TITLE:- DRAWING SYMBOLS

LECTURER:-

DATE:-

EQUIPMENT:-

Technical drawings simplify the operations of many difficult and complex jobs. Good technical drawings explain to the person who is looking at them the details of the job, such as measurements, shapes, kinds of materials, quality of finished surfaces etc.

Because anyone who works on the job must understand the drawing perfectly, all symbols used on the drawings and also the manner in which they are used on the drawings have been standardised.

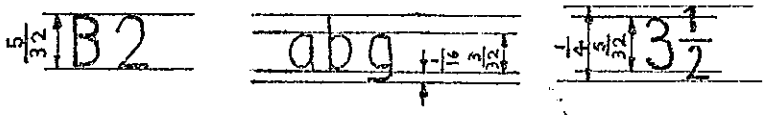
The following list shows the most common symbols, types of lines, notations, etc.

TYPES OF LINE

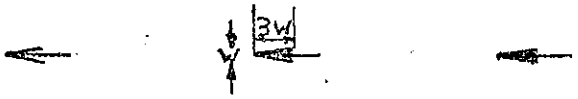
CONTINUOUS, THICK	———————	Visible outlines
SHORT DASHES, THIN	- - - - - - - - - - - - - -	Hidden outlines, Parts to be removed.
LONG CHAIN, THIN	—— · —— · ——	Centre-pitch-path lines to indicate motion.
LONG CHAIN, THICK	—— · —— · ——	Cutting or viewing planes
CONTINUOUS, THIN	———————	Dimension - Projection - extension - section lines
CONTINUOUS WAVY (FREEHAND THICK)	~~~~~~~~~~~~~~~	Break lines

Breaks indicate the shape and nature of material

Round Tube Timber



Acceptable formations and proportions of arrowheads



For normal use, the length should be from $\frac{1}{8}$" to 3/16" and the point should touch the extension line or outline

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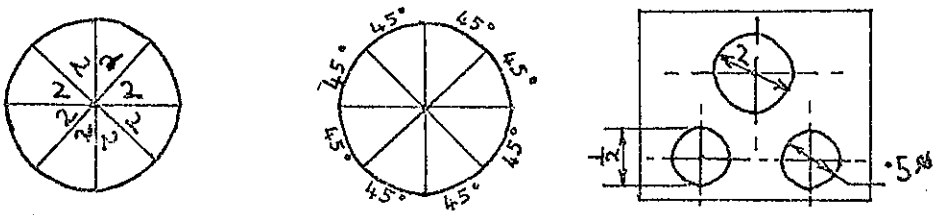
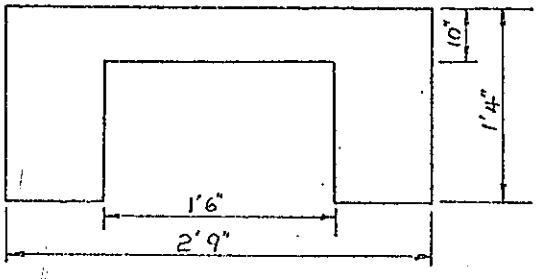


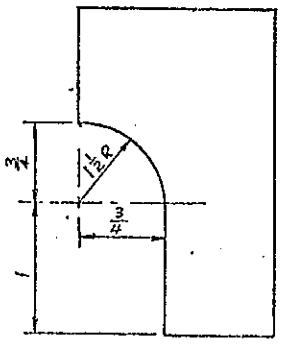
Linear figures change direction at Vertical

Angular figures change direction at horizontal

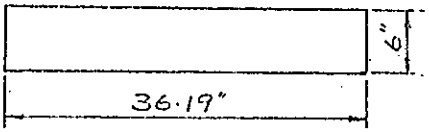
Hole diameters Dimensioning methods

The standard method of dimensioning is either in feet, inches, or metres and millimetres.

