Civinnovate

Discover, Learn, and Innovate in Civil Engineering

Chapter 2

Using Drawing Tools & Applied Geometry
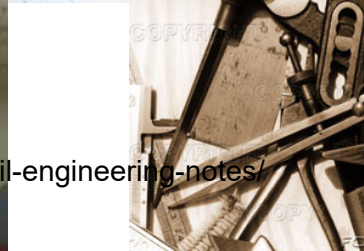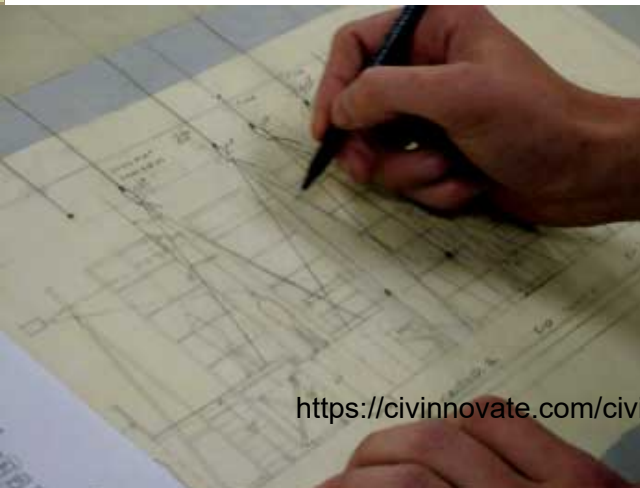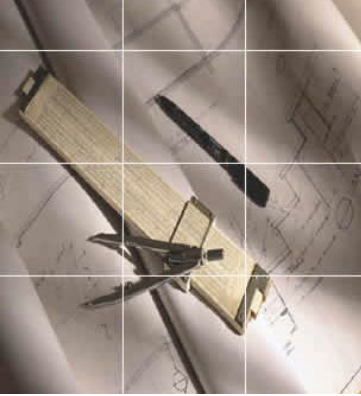
https://civinnovate.com/civil-engineering-notes/

TOPICS

- Preparation of Tools.

