Triangles

Definition:

The triangle is a plane figure bounded by three straight sides.

A scalene triangle is a triangle with three unequal sides and unequal angles.

An isosceles triangle is a triangle with two sides, and hence two angles, equal.

An equilateral triangle is a triangle with all sides, and hence all the angles, equal.

A right-angled triangle is a triangle containing one right angle. The side opposite the right angle is called the hypotenuse.

Triangles are congruent if:

The three sides are equal in length.

Two sides and the included angle are equal.

One side and the angles at its extremities are equal.

In a right angled triangle if the length of the hypotenuse and one other side are equal.

Similar triangles:

Similar shape but of different size.

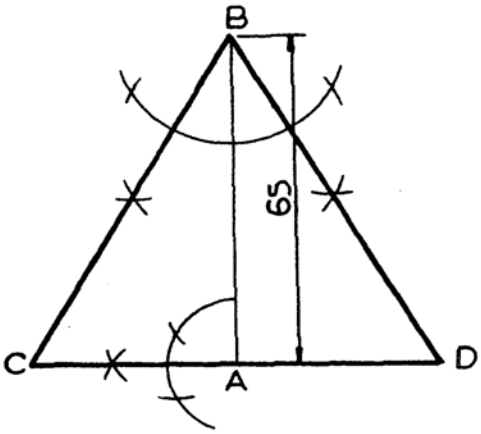
Their angles are all equal and their sides are in proportion.

Triangles 1.

Draw an equilateral triangle with an altitude of 65mm.

Procedure:

Draw the given altitude AB, and construct a base line. With centre B strike any radius and mark off 30º or use your 30/60 setsquares.

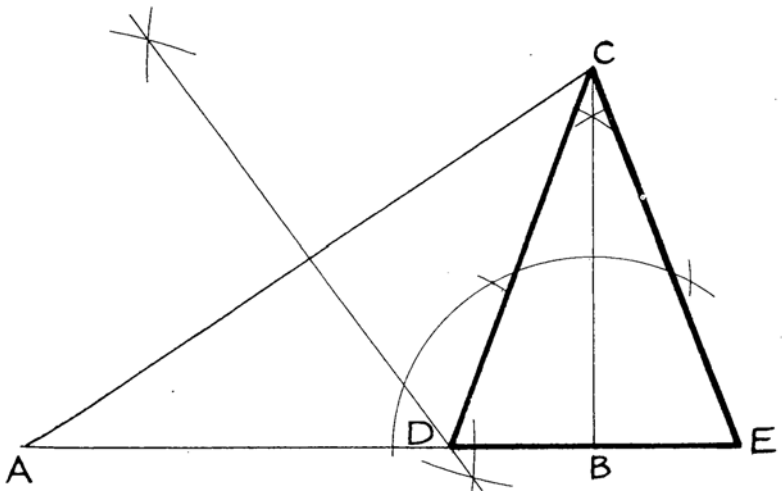


Triangles 2.

Construct an isosceles triangle given the perimeter and the altitude.

Procedure:

Draw a line AB equal to half the perimeter. From B erect a perpendicular and make BC equal to the altitude. Join A to C and bisect AC. Locate D and make DB= BE and complete triangle.

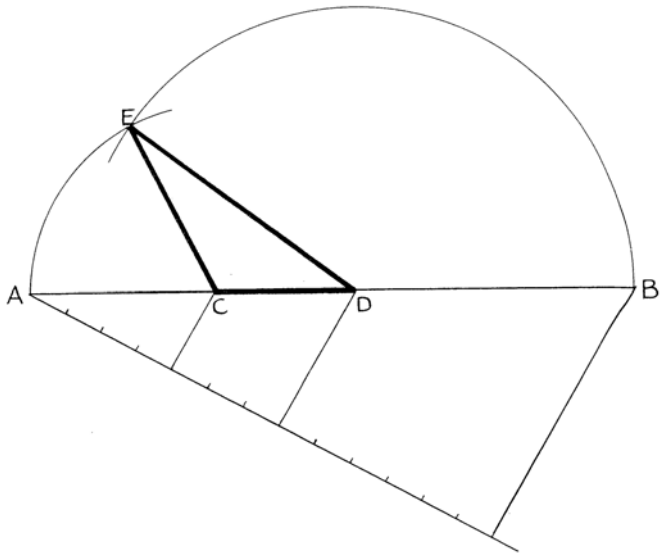


Triangles 3.

