as 0.5 mm, are available in different grades of lead. Most draftspersons use four or five different mechanical pencils with a different lead in each. The pencils come in different colours so it is easy to keep track of which lead is in each.



**Figure 7 —** Wood and mechanical pencils

### Erasers and erasing shields

The best eraser to use on drawings is either a soft pink eraser that has bevelled ends, or the white plastic eraser. Electric rotary erasers are also available. They permit easy erasure of small errors without erasing adjacent lines.

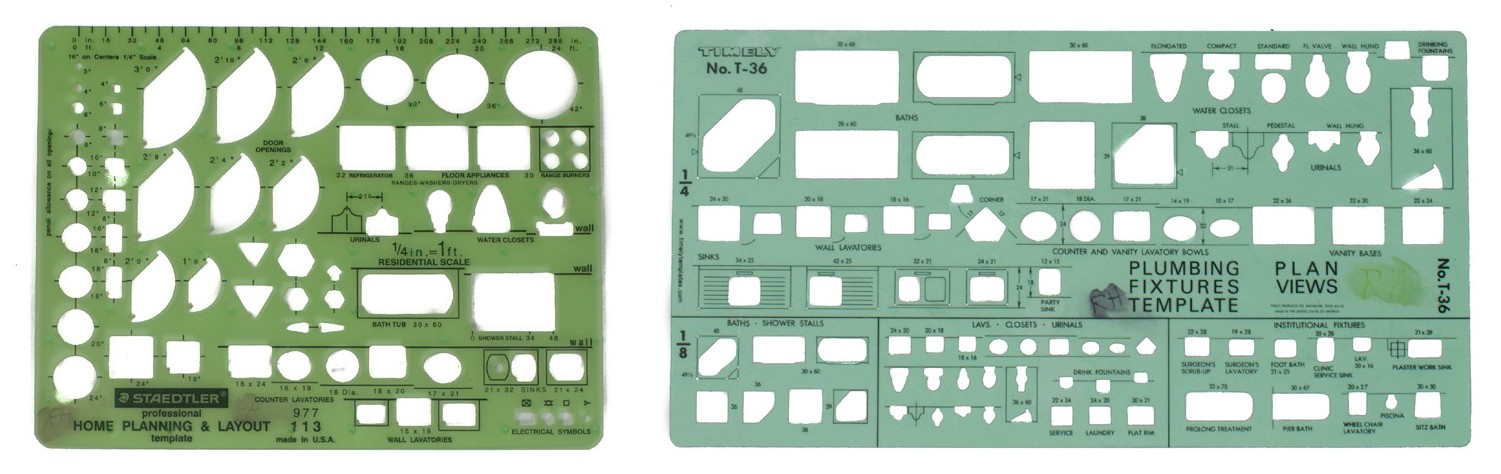
A metal erasing shield helps to confine erasures to the desired area. Erasing shields are made from very thin stainless steel and have holes of various shapes to accommodate the sections to be erased. Figure 8 shows two erasers and an erasing shield.



**Figure 8 —** Erasers and erasing shield

### Templates

Templates (Figure 9) are available for many different trades. Templates incorporate cut-outs of symbols and fixtures that are commonly used in that trade. These cut-outs make it easy to trace shapes onto drawing paper.



**Figure 9 —** Templates



### French curves and splines

A French curve (Figure 10) is a plastic template designed to help you draw curves. The French curve contains many different curves, but each one is represented over a very short distance only. One radius of curve blends

into another radius. It takes a lot of practice to use French curves effectively.

**Figure 10 —** French curve

A spline or flexible curve (Figure 11) can be used instead of a French curve to draw most curves. A spline is a plastic or rubber rod that is reinforced with metal. To use a spline, bend it to the shape of the curve you need. The design of the spline lets you hold a pencil against an edge and draw an accurate line without smudging. A spline cannot be used to draw curves that have a very short radius because the spline will not bend tightly.



**Figure 11 —** Spline

### Compass

A compass can be used for drawing circles, bisecting lines, or dividing angles. For very large circles you can use a beam compass. The four types of compasses are shown in Figure 12. Most compasses can be fitted with leads, pens, or points.