- Using of Tools

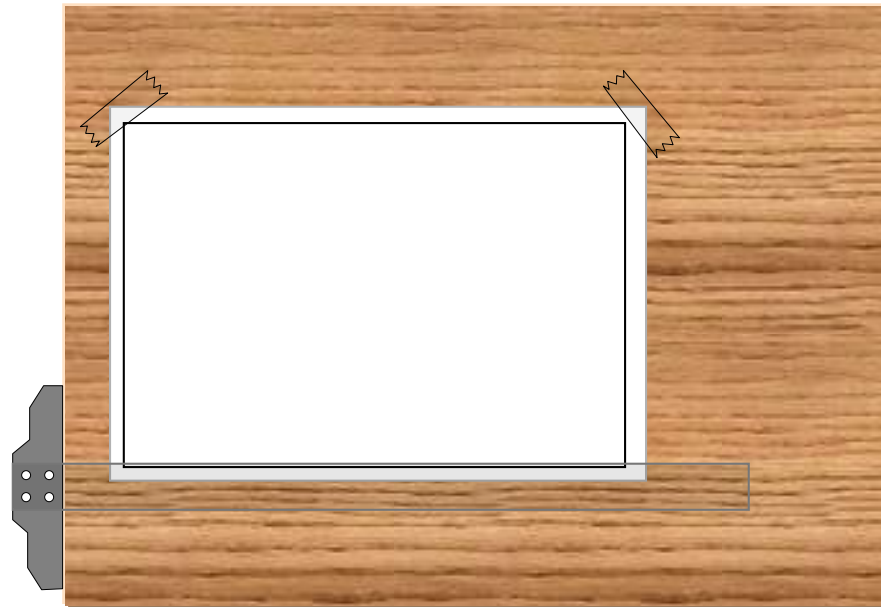- Applied   Geometry

Preparation of Tools

Fastening Paper to Drafting Board

1. Place the paper close to the table's left edge.

2. Move the paper until its lower edge place about the top edge of T-square.
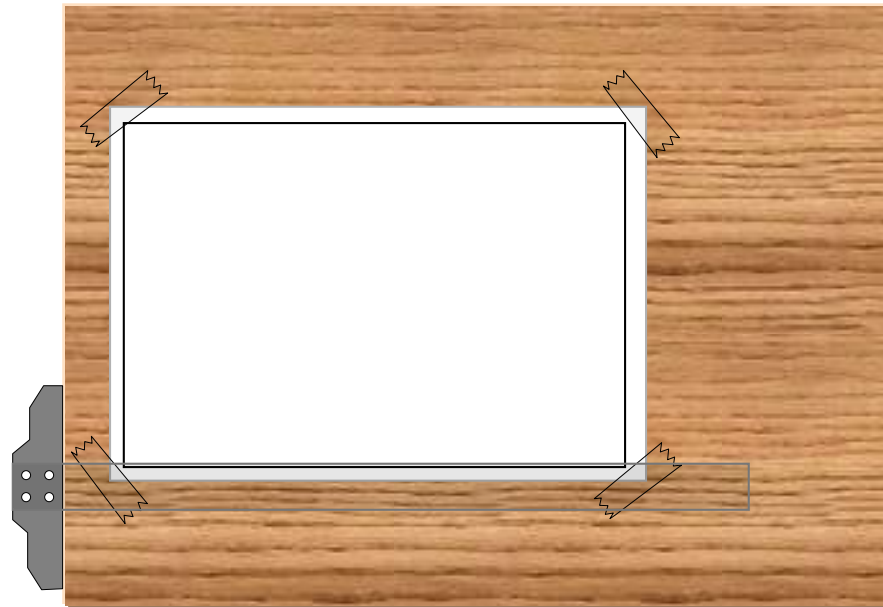
Fastening Paper to Drafting Board

3. Align the top edge of the paper with T-square blade.

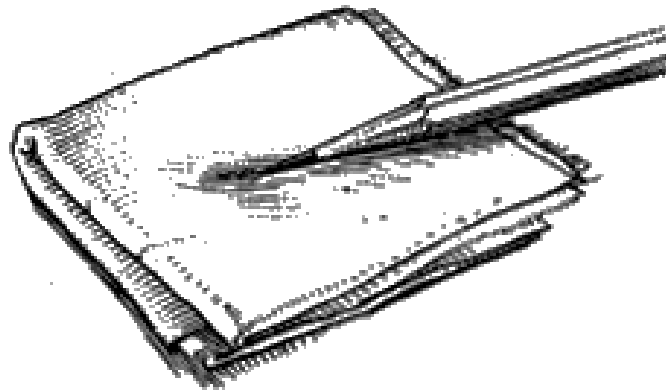4. Attach the paper's corners with tape.