Construct a triangle given the perimeter and the ratio of the sides.

Procedure:

Draw line AB equal in length to the perimeter. Divide AB into the required ratio. Using a compass swing the distances until they intersect to form the triangle.

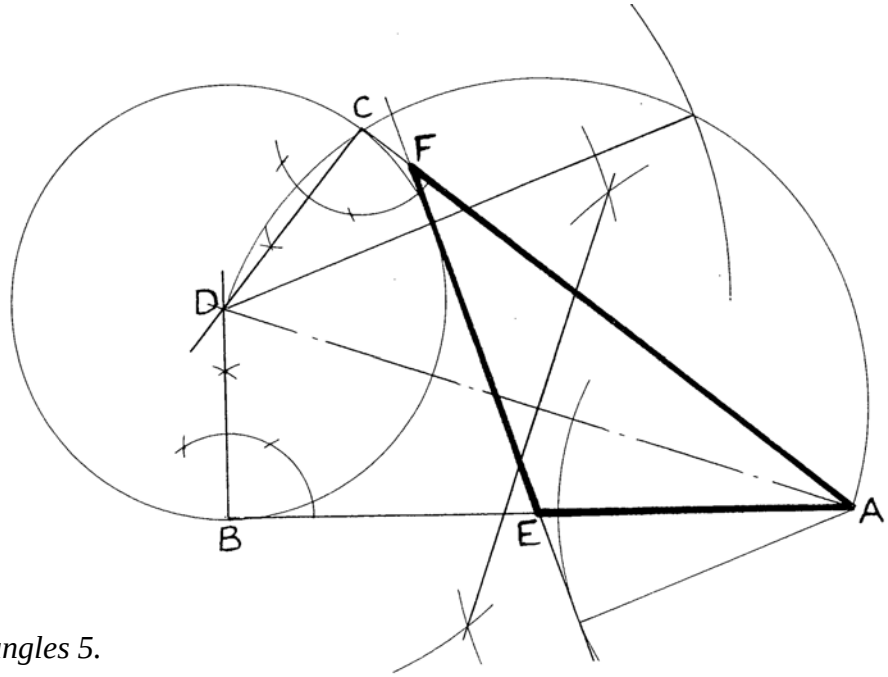


Triangles 4.

Construct a triangle given the perimeter, the altitude and the vertical angle.

Procedure:

Draw AB and AC both equal to half the stated perimeter. CAB as the vertical angle. Draw perpendiculars, which become normal when the circle is drawn. Construct the common tangent and let this intersect with AC and AB to form the triangle.

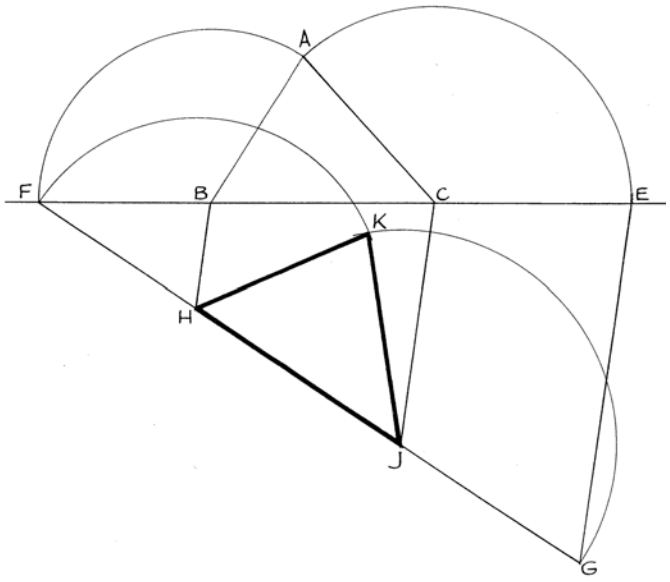


Triangles 5.