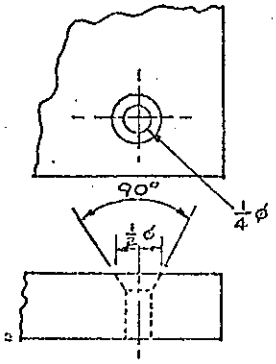




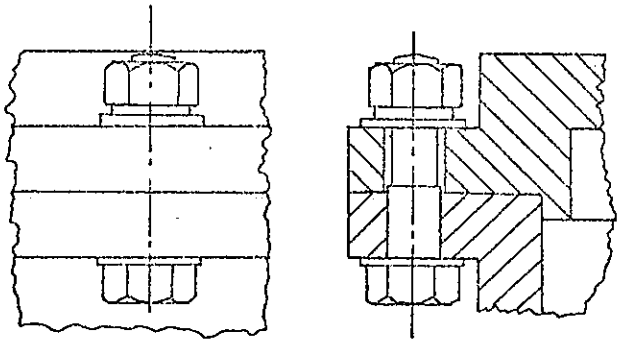
Where decimals are used, any figures preceding the decimal point should be given in inches, not feet and inches.

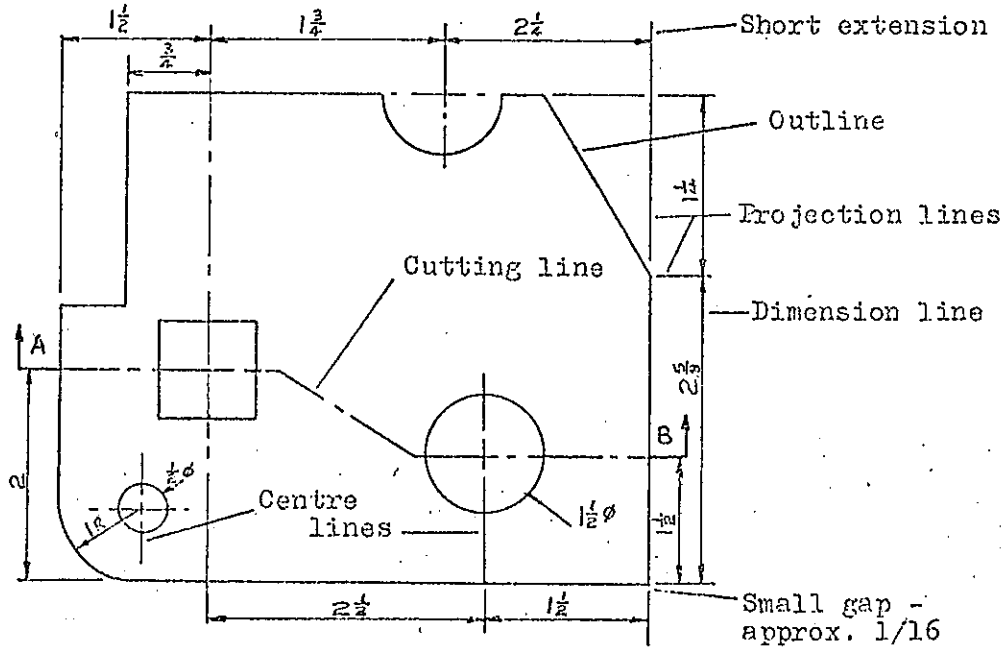


Assembly of nut, bolt, washer and spring washer.