Fastening Paper to Drafting Board

5. Move T-square down to smooth the paper.

6. Attach the remaining paper's corners with tape.
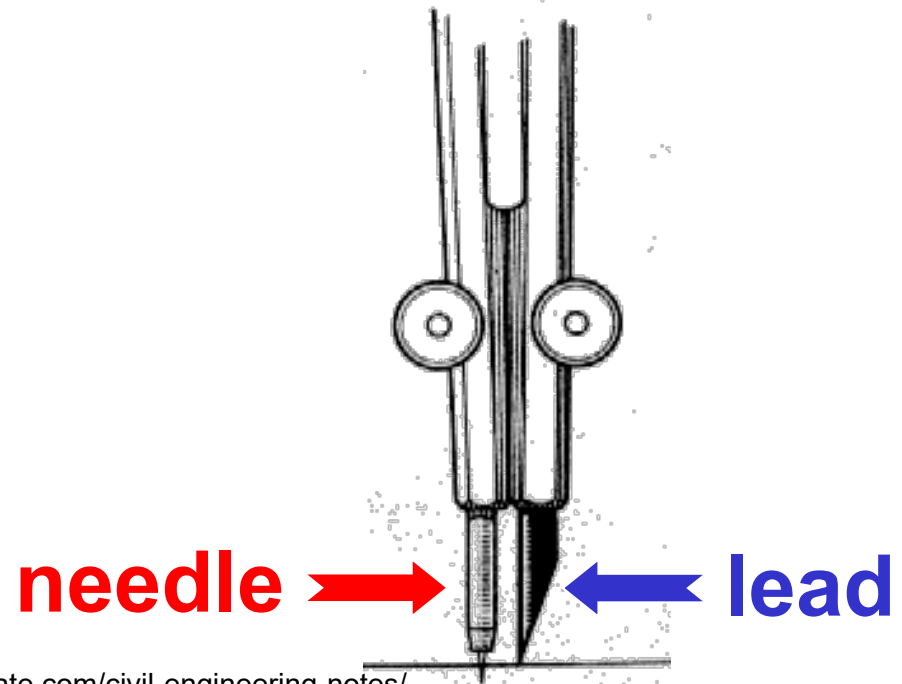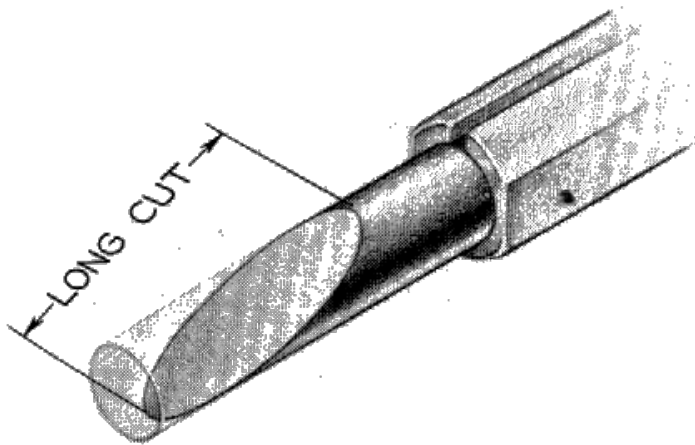
Sharpening the Pencil

1. Remove the wood with penknife while expose a lead about 8-10 mm.

2. Polish the lead into a conical shape with a sandpaper.
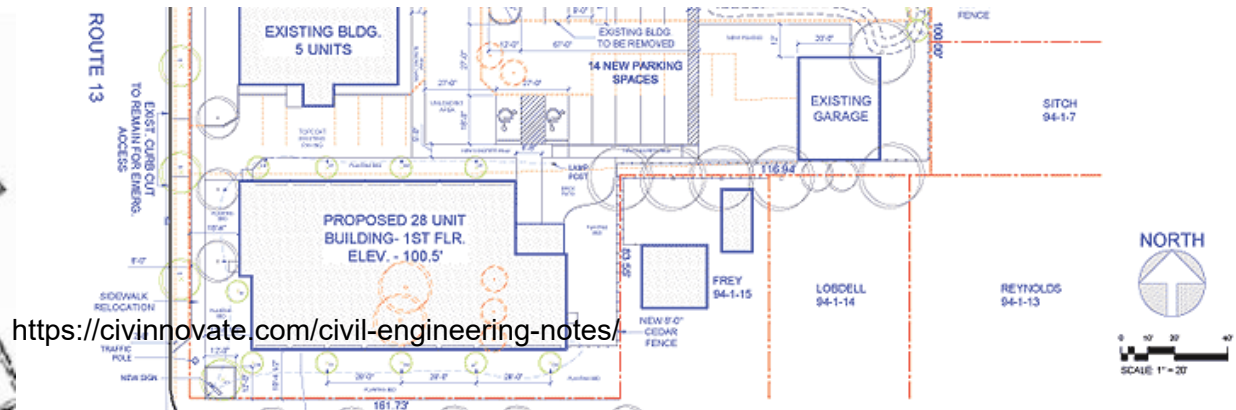
3. Clean the lead with tissue paper.