Construct a triangle similar to another triangle but with a different perimeter.

Procedure:

Draw the given triangle ABC. Produce BC in both directions, swing an arc from B radius BA, to find F. Do the same with A to find E. Draw a line FG at any angle the required perimeter. Bisect the lengths using similar triangles, and complete the triangle.

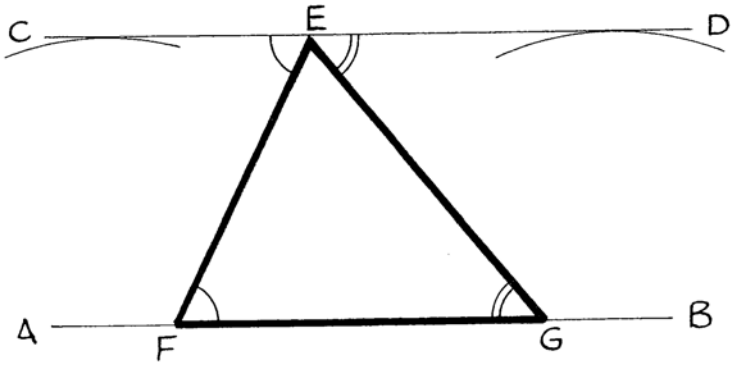


Triangles 6.

Construct a triangle, given the base angles and the altitude.

Procedure:

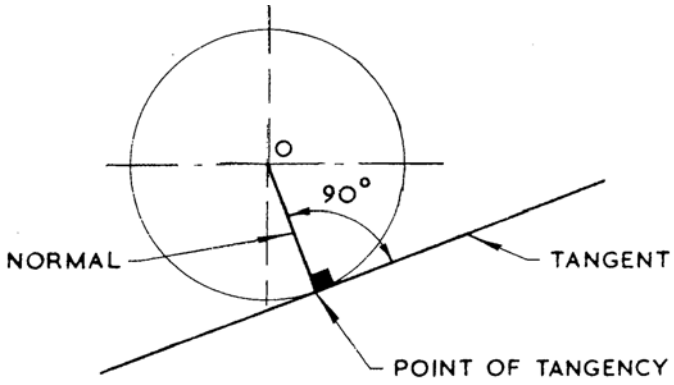
Draw a line AB. Construct CD parallel to AB so that the distance between them is equal in altitude. From any point E on CD draw in the known angles. Alternate angles are used to solve the problem.



Tangents

Definition:

A tangent to a circle is a straight line which touches the circle at one point, making an angle of 90º with a radius drawn to the point of contact.



Terminology:

Tangent: Usually a line, touching and non-intersecting a curved surface.

Point of Contact: (P.O.C.) the exact point where the line touches the curve, only one place.

Normal: Perpendicular (90º) line to the direction of a tangent, intersects the P.O.C. and centre of true circles.

Prior Knowledge required:

Basic geometry construction, the angle in a semicircle drawn from the endpoints and connecting on the circumference is a right (90º) angle.

Property of tangency:

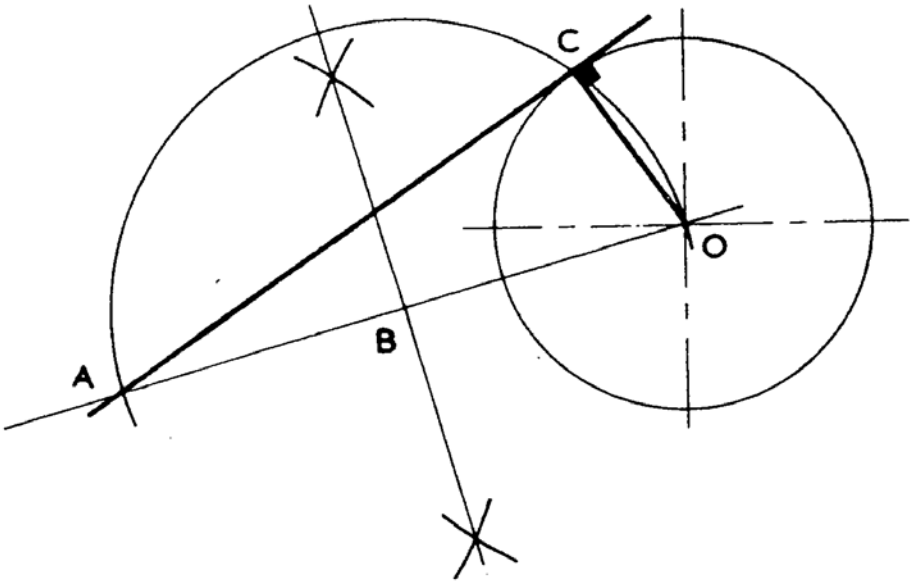
1. When two tangents are drawn to a circle from a point outside the circle the two tangents are equal in length, the triangles are congruent.

