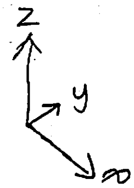
01/29/18

Solid Edge Basics

Order shows every step in making the object, akin to reverse engineering

Synchronous doesn't keep all operations in order

Default axis



- - - - - - - - Hidden

——— - ——— - ——— Centre

Sketching, starting w/ two dimensional drawing in only one of the three planes

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02/01/18

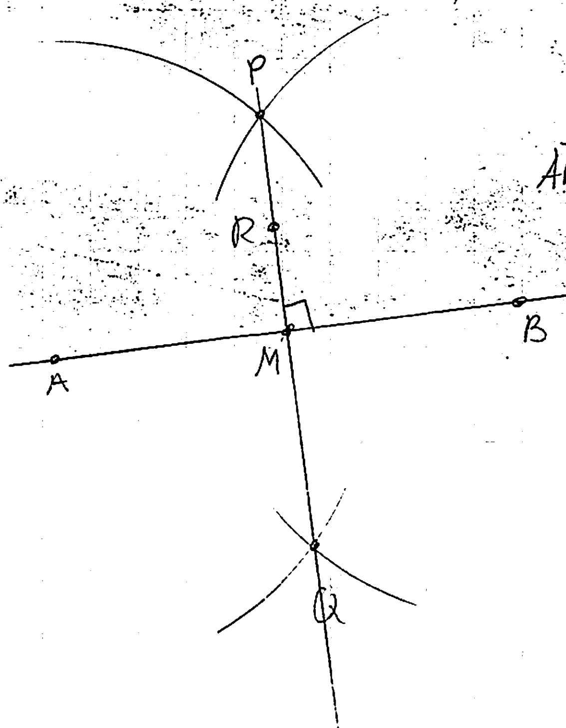
In class convention

Given - Blue
Finished - Red
Construction - Black

points / vertices - capital letters
edges / lines - lower case letters
angles - greek letters

Drawing midpoint

By perpendicular bisector



$\overline{AR} = \overline{RB}$

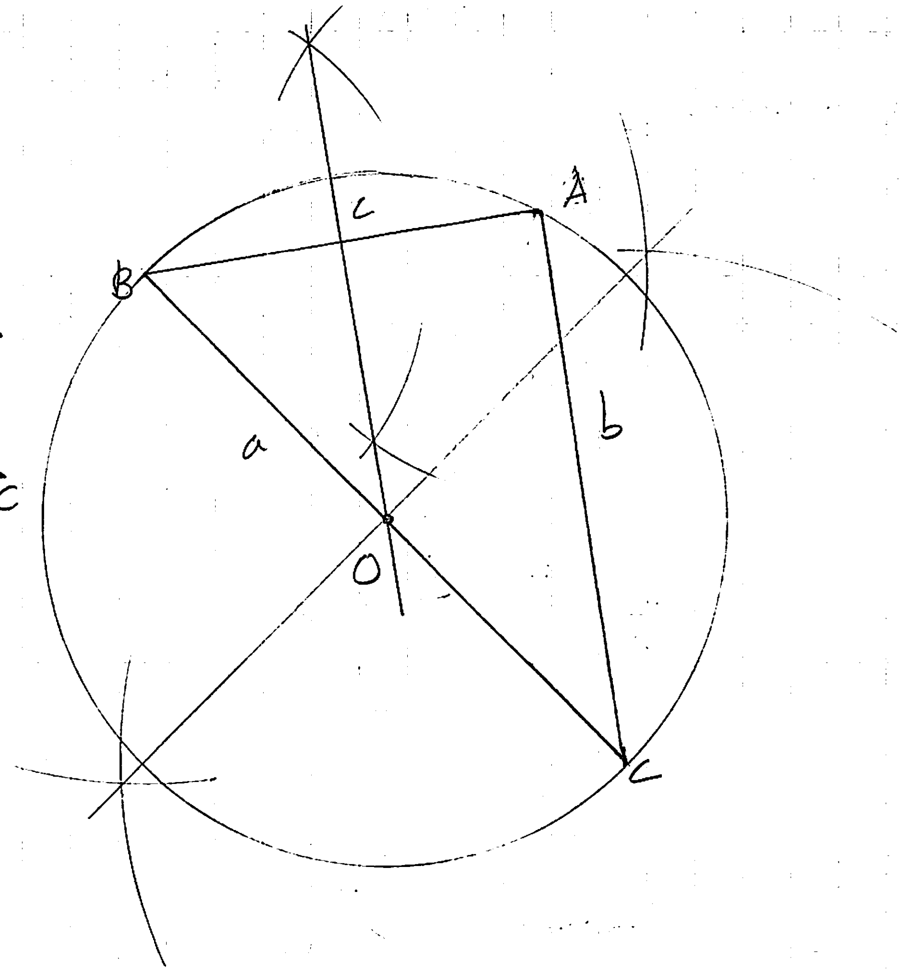
Use compass extended to greater than half way

Circumscribing a triangle

Use three perpendicular bisectors

$r = \overline{OA} = \overline{OB} = \overline{OC}$

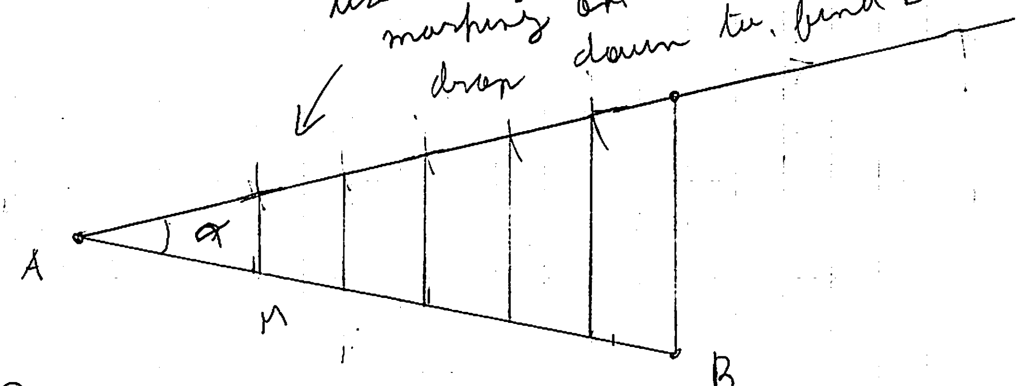
O is not necessarily the centre point of a line, it can be anywhere



02/05/18

More constructions

use compass marking on the ray and drop down to find B.

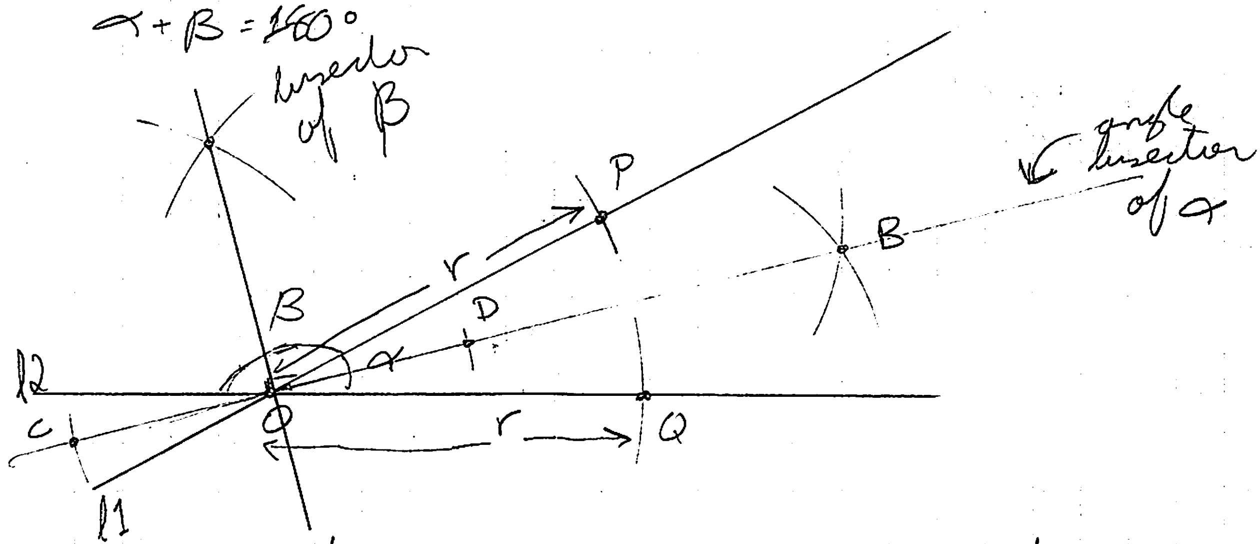


$\alpha < 90°$

$$\frac{AM}{MB} = \frac{2}{3}$$

- First divide into ... equal parts
- Create a ray w/ an acute angle from A

Bisecting Angles



- set compass on O and extend to arbitrary point
- set compasses at P & Q and create arcs