Preparing the Compass

1. Sharpen the lead with a sandpaper.

2. Adjust the **needle** and the **lead** so that the tip of the needle extends slightly more than the lead.

LONG CUT

needle ➡️ ⬅️ **lead**

Using the Tools

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Function of the Tools

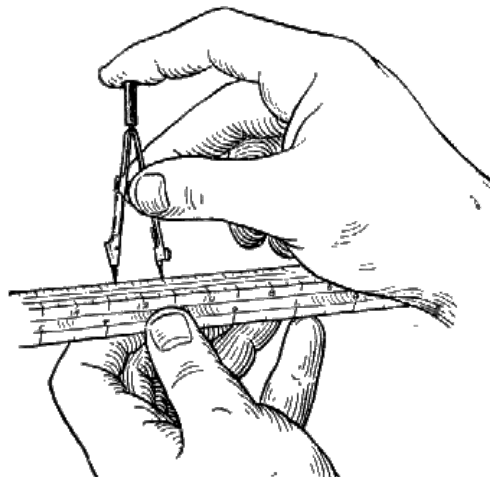| Tools	Shape to be drawn

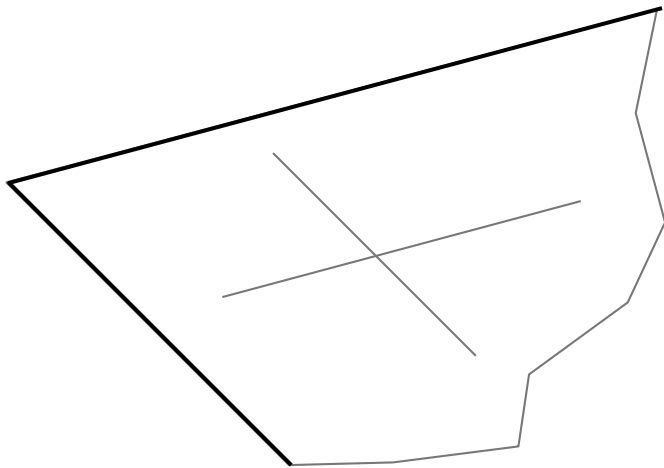1. T-square

2. Triangles

→ Straight line

3. Compass

4. Circle template

→ Arc, Circle

Using the Compass

1. Locate the center of the circle by two intersecting lines.

2. Adjust the distance between needle and lead to a distance equal to radius of the circle.

3. Set the needle point at center.

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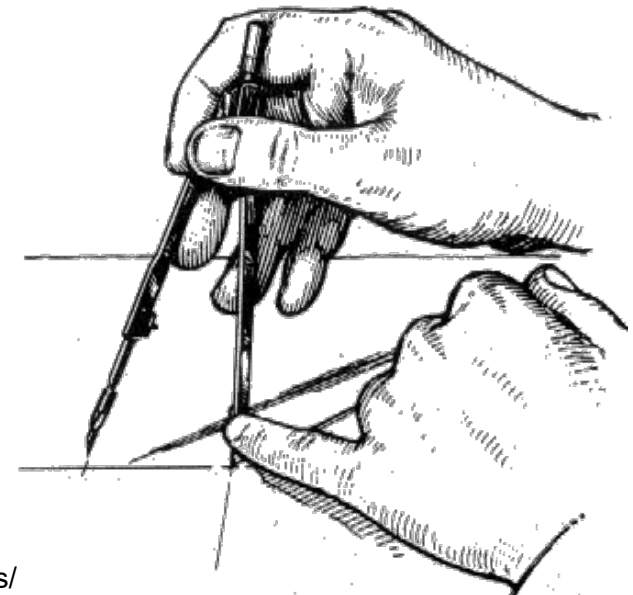
Using the Compass

4. *Start circle.* Apply enough pressure to the needle, holding compass handle between thumb and index fingers.