Tangents 1.

Construct a tangent from a given point (F) to a circle.

Procedure:

Join A to the centre of the circle O. Find the midpoint of AO. Swing a semicircle from the midpoint containing the points A and O. Where the semicircle intersects the circle this is the point of contact. Complete the tangent through this point and draw the normal.

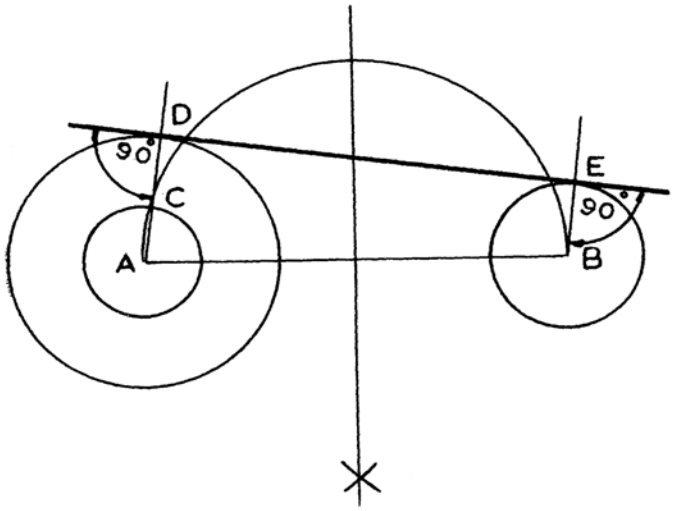


Tangents

Construct a tangent to two unequal circles.

Procedure:

Connect the circle centres, bisect this line and draw a semicircle. Draw a circle within the smaller circle, having a radius that is the difference between the given circles. (When the **T**angent **is out** the smaller **R**adius **is in**). Craw a straight line from A through C to find D. Draw a normal BE parallel to AD and complete the tangent that is perpendicular to these.

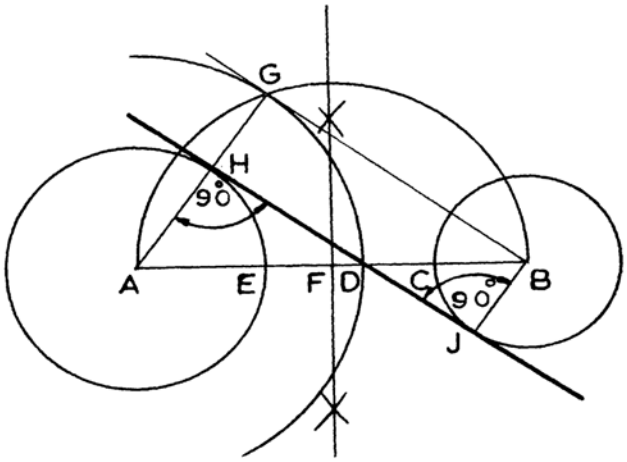


Tangents 3.

Construct an internal tangent between two unequal curves.

Procedure:

Join circle centres, bisect and draw a semi circle. Swing an arc the radius of both curves from the larger circle. Where the arc intersects the semicircle (G) forms a point on the normal. Connect this back to the centre to locate H. Complete the same parallel normal from B, and locate both points of contact. Complete the tangent. (When **T**angent **is in** the smaller **R**adius **is out**)



Tangents 4.