the angular bisector of α must be perpendicular to that of β

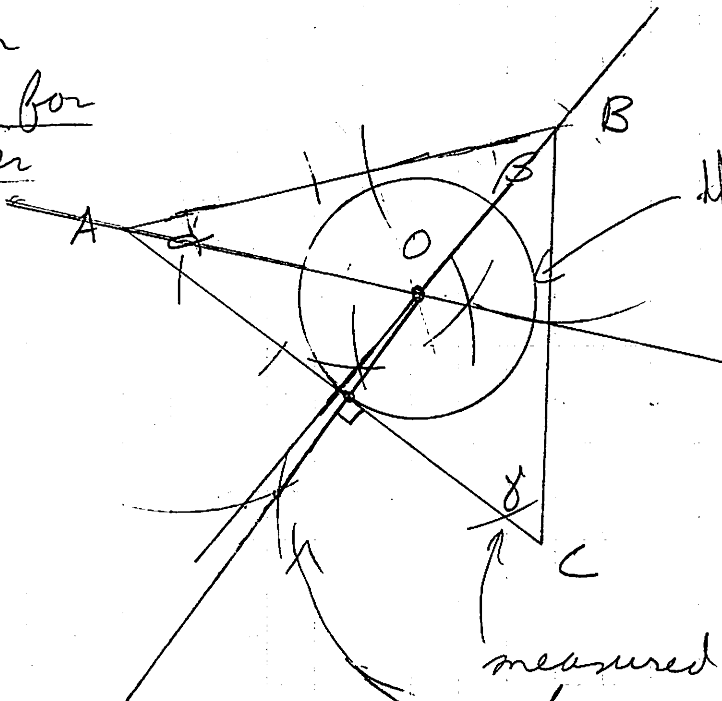
- to find the one for β create point C & D w/. compass then use them for bisector

→

Inscribing a triangle

Every triangle can be circumscribed (outcircle), there can also be an inscribed (in) circle)

Find angular bisectors for two angles



the circle should be touching every vertex

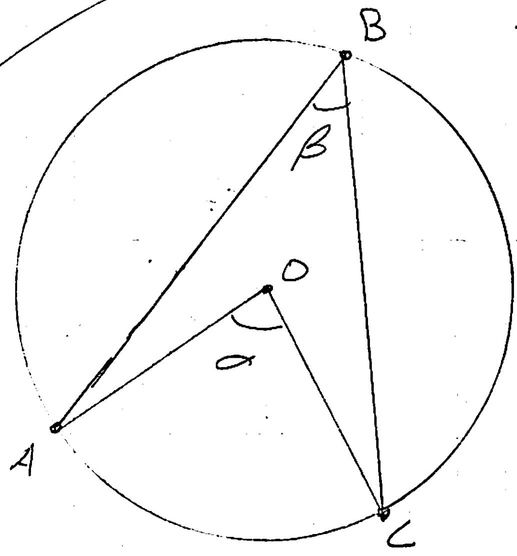
measured w/ compass from O

these curves found from first curves

02/06/18

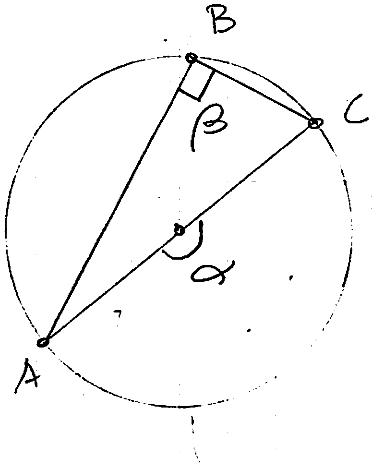
Thales Theorem

pick three random points on a circle and draw lines between them in this fashion, the relation holds true



$\beta = \frac{1}{2}\alpha$

If $\overline{AC}$ is a diameter, $\alpha = 180°$ & $\beta = 90°$



Finding a perpendicular at the end of a line

Find ⊥ to A

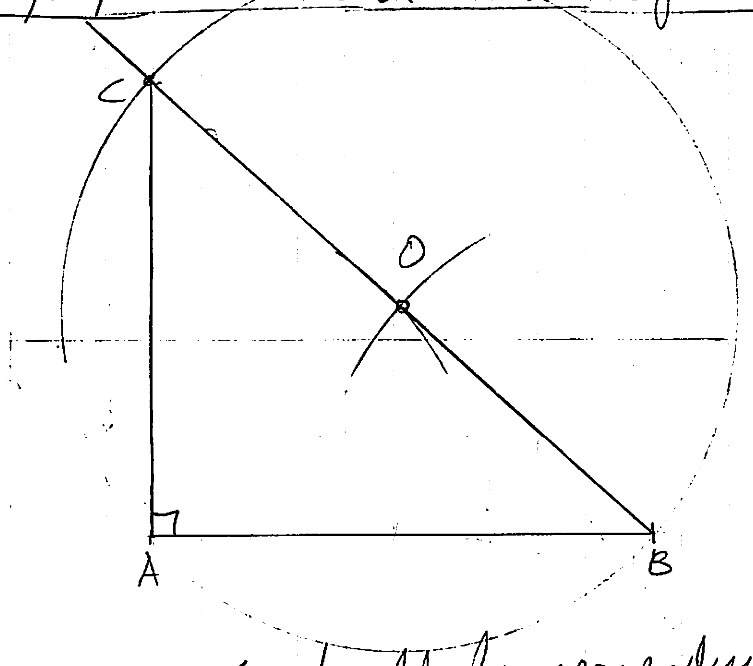
1) Open compass to $> \frac{1}{2}AB$

2) Draw arc above AB

3) Draw line from B through O

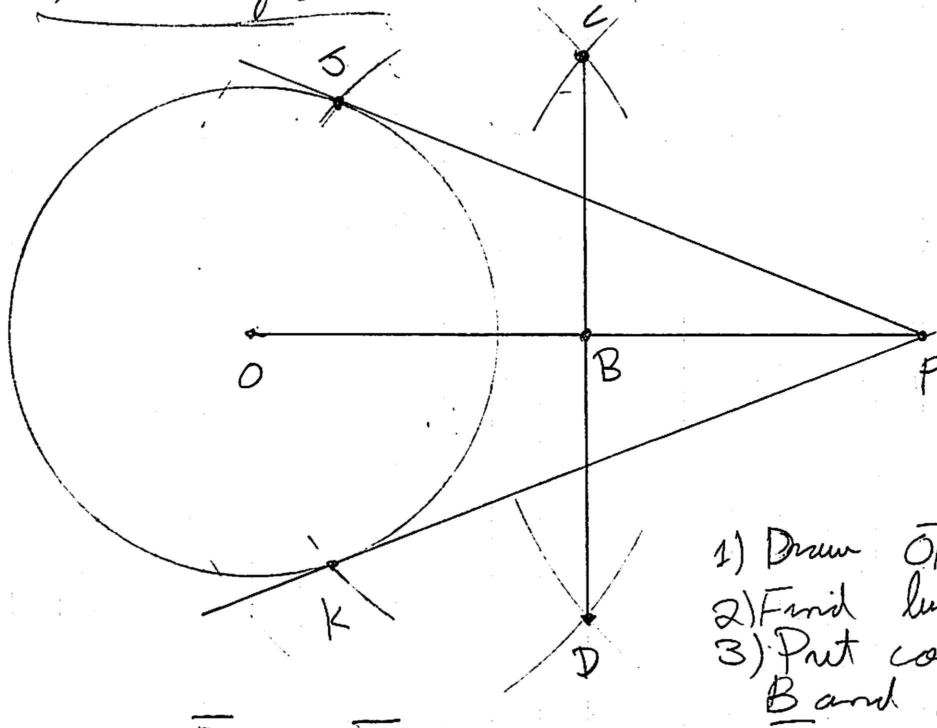
4) Put compass at O & draw arc on the line through B

