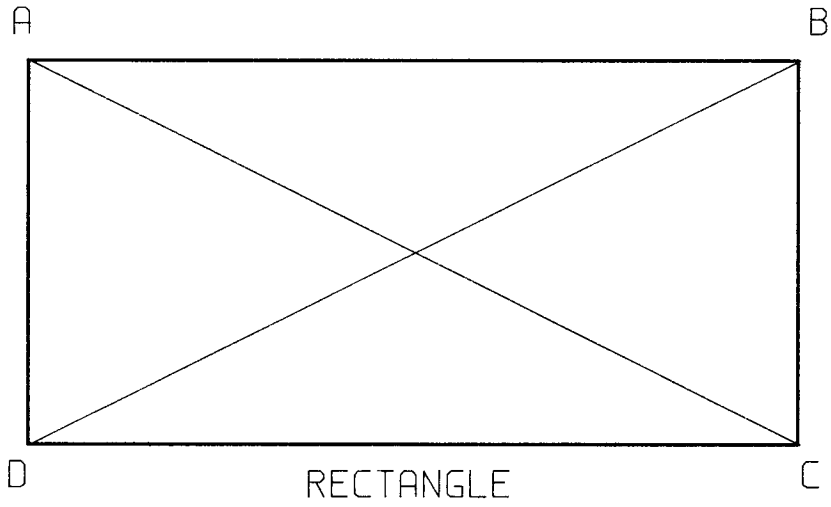
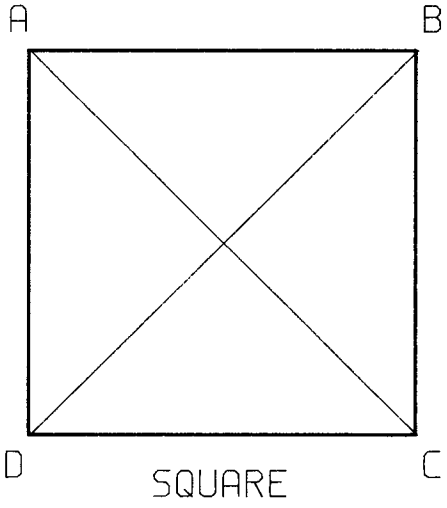
FORMULAS