The tangent point or point of contact between two circles in contact is found by draw a line between the circle centres.

Tangents 5.

Draw a curve of a given radius to touch two circles when the two circles are outside the radius.

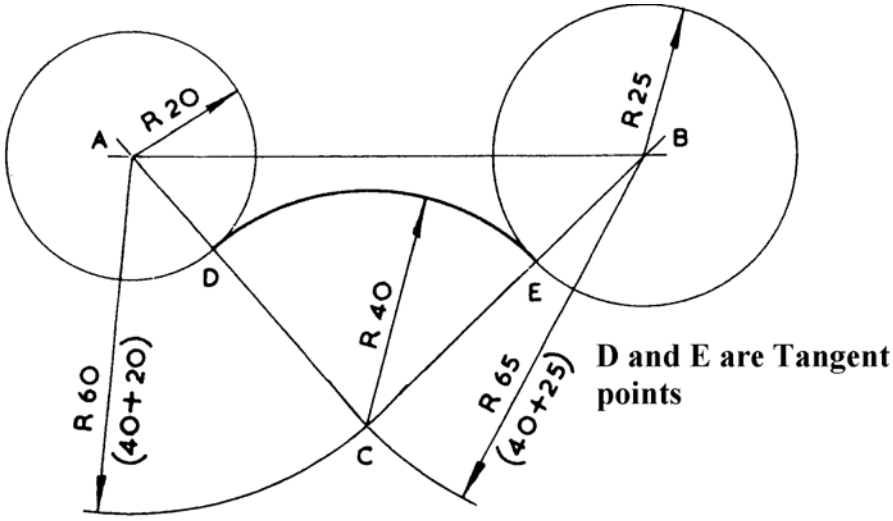
Procedure:

Given the radii A= 20mm and B= 25mm, centres 85mm apart. The radius of the curve to touch them is 40mm.

At centre A, 20mm + 40 mm = 60mm. Scribe an arc 60mm from centre A.

At centre B, 25mm + 40mm = 65mm. Scribe an arc 65mm from centre B.

The intersection of these arcs locates the centre for the curve R 40mm.



Tangents 6.

Draw a curve of a given radius to touch two circles when the two circles are inside the radius.

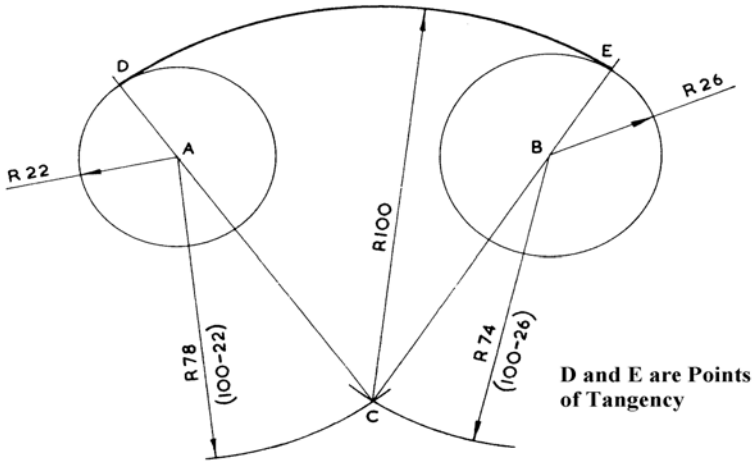
Procedure:

Given the radius of two circles A= 22 and B = 26, with centres 86mm apart. Draw a curve of radius 100 to touch them.

Swing an arc from A 100-22 = 78mm

Swing an arc from B 100 –26= 74mm.

Where these arcs intersect (C) is the centre for the radius 100.



Anthony Carty September 05

Polygons

Definition:

A polygon is a plane figure bounded by more than four straight sides. Polygons that are frequently referred to have particular names:

Pentagon = 5 sides Hexagon = 6 sides

Heptagon = 7 sides Octagon = 8 sides

Nonagon = 9 sides Decagon = 10 sides

Polygons: two types regular and irregular.

