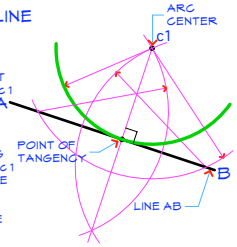
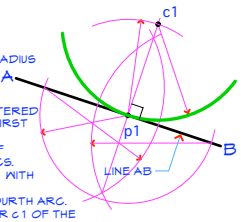
ARC TANGENT TO A GIVEN LINE AND A GIVEN ARC CENTER



GIVEN CENTER POINT c 1 AND LINE AB
AT SOME DISTANCE FROM c 1 CONSTRUCT
THE ARC TANGENT TO AB CENTERED ON c 1

1-DRAW AN ARC WITH CENTER AT c 1
AND INTERSECTING AB AT TWO POINTS.
2-CONSTRUCT A LINE PERPENDICULAR
TO AB GOING THROUGH c 1 BY DRAWING
TWO ARCS AS SHOWN GOING THROUGH c 1
3-CONSTRUCT A LINE GOING THROUGH THE
PAIR OF INTERSECTION POINTS OF THE
TWO ARCS.
4-WHERE THIS LINE INTERSECTS AB IS THE
POINT OF TANGENCY.
5-DRAW THE ARC CENTERED AT c 1 AND
GOING THROUGH THE POINT OF TANGENCY

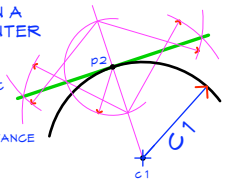
ARC TANGENT TO A GIVEN LINE AND A GIVEN ARC RADIUS



GIVEN LINE AB AND POINT p 1 ON AB
AND GIVEN THE ARC RADIUS CONSTRUCT
THE ARC TANGENT TO AB OF THE GIVEN RADIUS

1-STRIKE AN ARC ABOUT POINT p 1
INTERSECTING AB IN TWO PLACES.
2-STRIKE TWO EQUAL RADIUS ARCS CENTERED
ON THE INTERSECTION POINTS OF THE FIRST
ARC WITH AB.
3-DRAW A LINE THROUGH THE THE PAIR OF
INTERSECTION POINTS OF THE TWO ARCS.
4-DRAW A FOURTH ARC CENTERED ON p 1 WITH
THE SPECIFIED TANGENT ARC RADIUS.
5-EXTEND THE LINE TO INTERSECT THE FOURTH ARC.
6-THIS INTERSECTION POINT IS THE CENTER c 1 OF THE
TANGENT ARC THAT GOES THROUGH p 1.
7-DRAW THE TANGENT ARC CENTERED ON c 1 WITH THE
GIVEN RADIUS THROUGH THE POINT p 1.

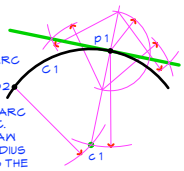
LINE TANGENT AT A POINT ON A GIVEN ARC WITH A GIVEN CENTER



GIVEN AN ARC C 1 CENTERED ON A GIVEN
POINT c 1 AND WITH POINT p2 ON THAT ARC
CONSTRUCT THE LINE TANGENT TO THE ARC
GOING THROUGH p2

1-DRAW A LINE STARTING AT c 1 GOING
THROUGH p2 AND EXTENDING SOME DISTANCE
BEYOND p2.
2-DRAW AN ARC CENTERED ON p2 AND
INTERSECTING THE LINE IN TWO PLACES.
3-DRAW TWO ARCS OF EQUAL RADIUS CENTERED
ON THE TWO INTERSECTIONS OF THE FIRST ARC
WITH THE LINE GOING THROUH c 1 AND p2.
4-DRAW THE TANGENT LINE BETWEEN ONE INTERSECTION
OF THE TWO EQUAL RADIUS ARCS AND THROUGH
THE OTHER INTERSECTION