Dimensioning a countersink





TITLE:- ORTHOGRAPHIC PROJECTION - FIRST ANGLE

LECTURER:-

DATE:-

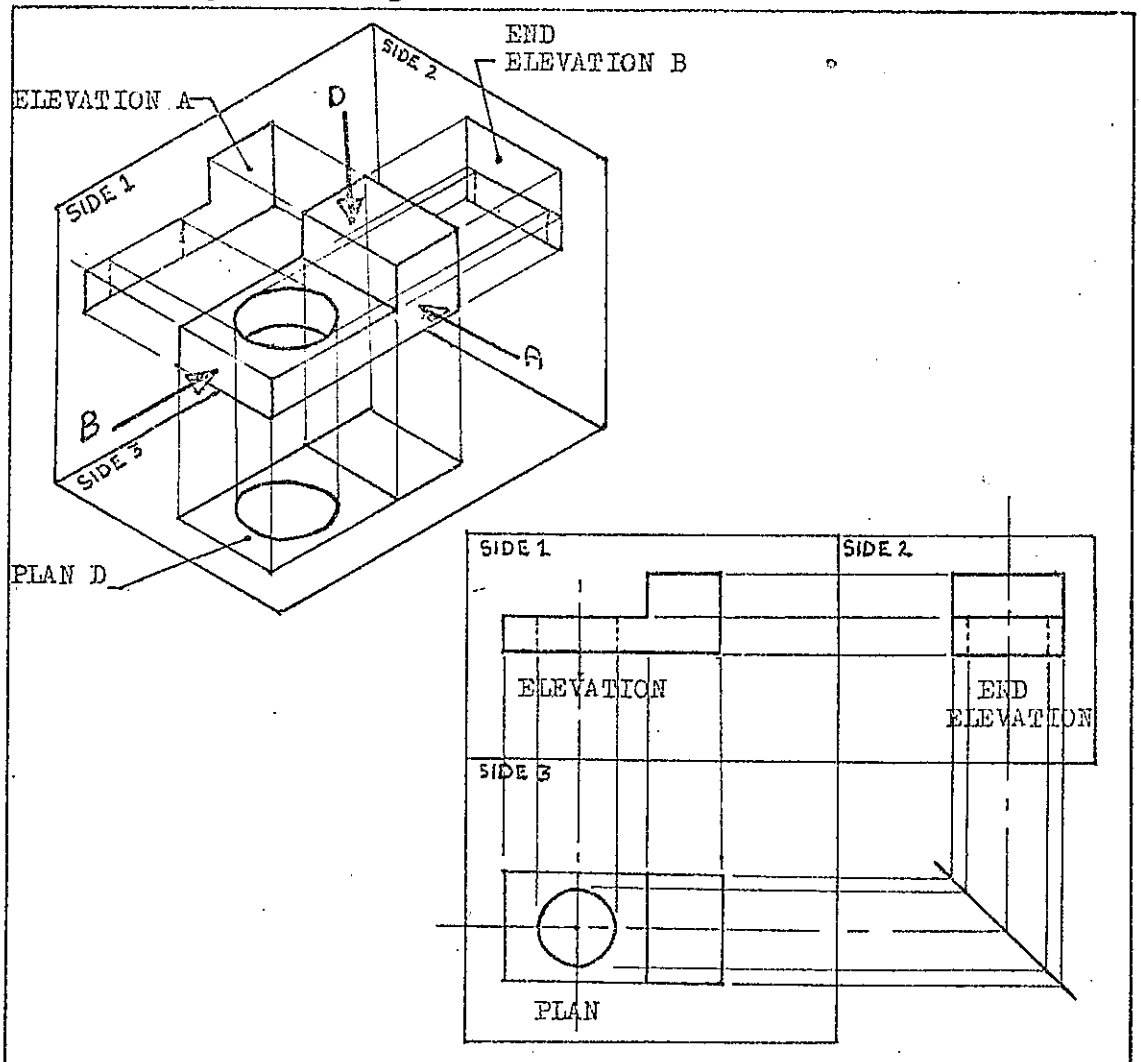
EQUIPMENT:-

Engineering or working drawings are made by the orthographic system. The name comes from the Greek words "Orthos" straight, and "Graphos" to draw. In this system the views are taken at right angles to each other, usually from three sides, and "projected" on to a surface directly behind the object on the plane from which it is being viewed.

With the first angle (English) system, the views are arranged as follows:-

1. ELEVATION:- The main view (front view) - drawn at the top of the sheet.
2. PLAN:- Top view - projected down from the elevation.
3. END ELEVATION:- Left hand end view - projected to the right of the elevation.

The following drawings illustrate how the views are obtained and also how they are arranged on the sheet.