**Friction compass Bow compass**



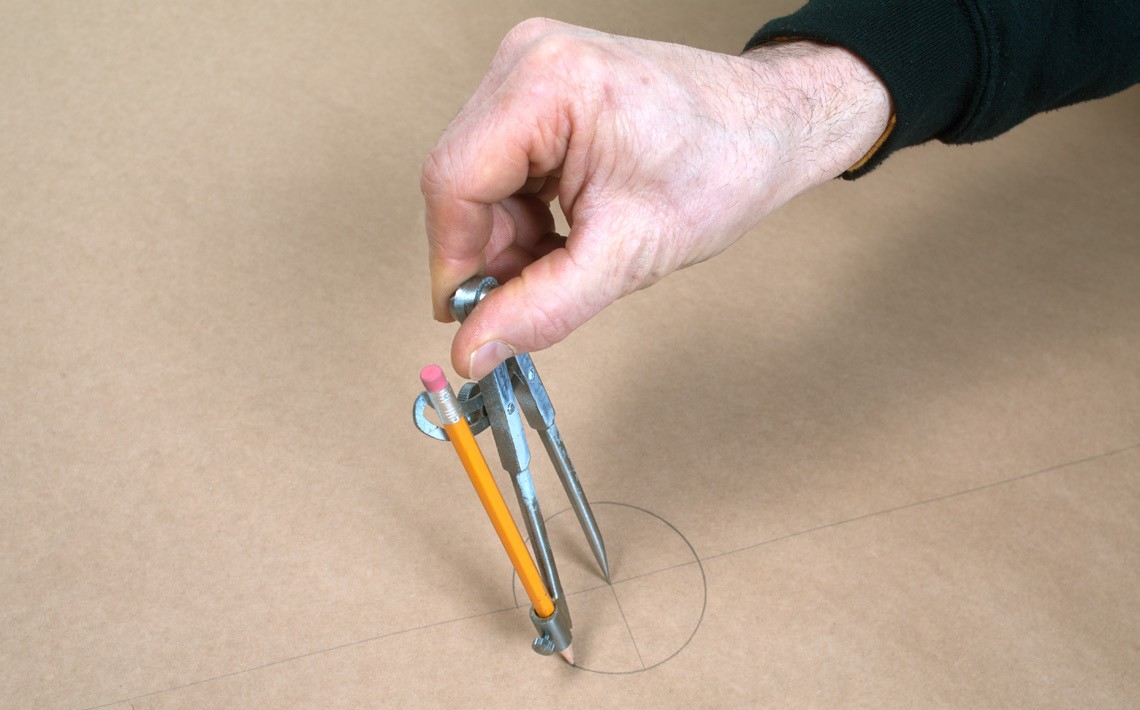
**Wing compass**



**Beam compass**

**Figure 12 —** Four types of compasses

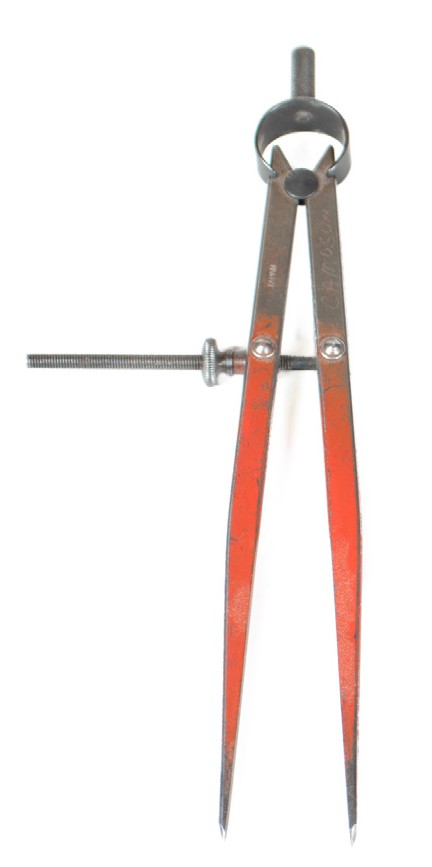
When using the compass, tilt it in the direction of the line, as shown in Figure 13.



**Figure 13 —** Drawing a circle with a compass

### Dividers

Dividers (Figure 14) are used for transferring dimensions from a drawing to a measuring device such as a ruler or scale. They are also used when scribing directly on material like metal.



**Figure 14 —** Dividers

### Dusting cloth or brush

It is very important to keep your drawings and drafting surface clean. When equipment gets dirty from the lead pencils, you should clean it regularly so that it does not smudge your drawings. Any soft, clean cloth is suitable. You may want to wash your board occasionally with a spray cleaner.