A regular polygon is one that has all its sides equal and therefore its entire exterior angles equal and all its interior angles equal.

It is possible to construct a circle within a regular polygon so that all the sides of the polygon so that all the sides are tangential to the circle.

Calculating the Exterior angle or a regular polygon.

Exterior angle = 360º/Number of sides.

Prior Knowledge required:

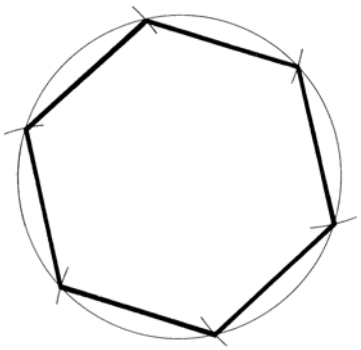
Ability to use/read protractor, setsquares and compass.

Polygons 1.

Construct a regular hexagon given the length of the sides.

Procedure:

Draw a circle with radius equal to the length of the side. From any point on the circumference, stop the radius around the circle six times. Connect the points to form the hexagon. The hexagon may also be draw-using setsquares.

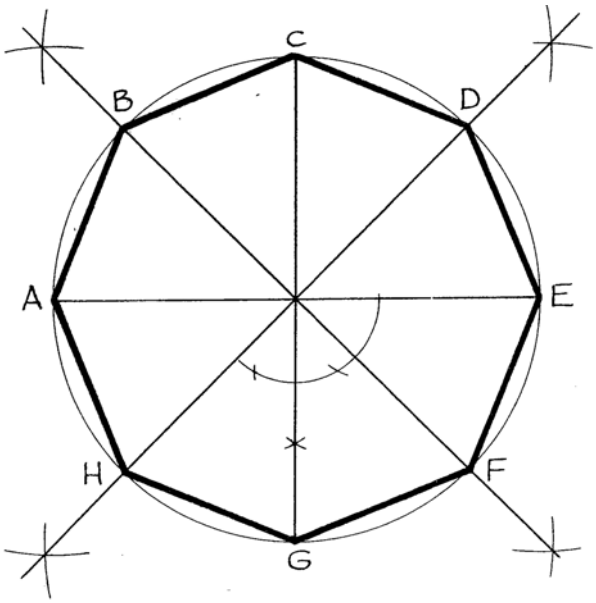


Polygons 2.

Construct a regular octagon given the diagonal.

Procedure:

Draw a circle with diameter equal to the diagonal. Construct another diagonal perpendicular to the original and bisect the quadrants. Connect the points where the bisectors and the diagonals intersect the circle to form the octagon.

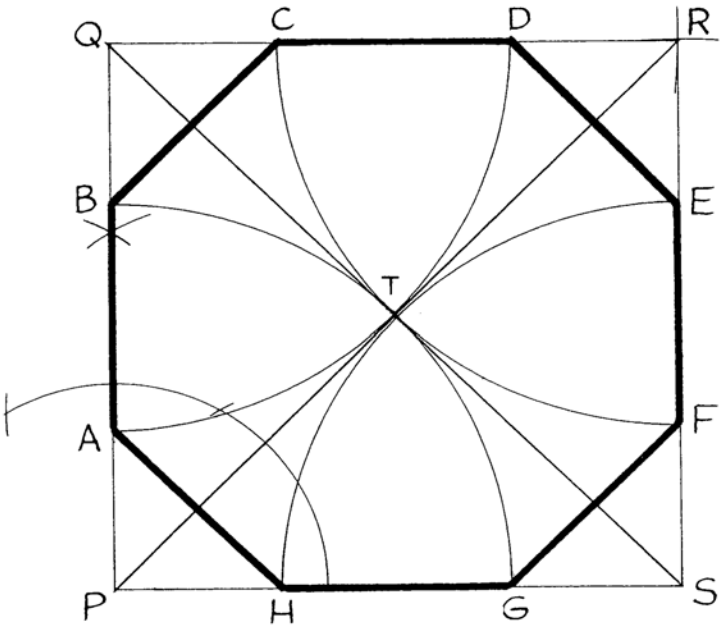


Polygons 3.