ORTHOGRAPHIC PROJECTION

First angle method

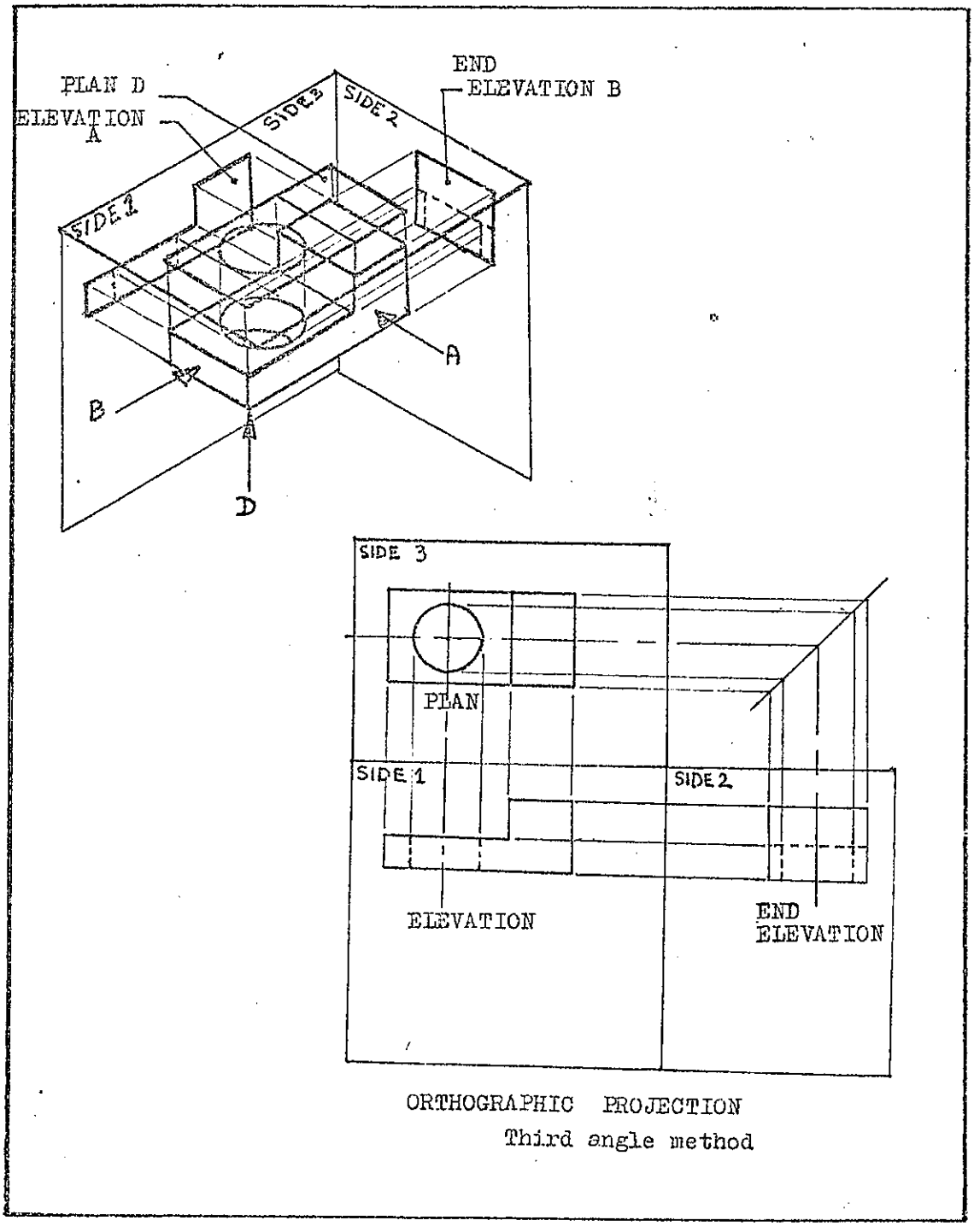
TITLE:- ORTHOGRAPHIC PROJECTION - THIRD ANGLE
LECTURER:-
DATE:-
EQUIPMENT:-

Third angle (American) differs from first angle in two ways:-

(1) Placement of views on sheet - plan is drawn at top of the sheet, elevation at the bottom, end elevation bottom right.

(2) END elevation is viewed from right hand end.

The method used should be the one which will supply the most details.



ORTHOGRAPHIC PROJECTION
Third angle method

TITLE:- ISOMETRIC DRAWINGS

LECTURER:-

DATE:-

EQUIPMENT:-

Perspective drawing is not very useful for showing constructional details because it shows the object as it appears and not as it really is. Parralel lines appear to converge. Three dimensions can be shown but because of foreshortening, direct measurements cannot be made.

Perspective drawings are used by artists for illustrations and by architects for representing proposed buildings.

Isometric drawings have some similarity to perspective drawings but are more easily made. Although they have the disadvantage of giving a distorted appearance to the object, they are easily interpreted and are a definite aid in forming a correct image of the object.