don't change width



C should be perpendicular to A

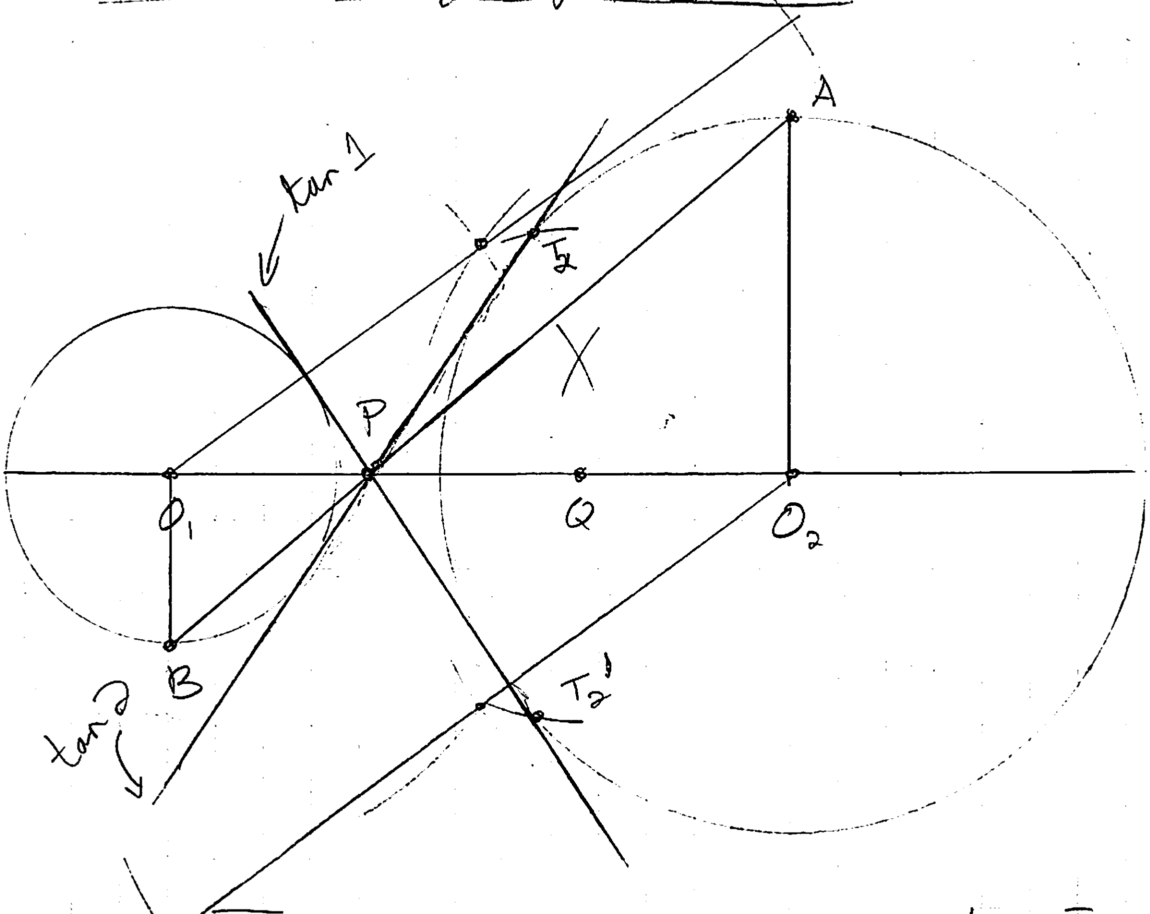
Finding tangents to given circle from extended point



$\overline{PJ}$ & $\overline{PK}$ are tangents

1) Draw $\overline{OP}$
2) Find bisector of OP
3) Put compass on B and open it to $\overline{OB}$
4) Draw arc through circle

Internal (crossbelt) tangent for 2 circles



1) Draw $\overline{O_1O_2}$
2) Draw $\perp$ from O_2 "up"
3) Draw $\perp$ from O_1 "down"
4) Draw $\overline{AB}$
5) Find tangent points from P to circle O_2
6) $\overline{T_1P}$ is first tangent & $T_2'P$ is second tangent

using previous construction

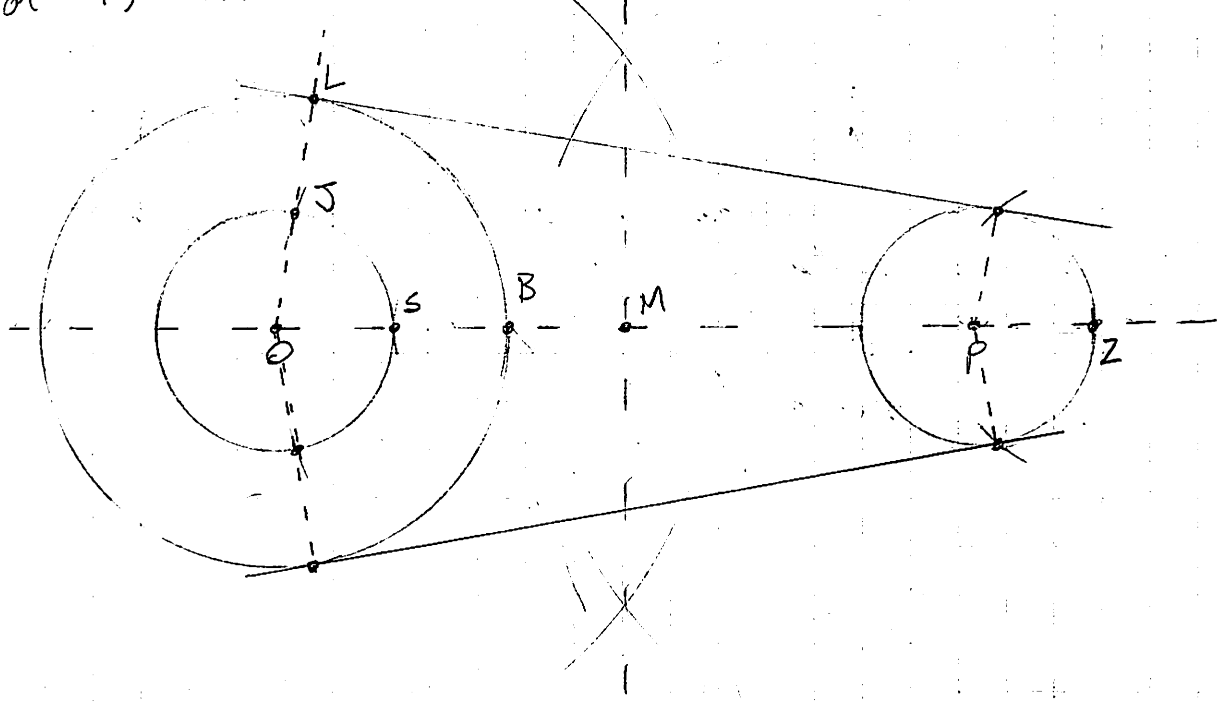
P is where $\overline{AB}$ intersects $\overline{O_1O_2}$

Q is midpoint of $\overline{PO_2}$

02/12/18

External or (open belt) tangent for two circles

Copying <JOS
at P, <TPZ



$O > P$ $\quad r = r_O - r_P$ $\quad$ O has smaller circle w/ radius p

1) Connect O & P with a line extended to edges of the circles
2) Set the compass width to radius of P
3) Compass point at intersection of line $\overline{OP}$ and circle O.
4) Draw arc w/ radius P from B onto line $\overline{OP}$, label the intersection S.
5) Draw circle w/ radius $\overline{OS}$ concentric w/ O
6) Find mediatrix of OP, call point M
7) Put compass on M, width OM

8) Draw an arc or inner circle and label J

9) Draw line $\overline{OJ}$, extend that to outer circle, point L

10) Compass width to $\overline{OS}$, compass point on P, draw arc intersecting $\overline{OP}$, define point Z.

11) Compass to length $\overline{SJ}$, compass point on Z

* circle formed by Z can be bigger or smaller than original circle

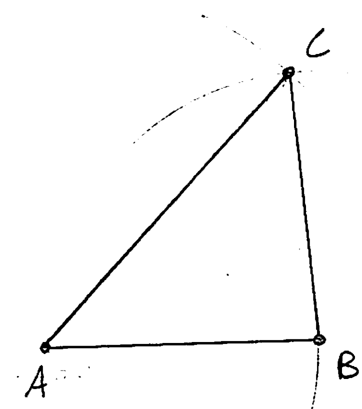
12) Draw an arc radius SJ. Crossing the new (Z) circle to define point T.

13) Draw line PT, extending it to define F on the original (given) circle P

?