5. *Complete circle*. Revolve handle clockwise.
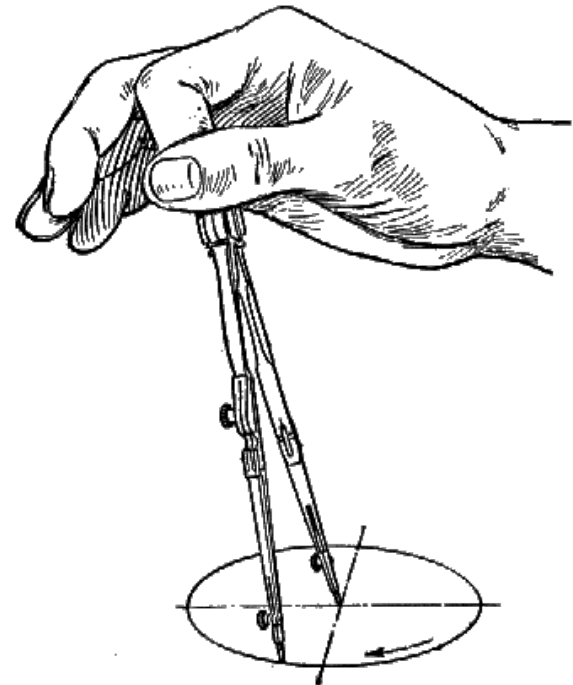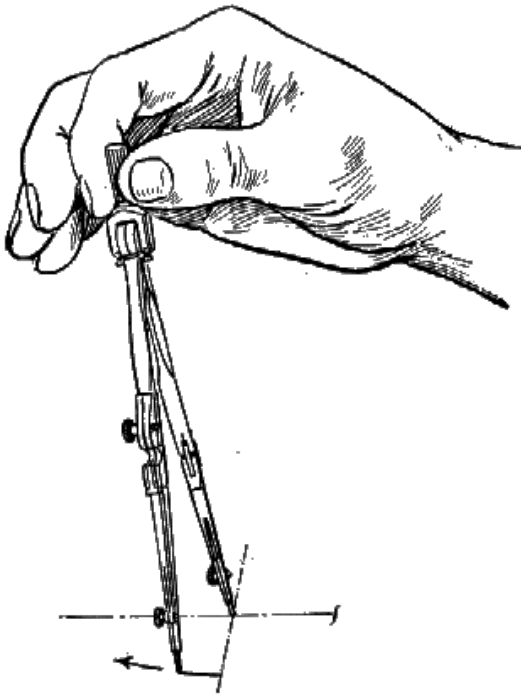
Using a Circle Template

1. Draw two perpendicular lines that pass through center of a circle to be drawn.

2. Place the template till all marking coincide with center lines.

3. Tracing the circle. (Hold the pencil normal to the paper.)

Given

Center of a circle to be drawn

Object line

Construction line

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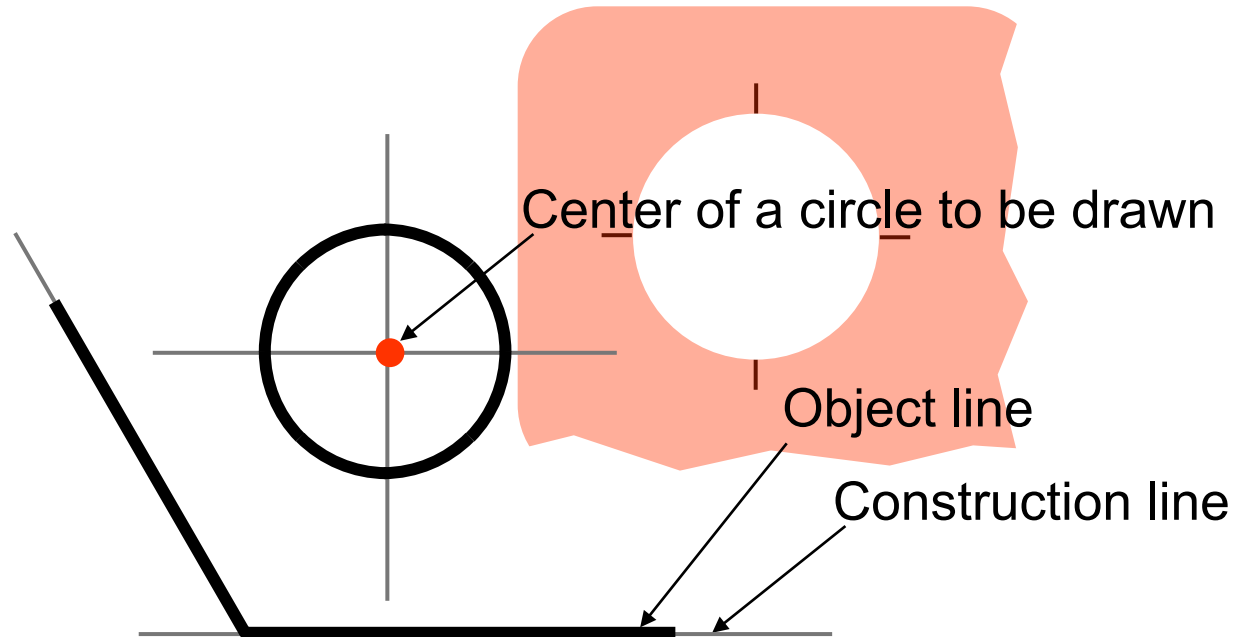
Draw a Horizontal Line