Use a brush like the one in Figure 15 to clean your table prior to placing paper down and to sweep away any debris as you are drawing. If you use your hand to brush, you could leave marks on the paper. After sharpening a pencil, wipe off any dust that is clinging to the point of the pencil to prevent smudging.

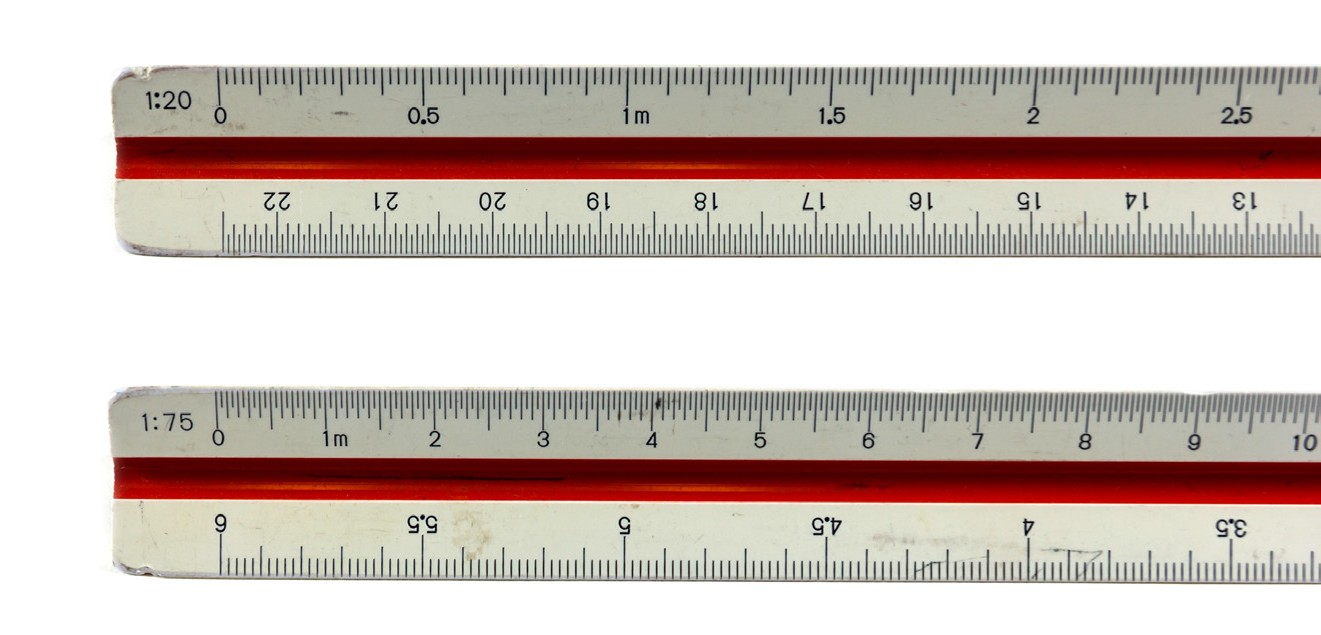


**Figure 15 —** Dusting brush

### Scale rulers

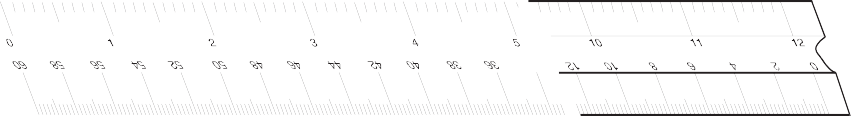
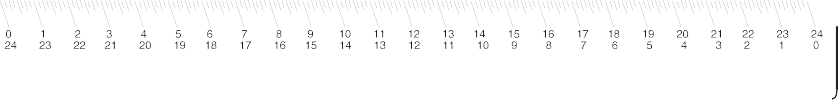
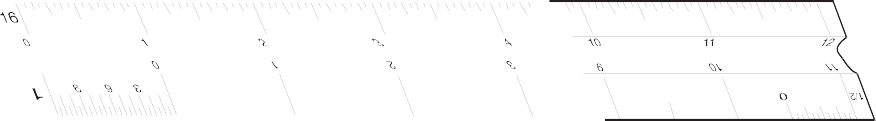
Scale rulers let you draw diagrams at a reduced scale. They also let you obtain dimensions from a scaled drawing. Scale rulers come in a variety of types to meet the requirements of many different kinds of work. Most scale rulers have three edges and six different scales. The scales are read from either end of the rule. A typical combination of metric scales is 1:20, 1:50, 1:100, 1:25, 1:75, and 1:125.