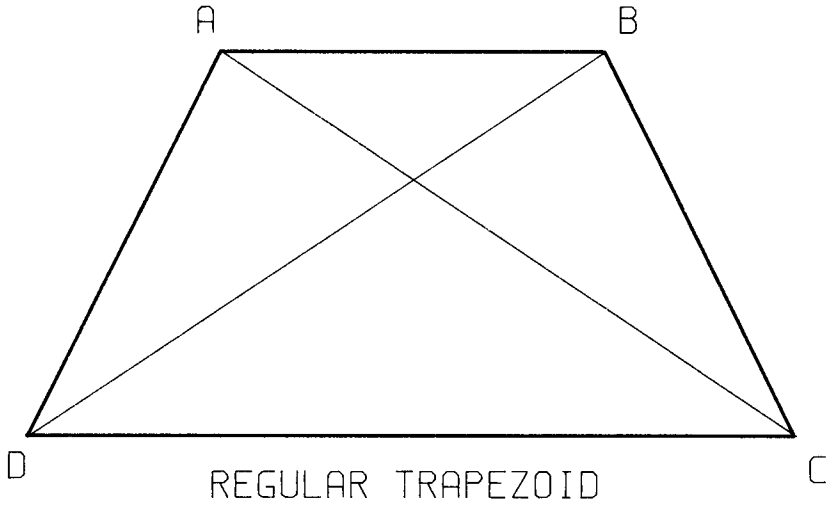
DIAGONALS



RECTANGLE



SQUARE



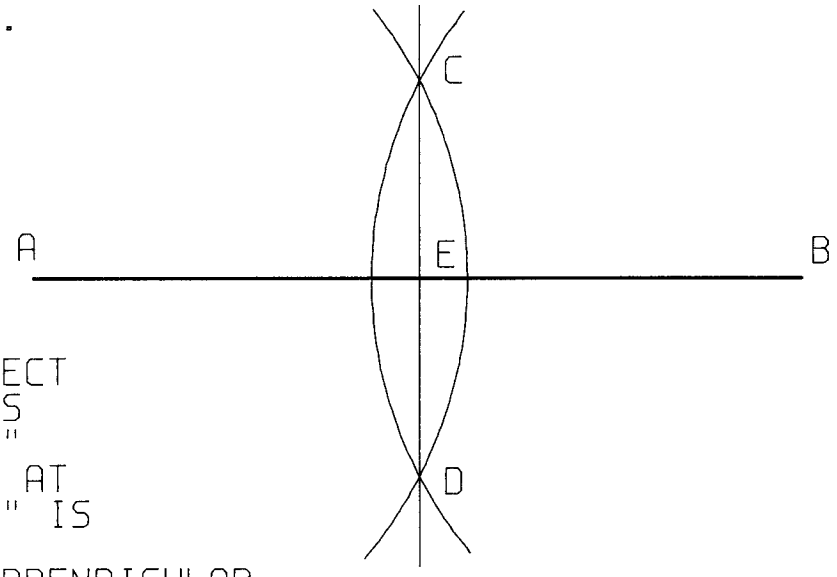
REGULAR TRAPEZOID

THE DIAGONALS ON ANY SQUARE, RECTANGLE, OR REGULAR TRAPEZOID ARE ALWAYS EQUAL. "AC"="BD" IN EACH FIGURE ABOVE. THIS PRINCIPLE CAN BE APPLIED WHEN TRYING TO SQUARE FLATS, DECKS OR OTHER SCENERY.

FORMULAS

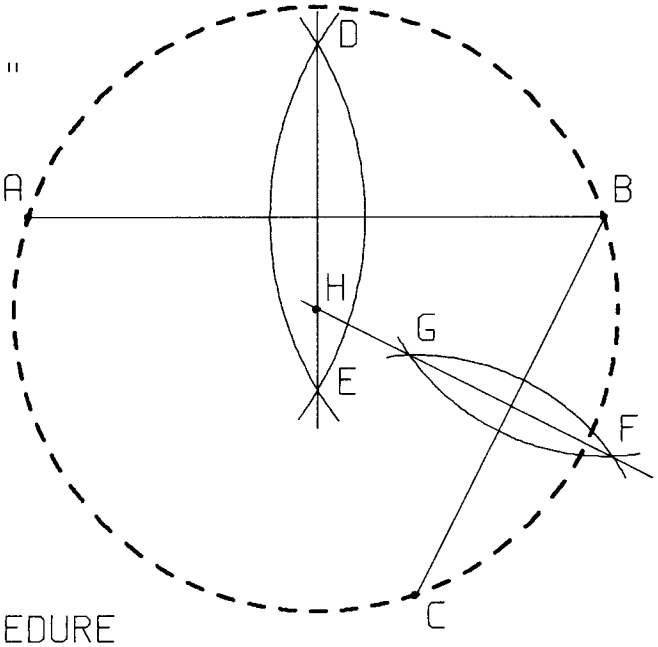
FINDING THE CENTER OF A LINE

START WITH LINE "AB". SELECT A RADIUS THAT IS SLIGHTLY LONGER THAN ONE HALF OF THE LINE LENGTH. SWING ARC "CD" USING "A" AS THE CENTER. USING THE SAME RADIUS SWING ARC "CD" USING "B" AS THE CENTER. CONNECT THE ARC INTERSECTIONS "C" & "D". LINE "CD" INTERSECTS LINE "AB" AT POINT "E". LINE "AE" IS EQUAL TO LINE "EB". (LINE "CD" IS THE PERPENDICULAR BISECTOR OF LINE "AB")



FINDING A CIRCLE THROUGH 3 KNOWN POINTS

POINTS "A", "B" & "C" ARE KNOWN. DRAW LINES "AB" & "BC". BISECT LINE "AB" AND FIND LINE "DE". BISECT LINE "BC" AND FIND LINE "FG". THE INTERSECTION OF LINES "DE" AND "GF" IS POINT "H". POINT "H" IS THE CENTER OF A CIRCLE HAVING A RADIUS EQUAL TO "HA", "HB" AND "HC".