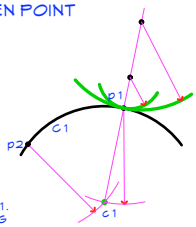
LINE TANGENT TO A GIVEN POINT ON AN ARC OF GIVEN RADIUS



GIVEN ARC C 1 AND POINTS p 1 AND p2 ON THAT ARC
LOCATE THE ARC CENTER AND CONSTRUCT THE
TANGENT LINE THROUGH p2

1-FROM ANY POINT p 1 ON THE ARC C 1 DRAW AN ARC
CENTERED ON p 1 WITH THE RADIUS OF THE ARC.
2-FROM ANY SECOND POINT p2 ON THE ARC DRAW
A SECOND ARC CENTERED ON p2 WITH THE RADIUS
OF C 1. THE INTERSECTION OF THE TWO ARCS IS THE
CENTER POINT c 1 OF ARC C 1.
3-DRAW A LINE FROM c 1 THROUGH p 1 EXTENDING
SOME DISTANCE BEYOND p 1.
4-DRAW AN ARC CENTERED ON p 1 THAT INTERSECTS
THE LINE IN TWO PLACES.
5-DRAW TWO ARCS OF EQUAL RADIUS EACH CENTERED
ON ONE OF THE INTERSECTIONS.
6-DRAW A LINE FROM ONE INTERSECTION OF THE TWO
ARCS THROUGH THE OTHER INTERSECTION.
THIS LINE IS THE TANGENT LINE THROUGH POINT p 1.

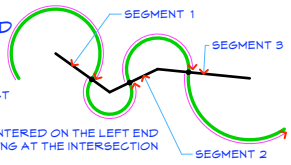
TANGENT ARCS THROUGH A GIVEN POINT ON A GIVEN ARC



GIVEN ARC C 1 AND POINTS p 1 AND p2 ON
THAT ARC LOCATE THE ARC CENTER AND
CONSTRUCT TANGENT ARCS TO THE GIVEN
ARC THROUGH POINT p 1.

1-FROM ANY POINT p 1 ON THE ARC C 1 DRAW
AN ARC CENTERED ON p 1 WITH THE RADIUS
OF THE ARC.
2-FROM ANY SECOND POINT p2 ON THE ARC
DRAW A SECOND ARC CENTERED ON p2 WITH
THE RADIUS OF C 1. THE INTERSECTION OF THE
TWO ARCS IS THE CENTER POINT c 1 OF ARC C 1.
3-DRAW A LINE FROM c 1 THROUGH p 1 EXTENDING
ANY DISTANCE BEYOND p 1.
4-CONSTRUCT ANY NUMBER OF ARCS WHO'S
CENTERS LIE ON THIS EXTENDED LINE AND GO
THROUGH POINT p 1.
THESE ARCS ARE ALL TANGENT TO ARC C 1.

TANGENT ARCS ON A SERIES OF CONNECTED LINE SEGMENTS



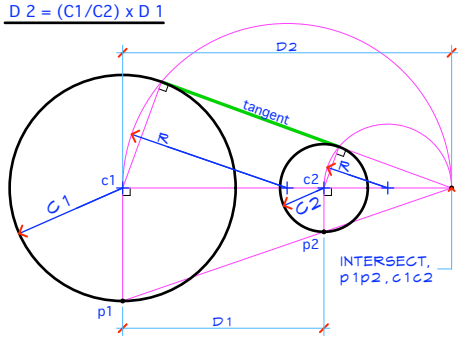
GIVEN THE CONNECTED LINE
SEGMENTS 1, 2 AND 3 CONSTRUCT
FOUR TANGENT ARCS

1-DRAW AN ARC CLOCKWISE CENTERED ON THE LEFT END
OF SEGMENT 1 AND TERMINATING AT THE INTERSECTION
WITH SEGMENT 1.
2-DRAW A SECOND ARC CENTERED ON THE INTERSECTION
OF SEGMENTS 1 AND 2 COUNTER CLOCKWISE FROM THE END
OF THE FIRST ARC TERMINATING AT THE INTERSECTION WITH SEGMENT 2.
3-DRAW A THIRD ARC CENTERED ON THE INTERSECTION OF SEGMENT 2 AND 3
CLOCKWISE FROM THE END OF THE SECOND ARC AND TERMINATING
AT THE INTERSECTION WITH SEGMENT 3.
4-DRAW THE FOURTH ARC CENTERED ON THE RIGHT END OF SEGMENT 3
COUNTERCLOCKWISE STARTING AT THE END OF THE THIRED ARC.