Because of the decimal basis of metric measurements, metric scale rulers are both applicable and easy to use at any scale. Figure 16 shows the two scales from both ends of the same side.



**Figure 16 —** Metric scale ruler

Imperial scale rulers may be an architect’s ruler, a mechanical engineer’s ruler, or a civil engineer’s ruler (Figure 17). The architect’s scale ruler is the most common, and is in inches and fractions of inches. A mechanical engineer’s scale ruler comes in inches and decimals of inches. A civil engineer’s scale ruler comes in feet and decimals of feet.



**Figure 17 —** Imperial scale rulers

## Drafting materials

The most common support for drawing is paper. Even though the original creative surface has changed from the drafting table to the computer screen, on the work site drawings are still primarily in printed form.

### Drawing paper

There is a wide variety of drawing paper available in many sizes and of different qualities.

Good quality drawing paper is acid-free and will not turn yellow with age. Light-coloured drawing papers are available in pale yellow or buff, but these should be used only when it is not necessary to make copies.

### Tracing paper

Tracing paper, which is transparent, can be used to make copies of drawings. It is thin enough to allow the light of photocopy machines to shine through the unmarked areas, and only the lines and figures will block the light. Materials used for tracing include tracing paper, vellum, tracing cloth, glass cloth, and polyester film with a matte finish.

##### Standard paper sizes

Paper sizes typically comply with one of two different standards: ISO (world standard) or ANSI/ ASME Y14 (American).

The standard ISO series of paper sizes is as follows: A0 841 mm × 1189 mm

A1 594 mm × 841 mm

A2 420 mm × 594 mm

A3 297 mm × 420 mm

A4 210 mm × 297 mm

A5 148 mm × 210 mm

The standard ANSI/ASME series of paper sizes is as follows: E 34 inch × 44 inch

D 22 inch × 34 inch

C 17 inch × 22 inch

B 11 inch × 17 inch

A 8.5 inch × 11 inch

The 81/2" × 11" standard letter paper corresponds to 216 mm × 279 mm. You can buy precut sheets that have a border and a preprinted title block in the lower right-hand corner. These are available in many standard sizes.

If the paper you use does not have a border and title block, you will have to draw them in. The left-hand border should be wider than the right-hand border and should be at least 50 mm wide to allow room for the prints to be bound. Figure 18 shows a title block with suitable dimensions added.

37 mm

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | TITLE | | | | |
| Revisions | | | |
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| 1 |  |  |  |
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| SCALE | DRN. BY | APPR. BY | DATE | DRNG. NO. |
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7 mm

16 mm

10 mm

35 mm 23 mm 22 mm 22 mm 34 mm

**Figure 18 —** Dimensions for title block

(Not to scale)

##### Paper rolls

Many grades of paper rolls are available in different widths that can be cut to any length required.

##### Drafting or masking tape

Use drafting or masking tape to hold the paper on the drafting surface. The tape should be attached at the corners to hold the sheet firmly stretched with no wrinkles. Only short pieces of tape are required.

## Computer drafting printing

Computer drafting programs are used effectively for all manner of drafting and have virtually replaced manual drafting. Small size computer-generated drawings can be printed on normal computer printers. However, larger drawings require a plotter. Older plotters used pencils, pens, or felt pens, but the new plotters are laser-based or jet printers and are capable of multiple colours. They are made to print all the sizes of drawings. Plotters also print well on vellum and some other non-paper media.

Now complete the Learning Task Self-Test.

Now complete the Student Activity.

# Student Activity

Complete the following quiz by filling in the descriptions of the tools and sketching images of each tool in the boxes provided.

1. Steel rule
2. T-square
3. Protractor
   * Checking and transferring angles to drawings
   * Calculating and measuring angles
4. Triangle (right angle & isosceles)
5. Eraser shield
   * Made from thin stainless steel
   * Allows you to erase specific areas
6. French curve/spline
   * Drawing of irregular curves

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1. Drafting brush
2. Compass
3. Drafting templates

* Made of plastic
* Standardization of shapes

1. Metric and imperial scales

* Allow you to draw a diagram at a reduced scale

1. Lettering guide

* Allows for uniform lettering

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