<u>Construct a triangle w/ given sides</u>

	$\overline{AB}$	$\overline{BC}$	$\overline{AC}$
Units:	5	6	7



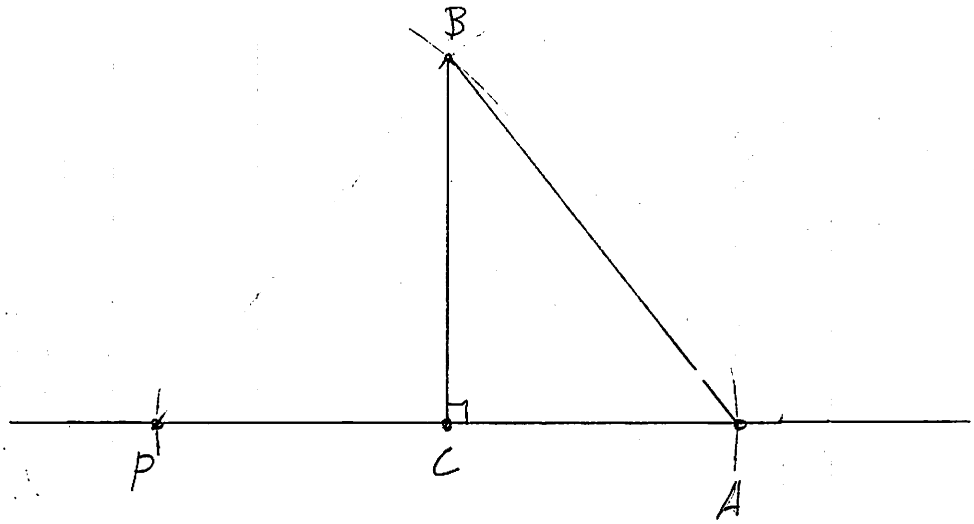
1) Place a point A conveniently
2) Measure length $\overline{AB}$
3) Put compass on AB, draw arc
4) Choose some point B on that arc
5) Open compass to distance $\overline{AC}$, draw arc from point A
6) Open compass to distance $\overline{BC}$
7) Put compass at B draw arc, intersecting arc from step 6, define point C

Variation of last - equilateral triangle - same process but you don't change the length of the compass for both points

Construct right triangle given one side and hypotenuse

$\underbrace{\text{one side}}_{L}$ $\underbrace{\text{hypotenuse}}_{H}$

1) Draw line $>2L$
2) Define point C near centre
3) Open compass to length L
4) Put compass at C, draw arcs on line to define A & P
5) Open compass to H, hypotenuse
6) Put compass at P and A, draw an arc above line
7) Label intersection B

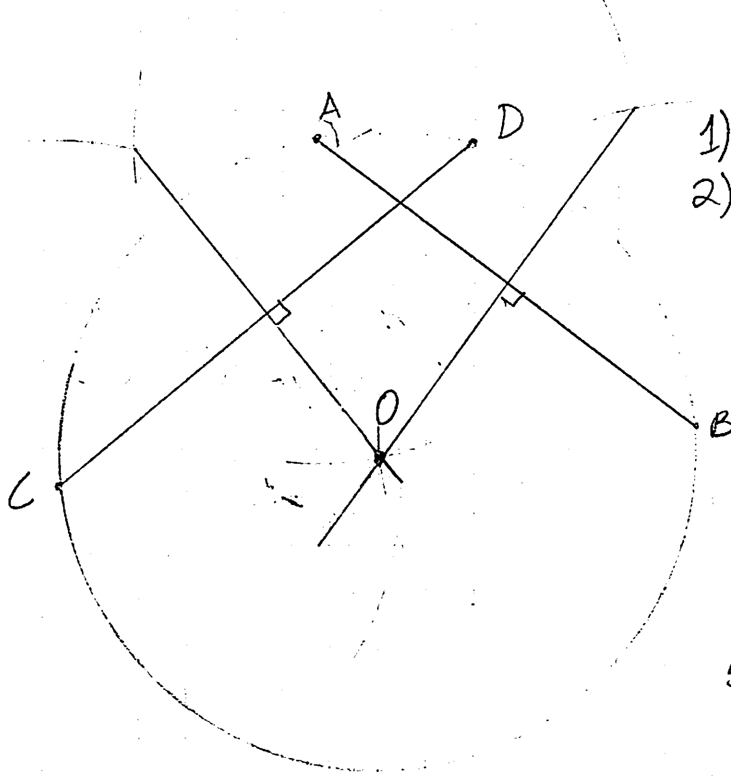


02/13/18

Find centre of circle

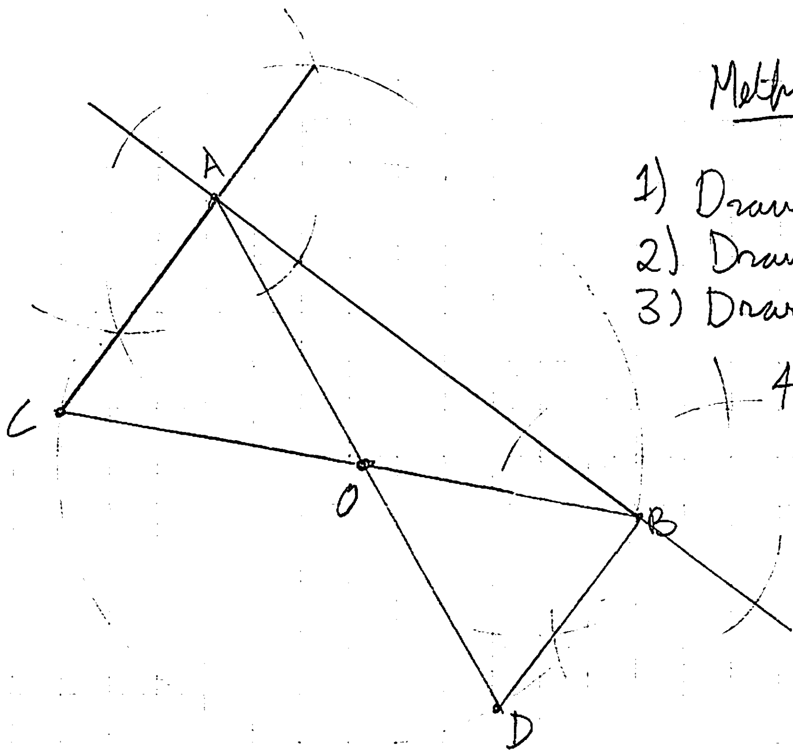
good when you aren't given full circle

Method 1



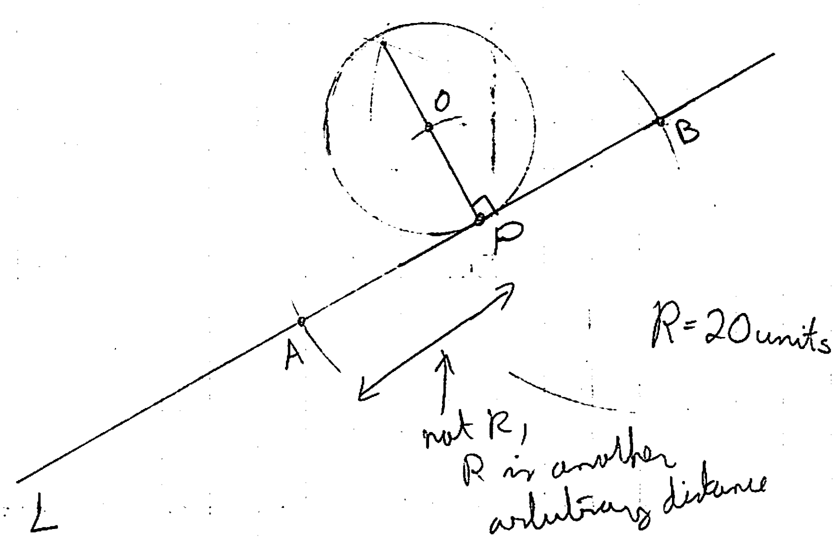
1) Draw arbitrary chord $\overline{AB}$
2) Draw another arbitrary chord $\overline{CD}$, not parallel to $\overline{AB}$
3) Draw the perpendicular bisector of AB
4) Draw perp bisector of CD
5) The intersection of the 2 bisectors is the centre

Method 2



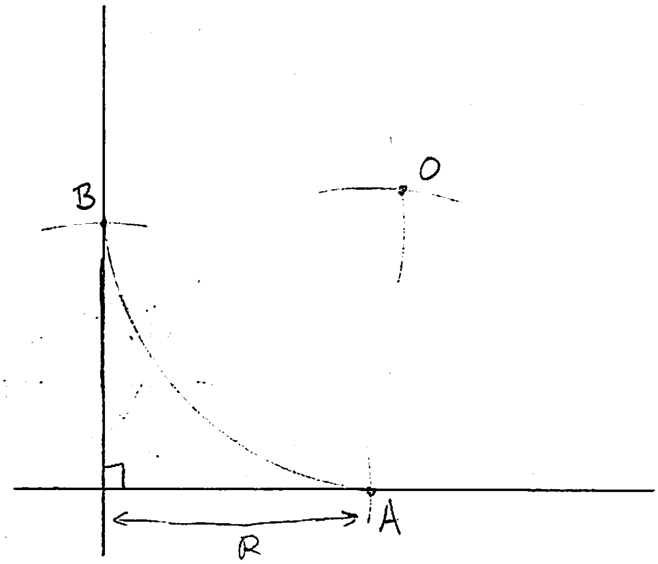
1) Draw chord AB
2) Draw $\perp$ to AB at A
3) Draw $\perp$ to AB at B
4) Connect $\overline{AD}$ & $\overline{CB}$, they intersect at centre

Given radius R, a line L, and point P on L, draw a circle with radius R tangent to L at P



1) Open compass to convenient width
2) With compass at P, mark A & B equidistant from P
3) Open compass to some width greater than $\overline{PB}$, w/ compass at A draw arc, w/ compass at B draw arc
4) Open compass to R, w/ compass at P, find point O that lies R units away from P
5) Draw circle at O.