1. Press the T-square head against the left edge of the table.

2. Smooth the blade to the right.
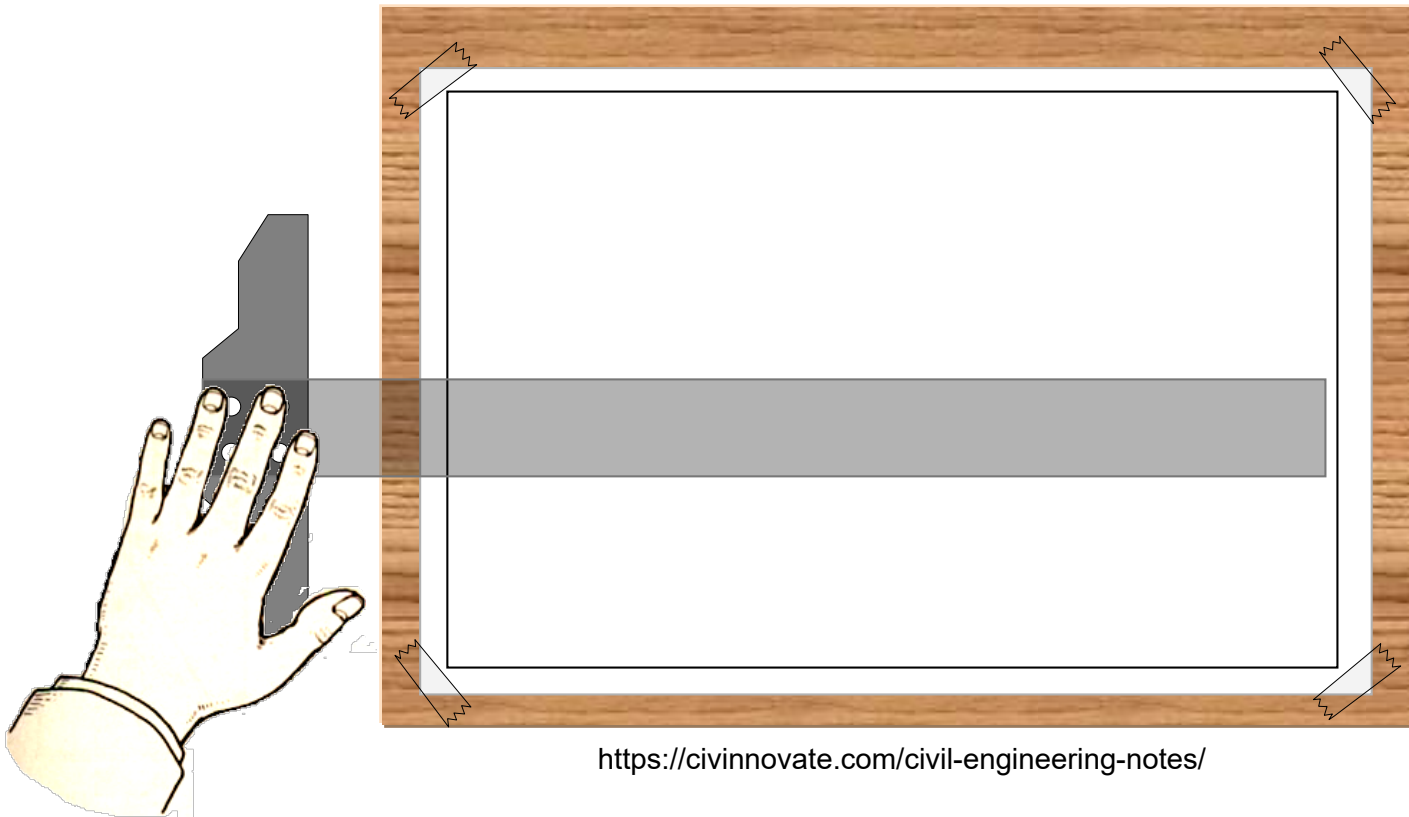
Draw a Horizontal Line

3. Lean the pencil at an angle about 60° with the paper in the direction