Construct a regular octagon given the diameter.

Procedure:

Construct a square the length of each side equal to the diameter. Draw diagonals to locate centre. Swing four arcs from the squares corners, radius corner to centre. Connect these points to form the octagon.

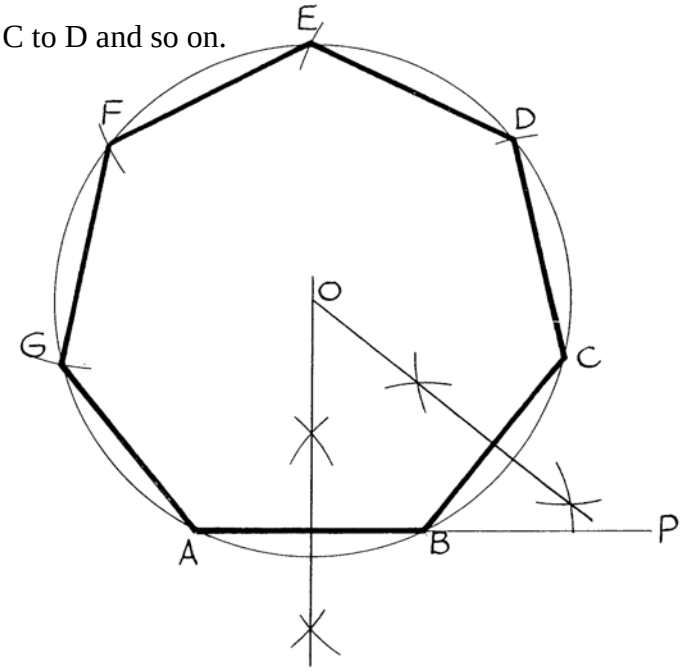


Polygons 4.

Construct any given polygon, given the length of a side.

Procedure:

Draw a line AB equal in length to one of the sides to produce AB to P. calculate the exterior angle, 360º/7= 51 3/7 º. Draw the exterior angle PBC so that BC = AB. Bisect AB and BC to intersect O. Draw a circle centre O and radius OA. Step of the sides of the figure from C to D and so on.

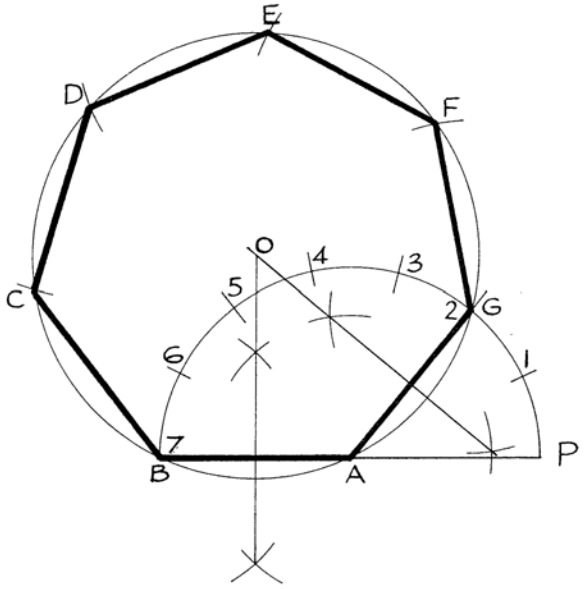


Polygons 5.

Construct any given polygon, given the length of a side

Procedure.

Draw a line AB equal in length to one of its sides. From a construct a semicircle, divide into the same number of polygon sides. Calculation 180º/7 =25 5/7º. Draw a line from point a through point 2. Bisect AB and A2 to find O. Draw circle and step off distances.



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Polygons 6.

Construct a regular polygon given a diagonal.

Procedure:

Draw a given circle and insert a diameter AM. Divide the diameter into the same number of divisions as the polygon sides. Swing arc the radius of AM from both A and M. This locates point N. From N draw a line through the second division to locate point B. Step of AB along the circumference.