Draw arc with given radius between 2 lines meeting at a right angle

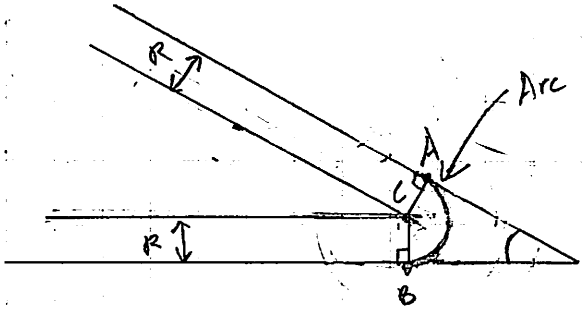


1) Open compass to given distance R ← arbitrary in this case
2) Place point of compass at the intersection of the lines
3) Draw arcs intersecting lines at A and B
4) Move compass to A, draw arc
5) Move compass to B, draw arc to intersect previous arc at O
6) Place compass at O, draw arch from A to B

02/15/18

<u>Arc in either acute or obtuse angle</u>

Arc has given radius R.

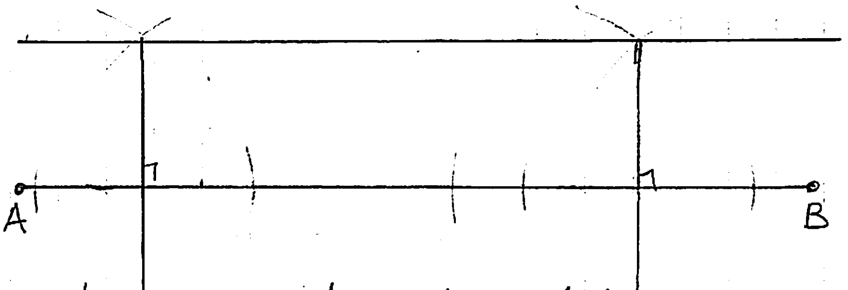


1) Draw two lines parallel to the original lines at distance R
2) Label intersection C on parallel lines to original.
3) Draw three perpendiculars from C to original lines to find tangent points A & B
4) Compass open to R, point at C, and draw from A to B

02/19/18

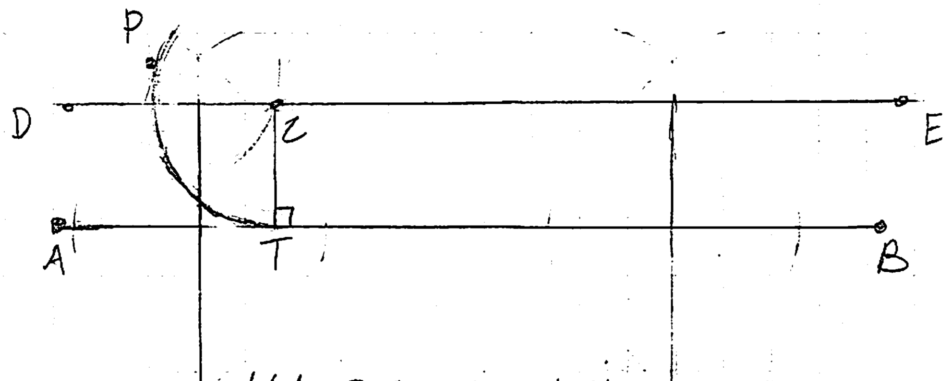
Construct a parallel line a certain distance away

Construct CD, parallel to AB, R away from AB



1) Construct two perpendiculars at arbitrary points
2) Connect them

Given a line AB and external point P, draw arc of given radius R through P tangent to AB

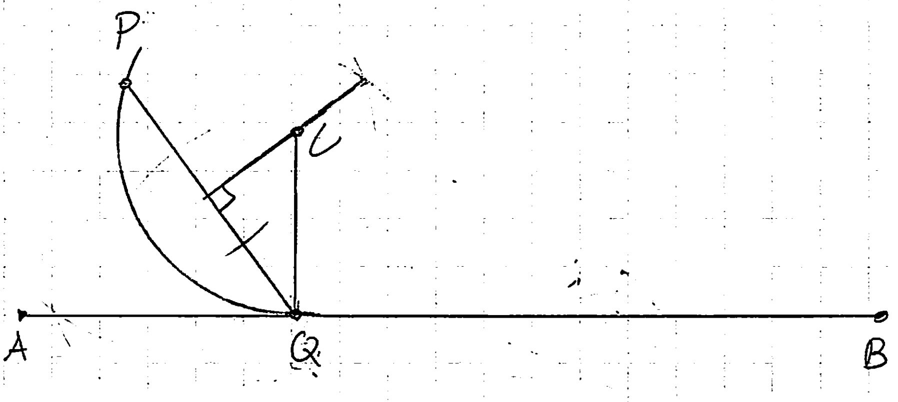


1) Draw parallel DE at distance R
2) Open compass width R, draw an arc from P to intersect DE to define C
3) Draw perpendicular from C to AB to find tangent point T.
4) Put compass at C and draw arc from P to T

→

Given line AB and external point P, tangent to AB at Q

Find arc from point P to line AB, tangent to AB at given point Q, don't have radius

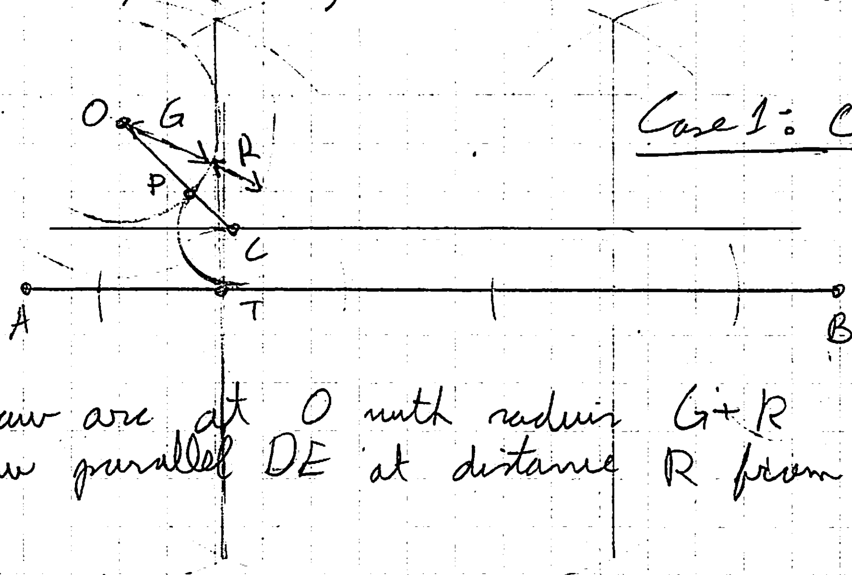


1) Draw line PQ
2) Find perpendicular bisector of PQ
3) Draw perpendicular from Q to define point C
4) Open compass to CQ (our radius), point on C, draw arc from P to Q

Draw arc tangent to a given line and another arc with given centre and radius

Line AB, centre O, radius G, New arc with some radius R

Case 1: O above arc

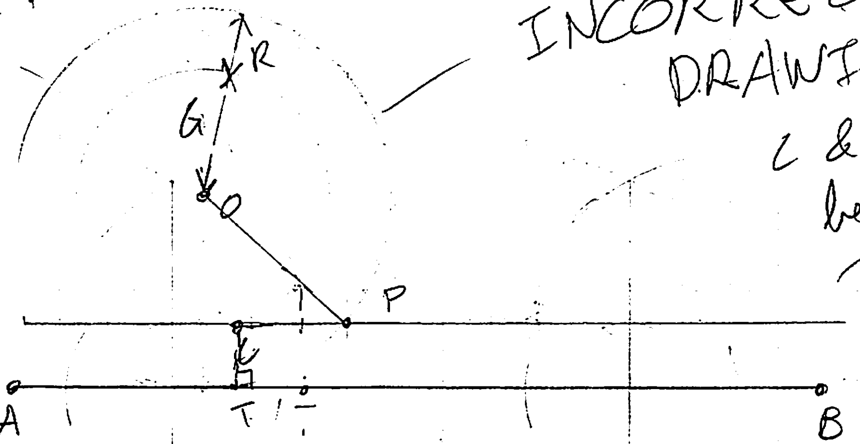


1) Draw arc at O with radius G+R
2) Draw parallel DE at distance R from AB

3) Intersection point is C, my centre
4) Connect OC, first point of tangency P at intersection of OC and original arc