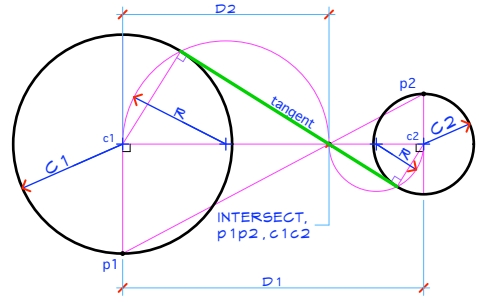
CONSTRUCT THE EXTERIOR AND INTERIOR TANGENTS TO TWO CIRCLES

(unequal diameters, unenclosed, non intersecting)

D 2 = (C1/C2) x D 1



D 2 = (C1/C2) x D 1



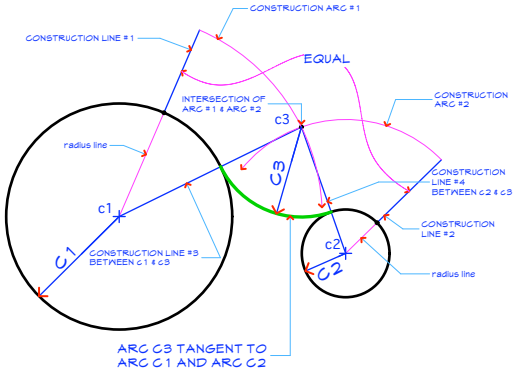
CONSTRUCT AN ARC THAT IS TANGENT TO TWO EXISTING ARCS

1-DRAW ARC C1 (ANY RADIUS), DRAW ARC C2 (ANY RADIUS AND DISTANCE FROM ARC C1).
2-DRAW RADIUS LINE FROM c1 TO ARC C1.
3-DRAW RADIUS LINE FROM c2 TO ARC C2.
4-DRAW TWO EQUAL LENGTH CONSTRUCTION LINES AS EXTENSIONS OF THE TWO RADIUS LINES.
5-DRAW CONSTRUCTION ARC #1 FROM END OF CONSTRUCTION LINE #1.
6-DRAW CONSTRUCTION ARC #2 FROM END OF CONSTRUCTION LINE #2.

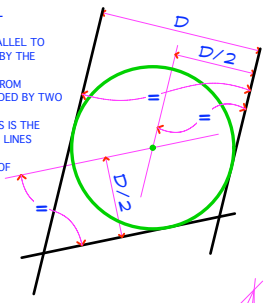
WHERE THE TWO CONSTRUCTION ARCS INTERSECT IS THE CENTER OF AN ARC TANGENT TO
ARC C1 AND ARC C2 WITH A RADIUS EQUAL TO THE LENGTH OF CONSTRUCTION LINES #1 AND #2

7-DRAW THE TANGENT ARC C3 FROM THE INTERSECTION OF CONSTRUCTION LINE #3 AND ARC C1
TO THE INTERSECTION OF CONSTRUCTION LINE #4 AND ARC C2

NOTE: THE FLATNESS OF THE TANGENT ARC IS DEPENDENT ON THE LENGTH OF THE TWO
EQUAL LENGTH CONSTUCTION LINES. THE LONGER THE LINES THE FLATTER THE ARC



ARC TANGENT TO THREE LINES TWO OF WHICH ARE PARALLEL

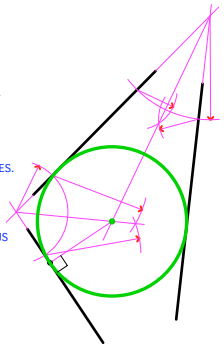


1- GIVEN THE DISTANCE D DRAW A LINE PARALLEL TO
AND OFFSET FROM EITHER PARALLEL LINE BY THE
DISTANCE D DEVIDED BY TWO.
2- DRAW A LINE PARALLEL TO AND OFFSET FROM
THE THIRED LINE BY THE DISTANCE D DEVIDED BY TWO

THE INTERSECTION OF THE TWO OFFSET LINES IS THE
CENTER OF THE ARC TANGENT TO THE THREE LINES

3- DRAW THE TANGENT ARC WITH A RADIUS OF
D DEVIDED BY TWO

ARC TANGENT TO THREE LINES



1- DRAW LINES EXTENDING TO THE INTERSECTIONS OF
THE THREE GIVEN LINES.
2- DRAW THE ANGLE BISECTIOR LINES AS SHOWN.

THE INTERSECTION OF THE ANGLE BISECTECTORS IS
THE CENTER OF THE ARC TANGENT TO THE THREE LINES.

3- DRAW A LINE THAT IS PERPENDICULAR TO ONE OF
THE LINES AND GOES TO THE ARC CENTER.

THE LENGTH OF THIS LINE IS THE TANGENT ARC RADIUS

4- DRAW THE TANGENT ARC