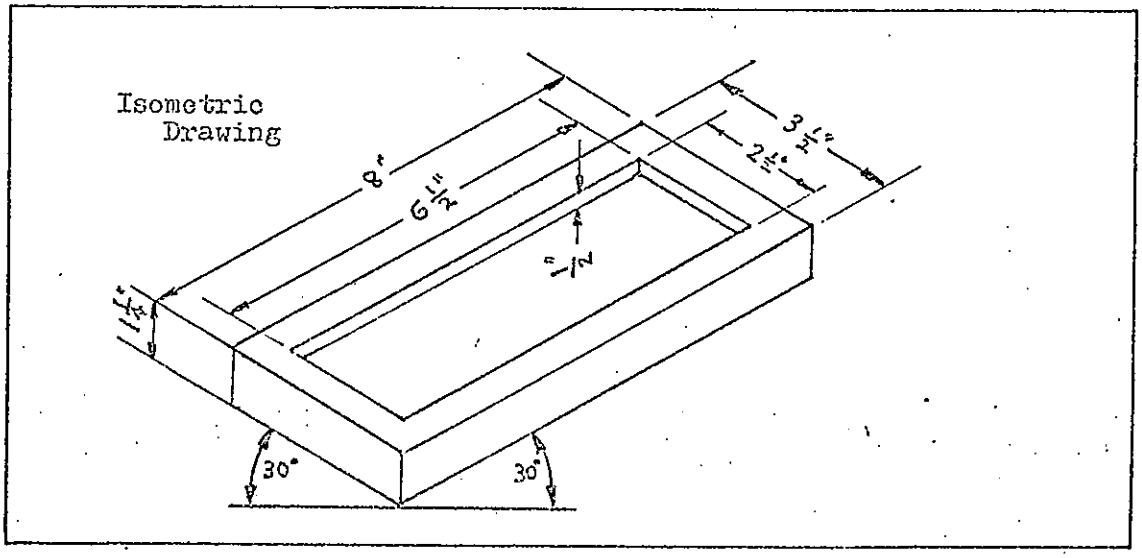
Isometric means equal measure (all main lines are at equal angles to each other).

Rules for Isometric drawing of objects which have angles of 90^{o}.

(a) Lines which were vertical remain vertical.
(b) Previously horizontal lines are shown at 30^{o} to the horizontal.
(c) Parallel lines remain parallel.
(d) The lengths of all the lines remain the same as, or if drawn proportional to, the original length.
(e) The regulating point is always the first to be marked when commencing an isometric drawing.
(f) Hidden lines should not be shown on isometric drawings, with a few exceptions.
(g) Isometric dimensioning
    (1) Extension and dimension lines must be drawn isometrically.
    (2) The extension lines must be drawn in the plane of the measurements to which they apply.
    (3) Dimension lines must be parallel to the direction of measurement.
    (4) Dimensions on the object within the outline, are often clearer when so placed.

Pictorial Drawing

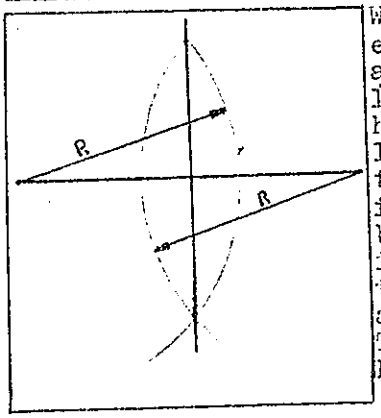
Both Perspective and Isometric drawings are known as pictorial drawings. They often enable one whose mind is not sufficiently trained, to read drawings. i.e. to visualize the form of an object with ease.



TITLE:- GEOMETRIC CONSTRUCTION
LECTURER:- GERRY HEYNES
DATE:- 20-2-81
EQUIPMENT:- Compass, rule, pencil

Straight Lines - Often it is necessary to divide a line into a number of equal parts. This is easy if the line is of a length that can be divided by a rule, but becomes harder if the line is an awkward length.

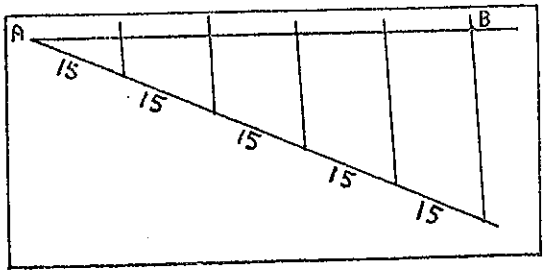
To bisect a straight line



When a line is required to be divided into two equal parts, compasses can be used accurately and quickly to bisect the line. For a given line, set compasses to any setting longer than half the length of the line. From L.H. end of line draw two arcs, one above and one below the line. Repeat from R.H. end without altering compass setting and mark points above and below the line where the two pairs of arcs intersect. Draw a straight line between these two points. This line now bisects the first at an angle of 90^{o}.
This operation can be repeated for the two halves to quadrisect the line.