5) Draw ⊥ from C to AB to define point T
6) Draw arc at C, radius R, from P to T

<u>Case 2</u>:



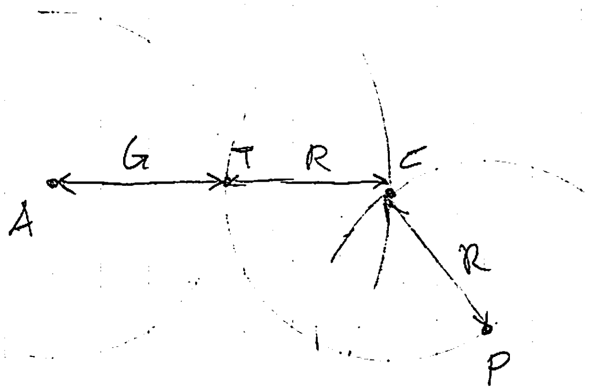
INCORRECT DRAWING, C & P should be on the same line, T is a ⊥ extension of the arc through C

All steps from case 1 apply except, step 1)
Draw arc at O w/ radius G-R

the arc is centre C through P & T

02/20/98

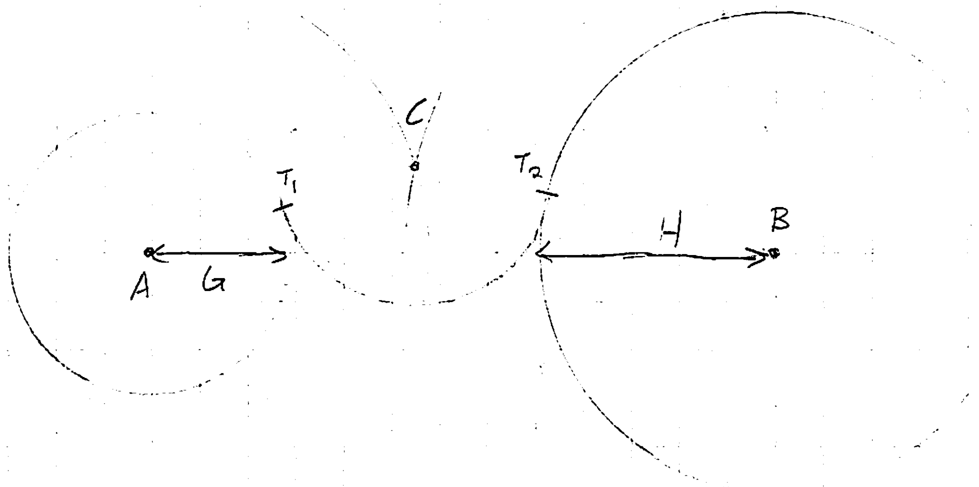
Given an arc A with radius G, find arc with radius R tangent to A and passing through point P not on arc A



1) Draw arc with radius R from point P.
2) Draw arc from point A with radius G+R, intersection defines centre C
3) Point of tangency T is on line connecting AC
4) Draw arc from T to P w/ radius R point at C

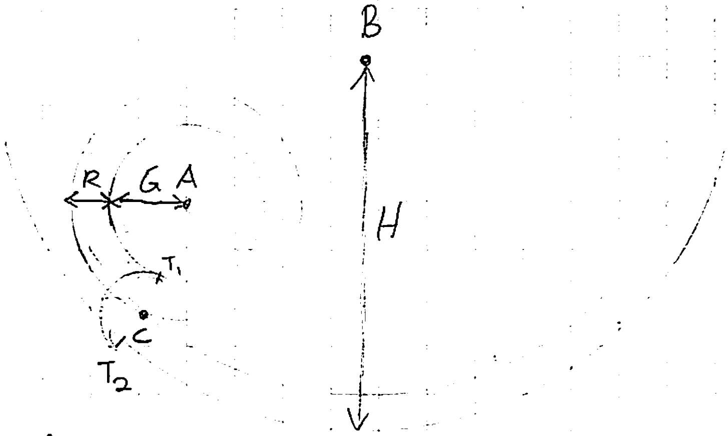
Arc with a given radius R tangent to two given arcs with given centres A and B and given radii G and H

Case 1:



1) Draw arc parallel to A with radius G+R
2) Draw arc parallel to B with radius H+R
3) Define point C centre of desired arc
4) Find point of tangency T_1 by finding intersection of AC with A
5) Find point of tangency T_2 by finding intersection of BC with arc B
6) Draw arc centre C, radius R.

Case 2:



only difference from case 1

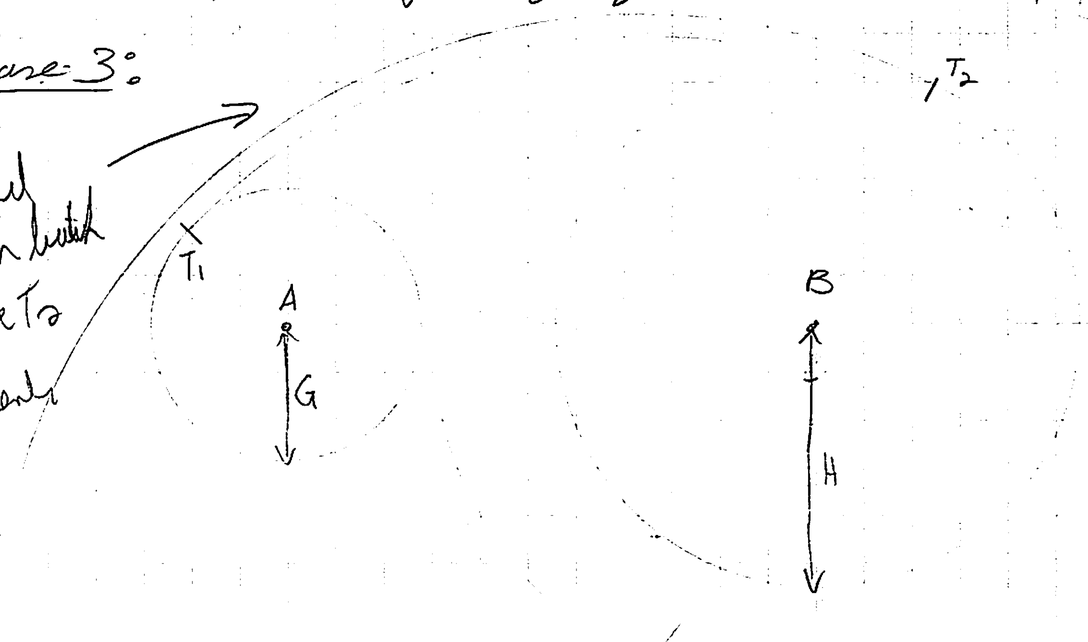
1) Draw arc parallel to A with radius G+R
2) Draw arc parallel to B with radius H−R

The rest is the same as case 1

* [Can draw any arc with its centre and two points of tangency

Case 3:

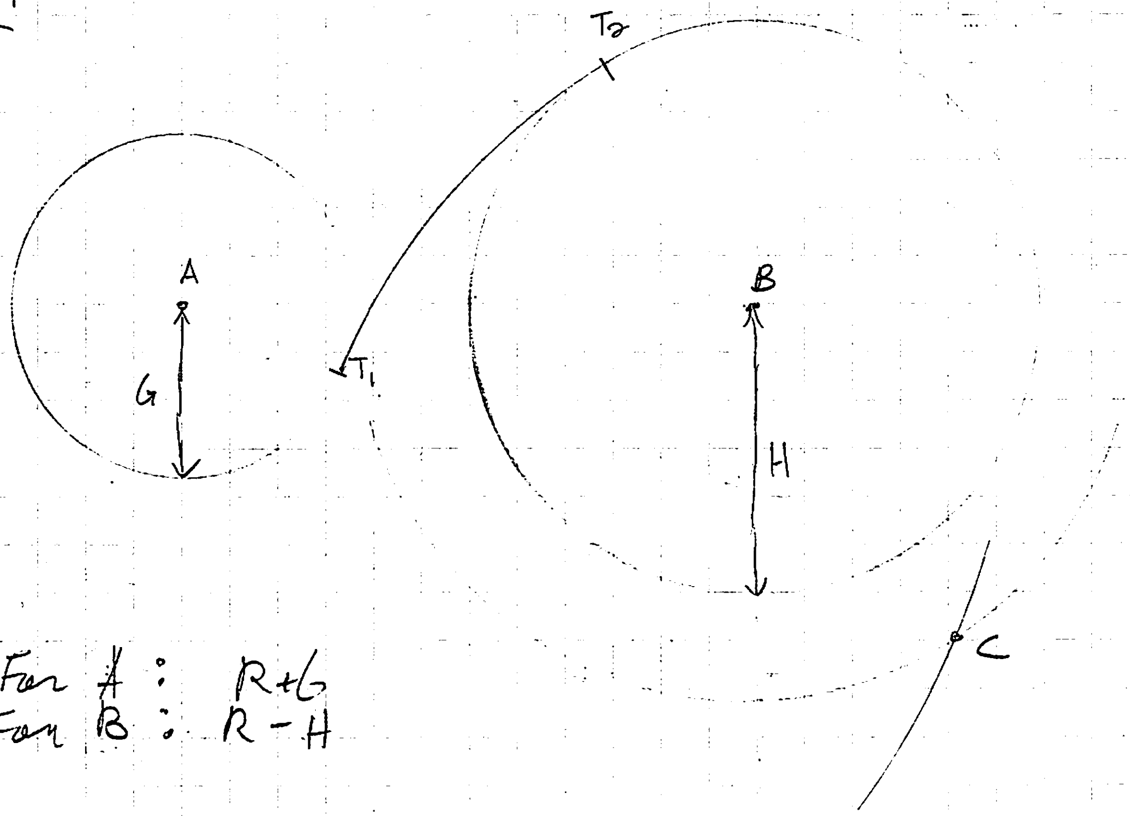
Should touch both T_1 & T_2 / measurements off