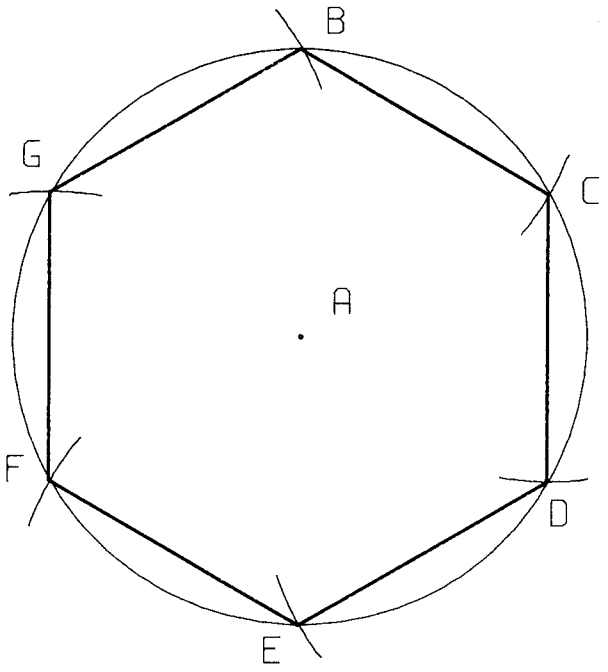
FINDING THE CENTER OF A CIRCLE

PICK THREE RANDOM POINTS ON THE CIRCUMFERENCE OF THE CIRCLE AND FOLLOW THE PROCEEDURE ABOVE.

FORMULAS

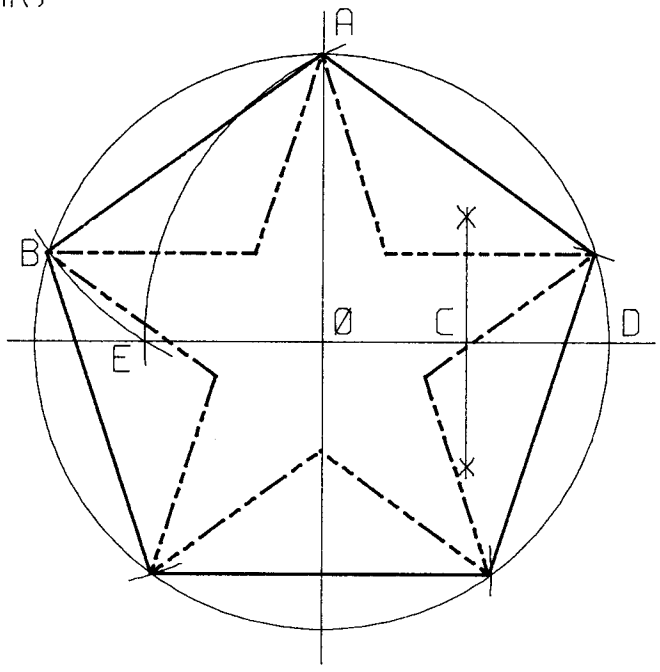
CONSTRUCTING A HEXAGON

THE RADIUS OF A CIRCLE IS EQUAL TO EACH SIDE OF A HEXAGON CONSTRUCTED WITHIN THAT CIRCLE. DRAW A CIRCLE WITH A RADIUS OF "AB". THEN PLACE THE COMPASS ON POINT "B" AND DRAW ARC "BC". CONTINUE AROUND THE CIRCUMFERENCE UNTIL IT IS DIVIDED INTO SIX EQUAL PARTS. DRAW LINES "BC","CD","DE","EF","FG" AND "GB".



CONSTRUCTING A PENTAGON (OR STAR)

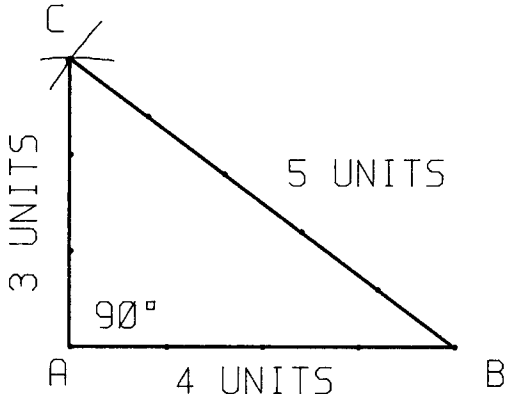
ESTABLISH A CIRCLE WITH RADIUS "OD". BISECT "OD" TO FIND "C". WITH "C" AS CENTER AND "CA" AS RADIUS STRIKE ARC "AE". WITH "A" AS CENTER AND "AE" AS RADIUS STRIKE ARC "AB". USING LENGTH "AB" DIVIDE THE CIRCLE INTO 5 EQUAL SEGMENTS. CONNECT THE SEGMENTS TO CREATE A PENTAGON OR 5 POINTED STAR.