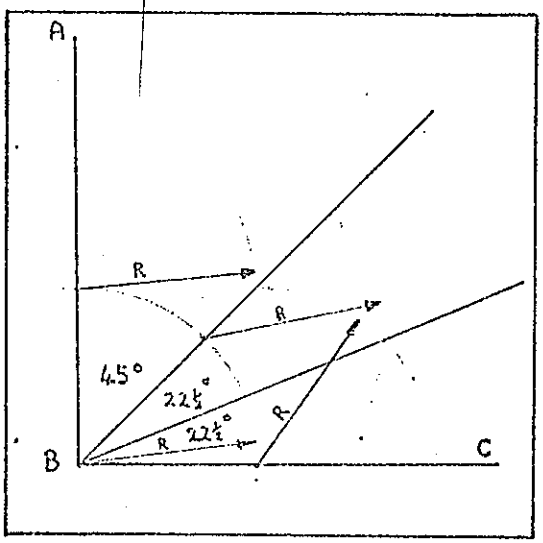
Dividing a line - Geometric method

It is sometimes necessary to divide a line into an odd number of parts which cannot be readily measured. Take a line A-B. From A draw a straight line to any convenient length and at any convenient angle (usually about 20^{o} and below 40^{o}). To divide the line into say five equal parts, set compasses to any convenient length, (approx. 1/5 of A-B), and step off five lengths on second line. Correct fifth point on second line to B, then draw parallel lines from other four points through A-B. Where these lines intersect A-B, the line is divided into five equal parts.



Angles - In engineering drawing, it often becomes necessary to construct angles at which lines converge or diverge from one another. The common angles of 15^{o}, 30^{o}, 45^{o}, 60^{o}, 75^{o} and 90^{o} can be constructed using set squares. They can also be constructed using compasses. Any other angles can be found using a protractor.

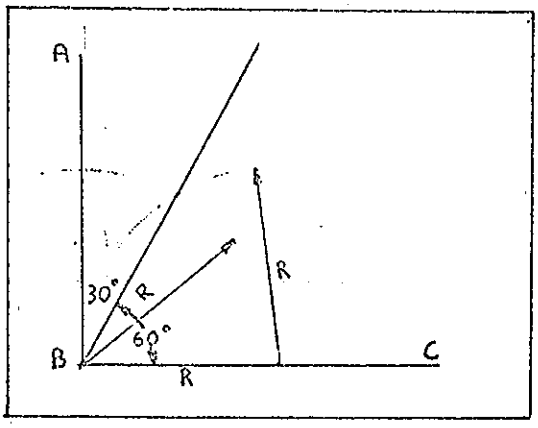
Construction of 45°, $22\frac{1}{2}^{\circ}$ with Compasses



Bisection of angles To bisect an angle of 90° using compasses, take two lines meeting at 90° (AB and BC), the intersection being at B. With compasses at equal setting, scribe two arcs from B to intersect both lines, and then with compasses on same setting, scribe two more arcs to intersect each other from the points where the first arcs cut the lines. From B draw a straight line through the point where the arcs intersect each other. This line now bisects the original 90° angle.

This method can be used for any acute angle. With an obtuse angle the compasses must be set at a larger size before scribing the second pair of arcs to intersect each other.

Construction of 15°, 30°, 60°, 75°, with compasses.



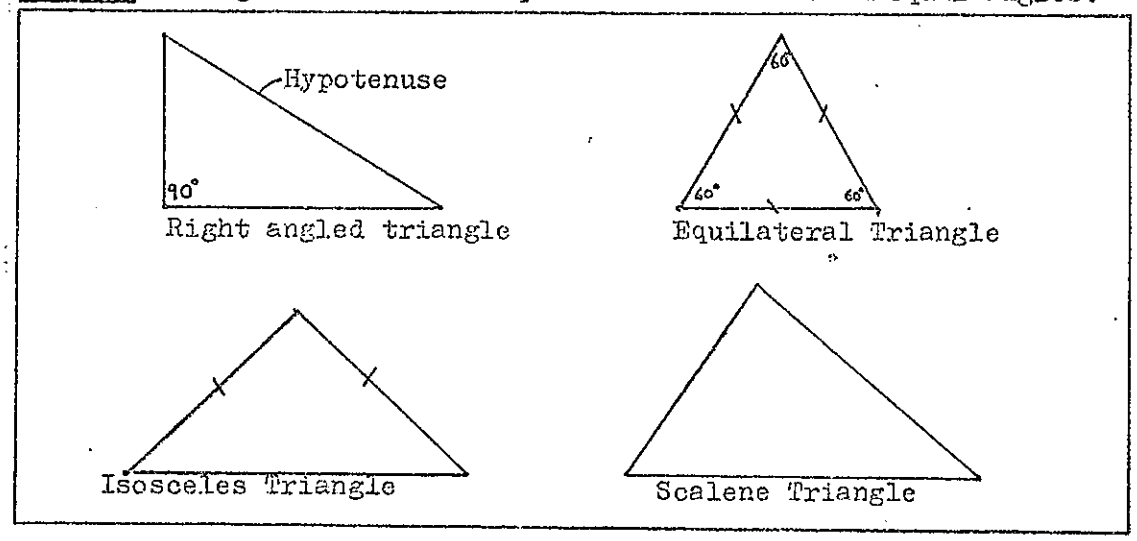
To construct 15°, 75° angle bisect 30° angle using above method.