1) arc A : radius R − G C
2) arc B : radius R − H

R is larger than H and G

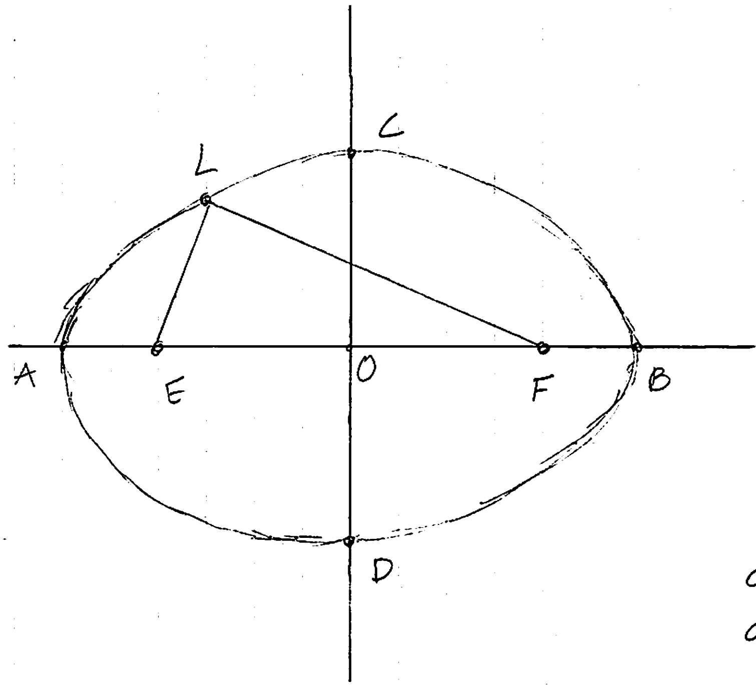
Case 4



1) For A : R+G
2) For B : R − H

02/26/18

Ellipses

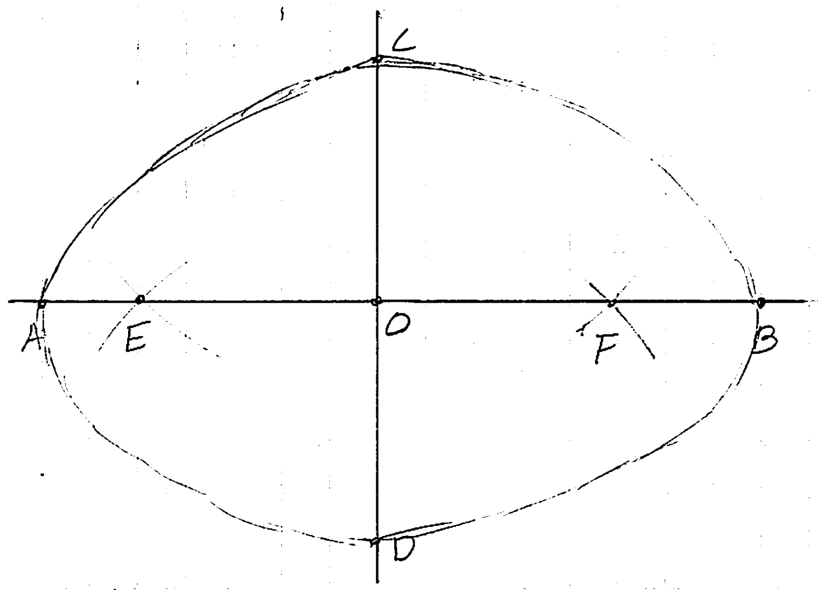


Centre O
Major axis AB
Minor axis CD
Focuses EF

$$1 = \frac{x^2}{a_1^2} + \frac{y^2}{a_2^2}$$

$a_1 = \overline{AB}$
$a_2 = \overline{CD}$

Find focii EF

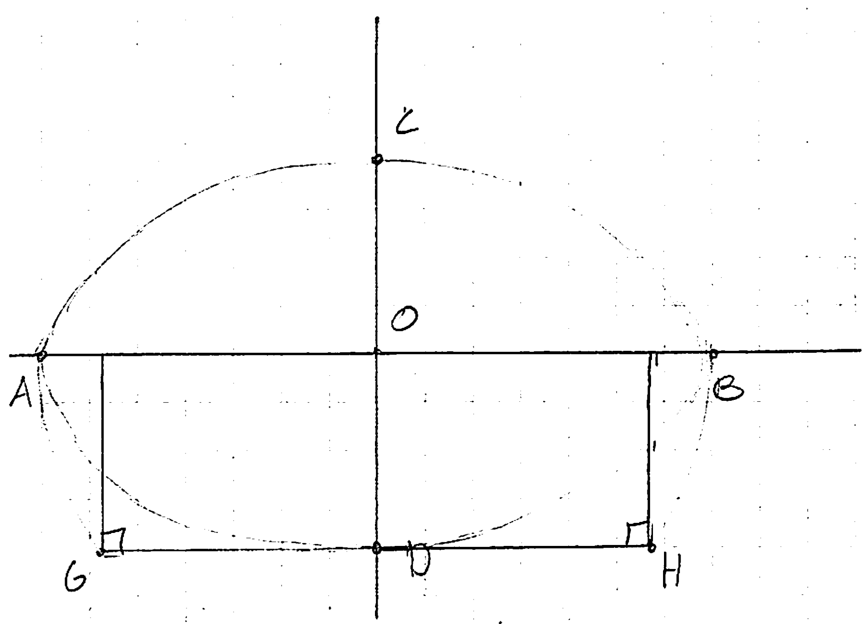


1st method

1) Open compass to $\frac{1}{2}$ AB, ie $\overline{AO}$
2) Place compass at either C or D
3) Draw arc intersecting $\overline{AB}$ at focii E and F

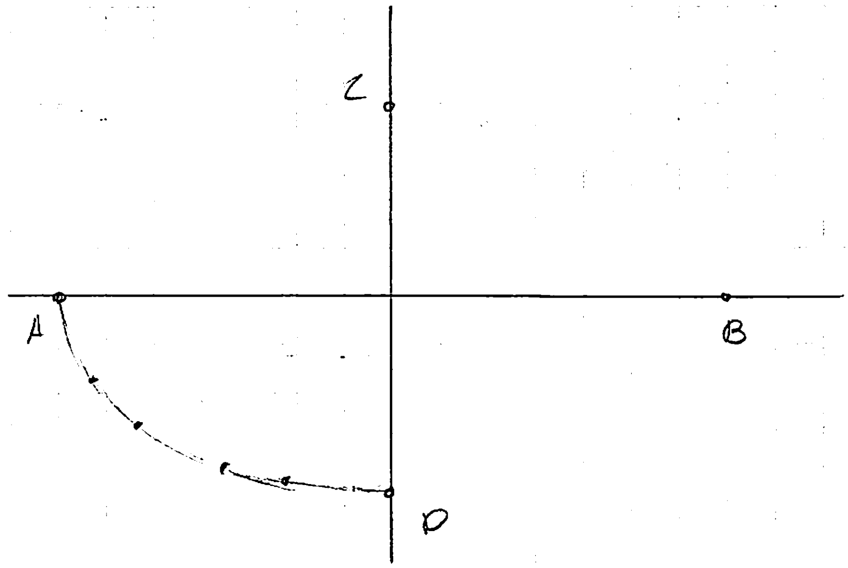
2nd method

1) Open compass to ½AB
2) Draw semicircle from A to B at centre O
3) Draw line through D, ∥ to AB intersecting semicircle at GH
4) Draw ⊥ from G and H to AB, intersect at EF