FORMULAS

FINDING A 90° ANGLE

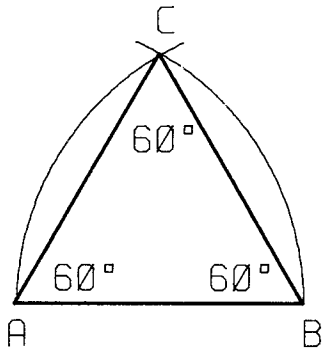
ESTABLISH A UNIT OF MEASURE. DRAW LINE "AB" 4 UNITS LONG. SWING AN ARC FROM POINT "A" THAT IS 3 UNITS LONG AND APPROXIMATELY 90° FROM LINE "AB". SWING AN ARC FROM POINT "B" THAT IS 5 UNITS LONG AND INTERSECTS ARC "AC" LINE "AC" IS PERPENDICULAR TO LINE "AB".



(NOTE: THIS IS NOT A 30°-60°-90° TRIANGLE. ANGLE "B" IS NOT 30° AND ANGLE "C" IS NOT 60°)

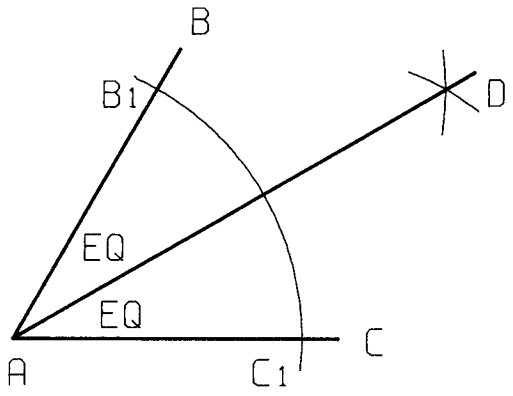
FINDING A 60° ANGLE

DRAW A LINE "AB". SWING AN ARC FROM "A" EQUAL TO "AB" TOWARD POINT "C". SWING AN ARC FROM POINT "B" EQUAL TO "AB" TOWARD POINT "C". DRAW A LINE FROM THE INTERSECTION OF THE ARCS TO ESTABLISH LINES "AC" & "BC". THIS IS AN EQUALATERAL TRIANGLE AND ALL THREE ANGLES EQUAL 60°



BISECTING AN ANGLE

TO BISECT ANGLE "BAC", DRAW AN ARC FROM POINT "A" TO ESTABLISH POINTS "B_1" AND "C_1". SWING ARC "B_1D" AND ARC "C_1D". DRAW LINE "AD". ANGLE "BAD" IS EQUAL TO ANGLE "DAC" AND EACH IS HALF OF THE ANGLE "BAC"



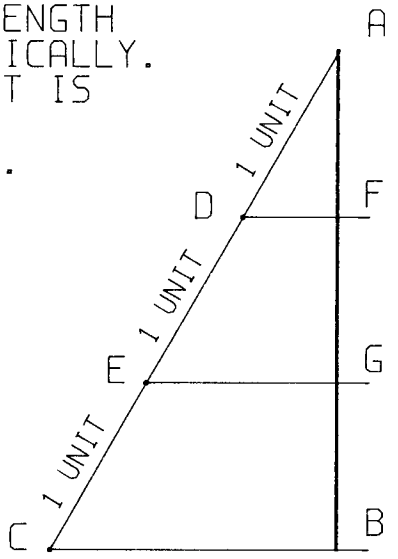
FINDING A 30° ANGLE

DRAW AN EQUALATERAL TRIANGLE AND BISECT ONE OF THE ANGLES.

FORMULAS

DIVIDING A LINE INTO EQUAL PARTS

YOU WISH TO DIVIDE LINE "AB" INTO THREE EQUAL PARTS AND 1) DON'T KNOW IT'S LENGTH OR 2) IT IS NOT EASILY DIVIDED NUMERICALLY. DRAW LINE "AC" TO A KNOWN LENGTH THAT IS DIVISABLE BY THREE. DRAW LINE "CB". DRAW LINE "EG" PARALLEL TO LINE "CB". DRAW LINE "DF" PARALLEL TO LINE "CB" "AF"="FG"="GB.
IF YOU WISH TO DIVIDE LINE "AB" INTO 5 OR 6 EQUAL PARTS DRAW LINE "AC" TO A KNOWN LENGTH THAT IS DIVISABLE BY 5 OR 6.