TITLE:- TRIANGLES, QUADRILATERALS & POLYGONS
LECTURER:- GERRY HENNIS
DATE:- 20-2-81
EQUIPMENT:- Drawing Set

Triangles are figures which have three straight sides and three included angles.
The three angles of any triangle always add up to 180°.

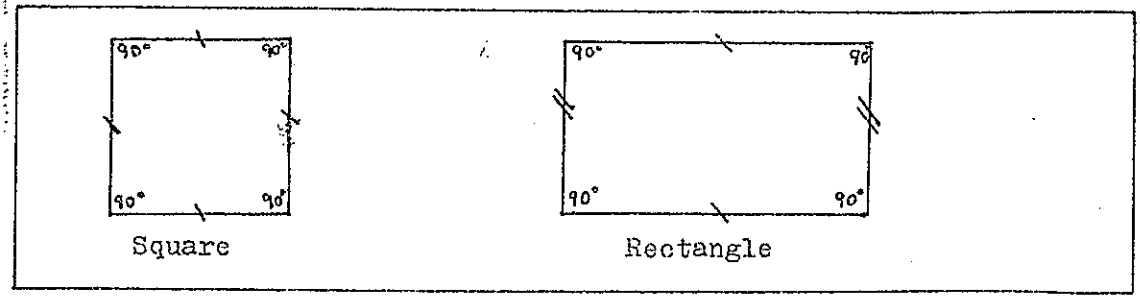
Types

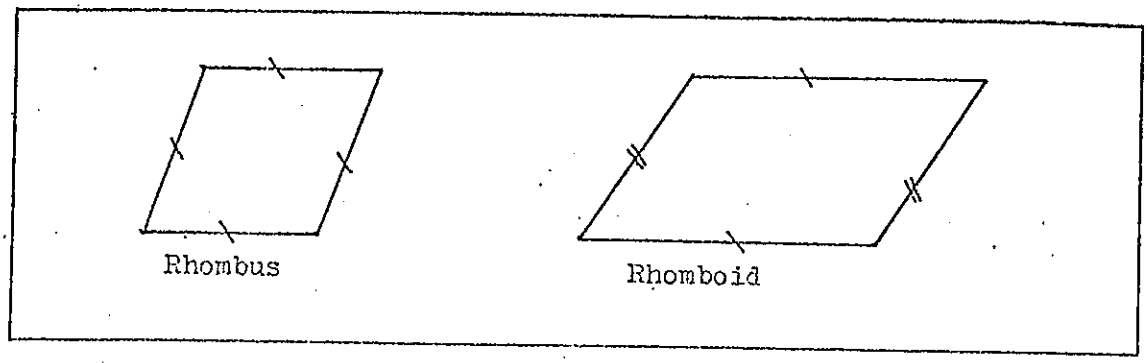
Right angled A triangle in which one of the angles is 90° is a right angled triangle. The side opposite the 90° angle is called the hypotenuse. Any right angled triangle can be fitted in a semi-circle.
Equilateral triangle has its three sides of equal length and its three angles are all 60°.
Isosceles triangle has two sides equal and two angles equal.
Scalene triangle has three unequal sides and three unequal angles.