Drawing ellipse w/ given major & minor axes

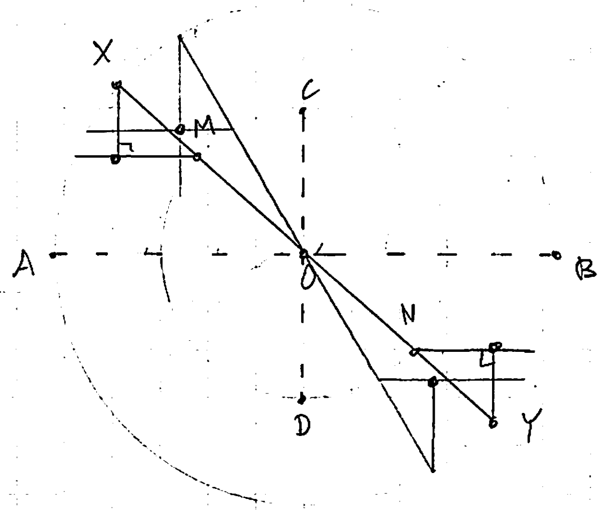
"Trammel" method (using a piece of paper)



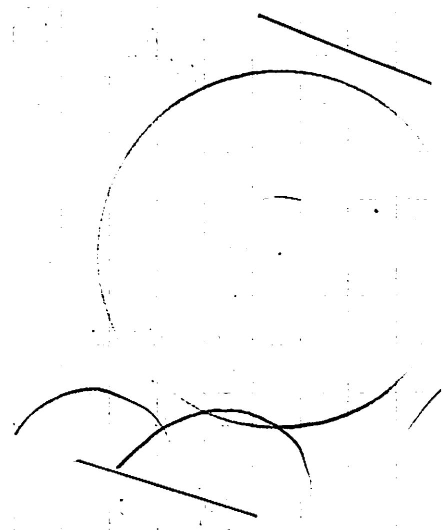
1) Measure ½ AB - M
2) Measure ½ CD - L
3) Move trammel around axes, keep point L on major axis, M on minor axis

Concentric circle method

1) Draw circle at O w/ radius ½ AB
2) Draw circle at O w/ radius ½ CD
3) Draw arbitrary diameter intersecting large circle at X, Y and smaller circle M, N
4) Draw lines through M, N ∥ to $\overline{AB}$
Draw lines through X, Y ∥ to $\overline{CD}$
5) Intersection of lines define 2 points of ellipse
6) Repeat steps 3-5 until done



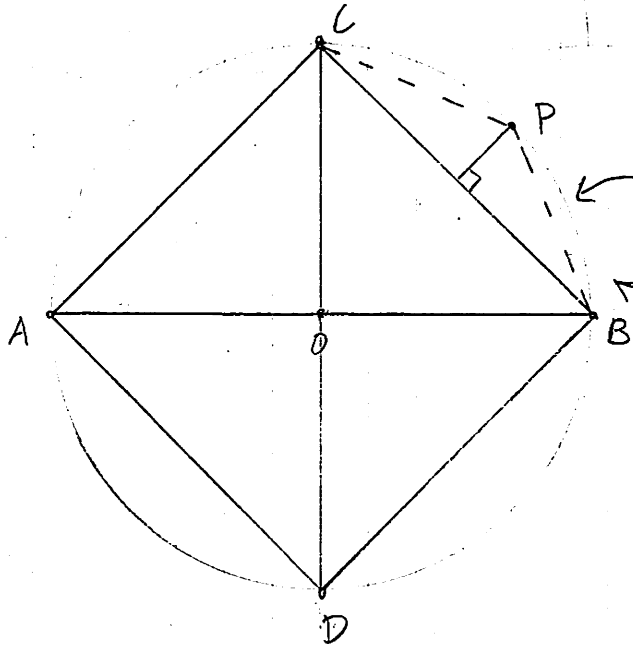
the right angles are points on the ellipse



03/01/18

Regular Polygons

Square

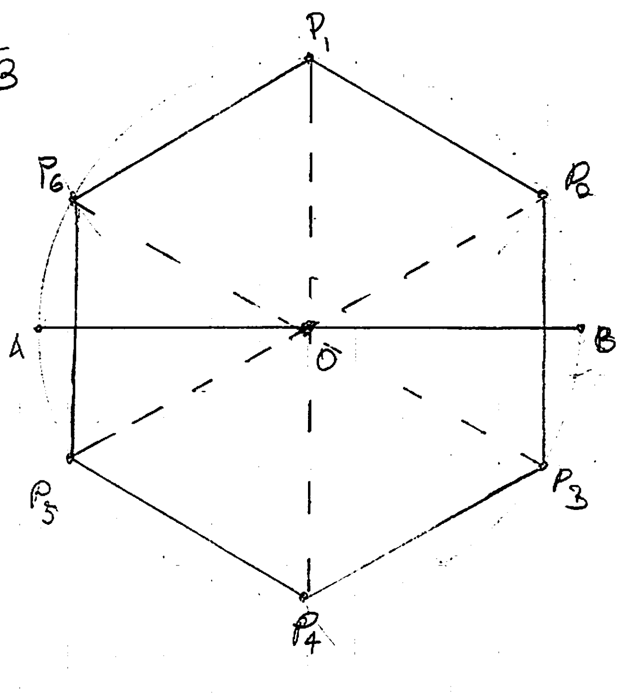


this can be easily doubled to make an octagon

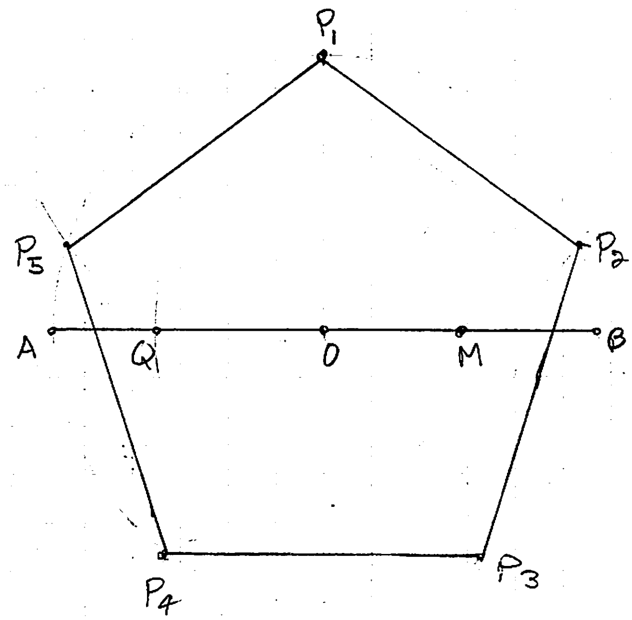
do that to each side to create an octagon

Regular Hexagon

1) Measure radius $\overline{OB}$
2) Pick a point on the circle, call it P_1
3) Put compass at P_1, draw
4) Move to P_2 to define P_3



Pentagon



1) Define point P_1 on diameter $\perp$ to $\overline{AB}$
2) Midpoint M of $\overline{OB}$
3) Put compass at M, open to width MP_1
4) Draw arc intersecting $\overline{AO}$ at Q
5) QP_1 is the length of the side
6) Set compass width to QP_1, At P_1, draw arcs to define P_2, P_5
7) Move compass to P_2 to find P_3, ...

03/13/18

Surface Construction

Solid Modeling vs: **Surface Construction**

analytic shapes (circles, lines, squares, arcs) extrusions, cuts, ..

↓

Function over form

arbitrary curves b-spline

↓

Ergonomics, Appearance Style

04/24/18

Parts List

For every part:
- File name
- Quantity
- Author
- Title ← two, three words
- Comment ← additional comment where part came from / where it fits in
- Item number

05/17/18

Final exam review

Part		# of questions
A -	T/F basics, mixed topics	15-20
B -	Multiple choice, mixed topics	5-10
C -	Short Answer (could include drawing/sketching)	~3
D -	Dimensioning, views (most drawing heavy)	~3
E -	Misc. questions on solid edge	10

Topics:

Surfacing in SE
Assemblies
Drafts, draft environment

Bring drawing equipment, straight edge, maybe compass

Dimensioning rules
Sectional views
Auxiliary views ← auxiliary view, lets you dimension true shape or any on oblique surface
Isometric sketching → might be an example pulled from lab exercises in assignment tab
Standard views

might have go from standard views to isometric

little overlap between first & second tests

A & E will include the most solid edge stuff

C & D involve drawing

E - most likely where surfacing & assemblies will show up (think assignment 4)

B - more about views, dimension, etc. example: which of these is correct way to dimension a part

→

Assembly relationships with flush fit

Align - two parts are adjacent / parallel

Mate - two parts are flush with each other

Axial - two parts with circular axes aligned