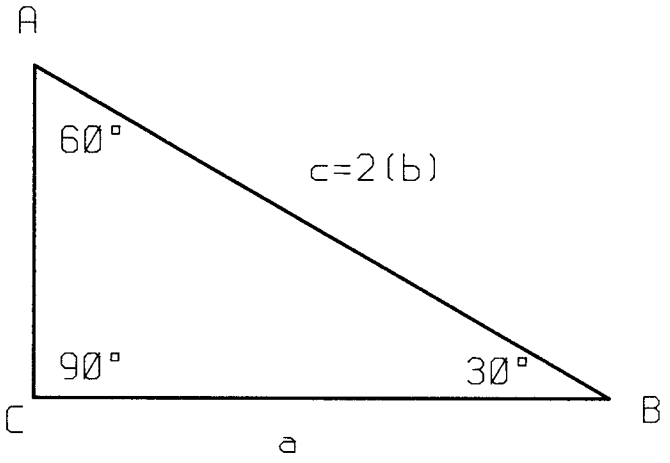


FINDING A 30°-60°-90° TRIANGLE (MATHEMATICAL SOLUTION)

$a=1.732(b)$

$b=\frac{a}{1.732}$

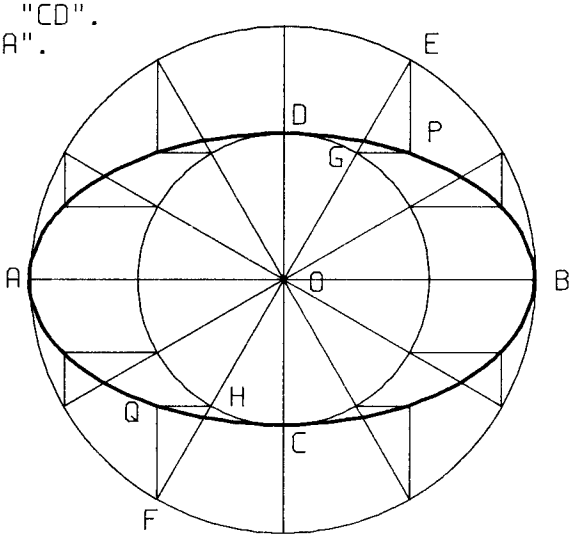
$c=2(b)$



FORMULAS

ELLIPSE: BY CONCENTRIC CIRCLE METHOD

LINE "AB" IS THE MAJOR AXIS. LINE "CD" IS THE MINOR AXIS. POINT "O" IS THE CENTER OF THE ELLIPSE AND THE INTERSECTION OF LINES "AB" & "CD". DRAW A CIRCLE, WITH CENTER "O" AND RADIUS "OA". DRAW ANOTHER CIRCLE, WITH CENTER "O" AND RADIUS "OC". DRAW A RADIAL LINE, SUCH AS "EF" THROUGH POINT "O". WHERE LINE "EF" INTERSECTS THE LARGE CIRCLE DRAW VERTICAL LINES SUCH AS "EP" & "FQ". WHERE LINE "EF" INTERSECTS THE SMALL CIRCLE DRAW HORIZONTAL LINES SUCH AS "GP" AND "HQ". POINTS "P" & "Q" ARE POINTS ON THE ELLIPSE. REPEAT THIS CONSTRUCTION TO ESTABLISH MORE POINTS ON THE ELLIPSE AND DRAW A SMOOTH CURVE THROUGH THESE POINTS TO FORM AN ELLIPSE.



ELLIPSE: BY CIRCULAR ARC METHOD

THIS METHOD WILL GIVE AN APPROXIMATION OF A TRUE ELLIPSE. LINE "AB" IS THE MAJOR AXIS. LINE "CD" IS THE MINOR AXIS. POINT "O" IS THE CENTER OF THE ELLIPSE AND THE INTERSECTION OF LINES "AB" & "CD". DRAW LINE "AC". SWING AN ARC FROM POINT "O" WITH A RADIUS OF "AO" TO POINT "E" ON LINE "CD". SWING AN ARC FROM POINT "C" WITH A RADIUS OF "CE" TO POINT "F" ON LINE "AC". BISECT LINE "AF" WITH LINE "GH". LINE "GH" INTERSECTS LINE "AB" AT POINT "J" AND LINE "CD" AT POINT "K". SWING AN ARC "WAZ" WITH RADIUS "JA" AND CENTER "J". SWING ARC "WCX" WITH RADIUS "KW" AND CENTER "K". SWING ARC "YDZ" WITH RADIUS "KW" AND CENTER "M". SWING ARC "XBY" WITH RADIUS "JA" AND CENTER "L". POINTS "J" & "L" ARE ON THE MAJOR AXIS AND POINTS "K" & "M" ARE ON THE MINOR AXIS.