Quadrilaterals are plane figures bounded by four straight sides.
Definitions

A square is a four sided figure which has all of its sides equal and all of its angles right angles.
A rectangle is a four sided figure with its opposite sides equal to each other and parallel to each other and all its angles are right angles. Often called an oblong.
A rhombus is a four sided figure which has all its sides equal and opposite sides parallel and none of its angles are right angles.
A rhomboid is a four sided figure which has its opposite sides equal and parallel and none of its angles are right angles.
When only two sides of a quadrilateral are parallel to each other, the figure is known as a trapezium.
When none of the sides of a quadrilateral are parallel to each other, the figure is known as a trapezoid.
If the opposite sides of a quadrilateral are parallel to each other, the figure is known as a parallelogram.





Polygons are plane figures bounded by more than four straight lines. If all of the sides and angles are equal, the figure is termed a regular polygon.
Polygons are named according to their number of sides.
The more common are:-

Pentagon	-	has five sides
Hexagon	-	has six sides
Heptagon	-	has seven sides
Octagon	-	has eight sides
Nonagon	-	has nine sides.

Of the above, the hexagon is by far the most common since nearly all nuts and bolt heads are hexagonal.

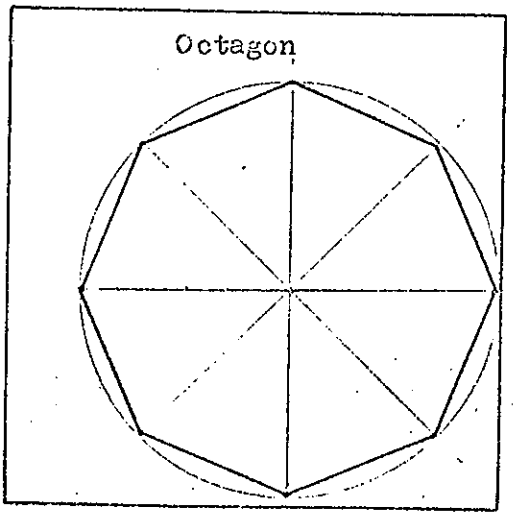
Construction

(1) The hexagon, having six equal sides will have six equal angles each of 60°. It is therefore very easy to construct either by means of 60° set square or by using compasses.
It may be constructed within a circle (inscribed) or about a circle (circumscribed) by means of a set square.

Inscribed hexagon using compasses
Allowing for curvature, it has been found that the radius divides into the circumference six times. Therefore, if a circle is drawn, six divisions can be stepped off with compasses, each one being equal to the radius.

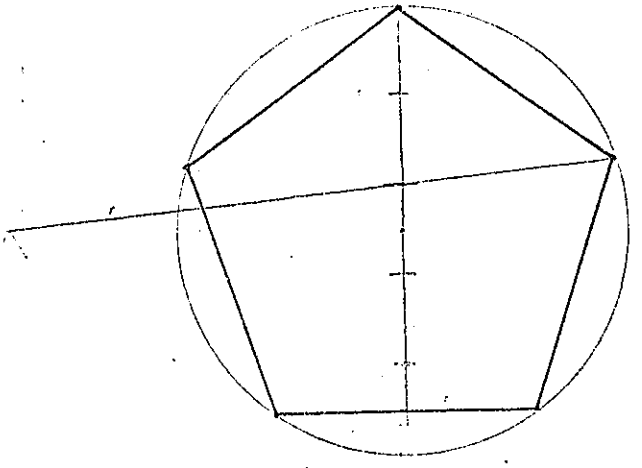
(2) The octagon. Next to the hexagon, this is the most commonly used polygon. It has eight sides and eight angles, each angle equals 45°. This figure can easily be constructed by using a tee square and 45° set square or by using compasses.

Circumscribed octagon using compasses
Draw circle. Box in the circle using parallel lines at right angles to each other. From corners of the box draw in arcs to cut sides of box with their radii being equal to the distance from the corner of the box to the centre of the circle. The points of intersection of the arcs and the sides of the square can now be connected to form the octagon.



To construct a regular polygon in a circle.
A polygon is a figure bounded by more than four straight lines. Regular polygons have all sides and all angles equal. Draw diameter through the circle. Divide the diameter line into the same number of equal parts as the figure has sides; say Five. With

compasses set at the length of the diameter, draw an arc from the point at which diameter cuts circumference. Keep compass setting unchanged, draw arc from other end of diameter to cut the first arc. From the point where these two arcs coincide, draw a straight line through the second division on the diameter line and extend it to cut circumference.
With compasses set to distance between this last point on circumference to be mentioned and where diameter cuts circumference, step off the five sides around the circle.



Construction of a regular Polygon in a circle