of the line and slightly "toed in".

4. Draw the line from left to right while rotating the pencil slowly.

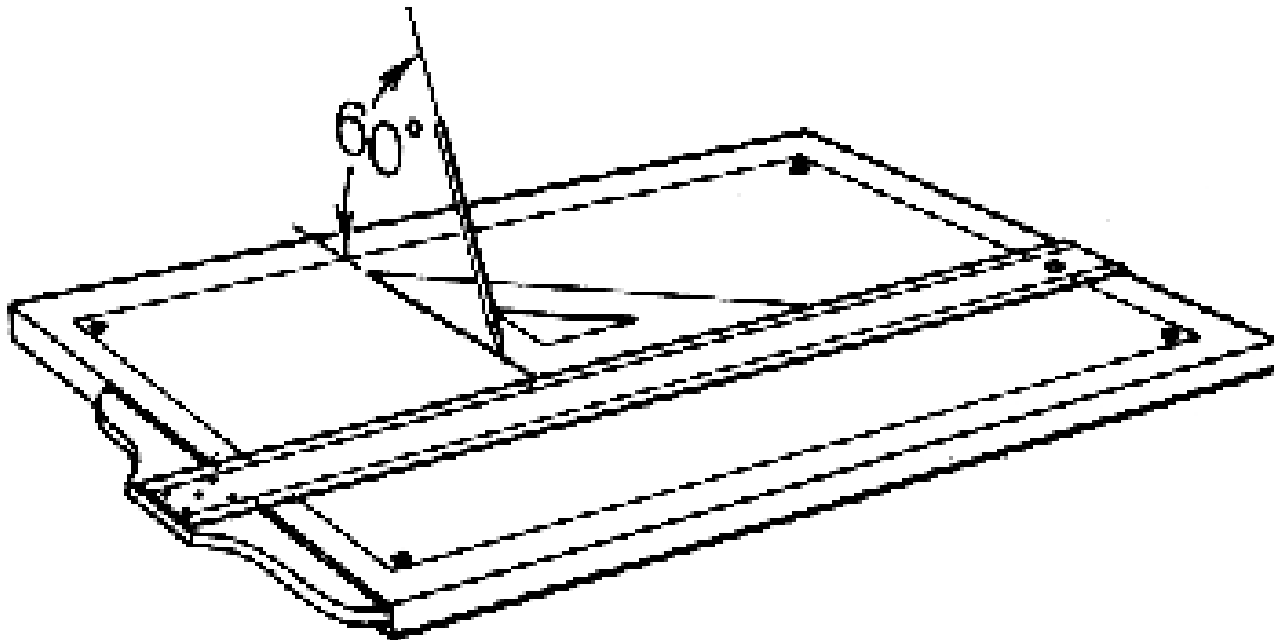https://civinnovate.com/civil-engineering-notes/
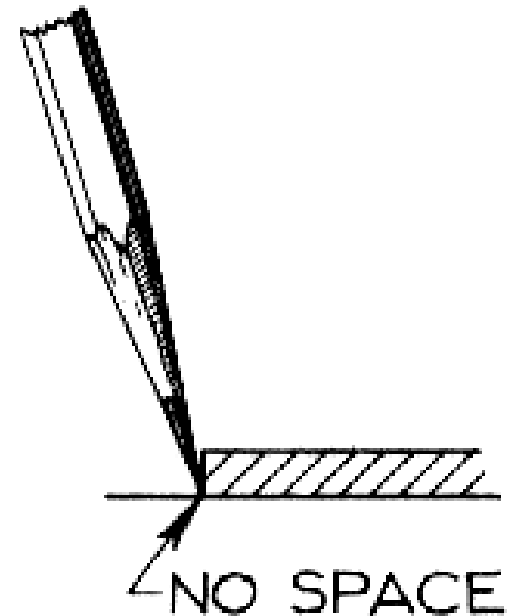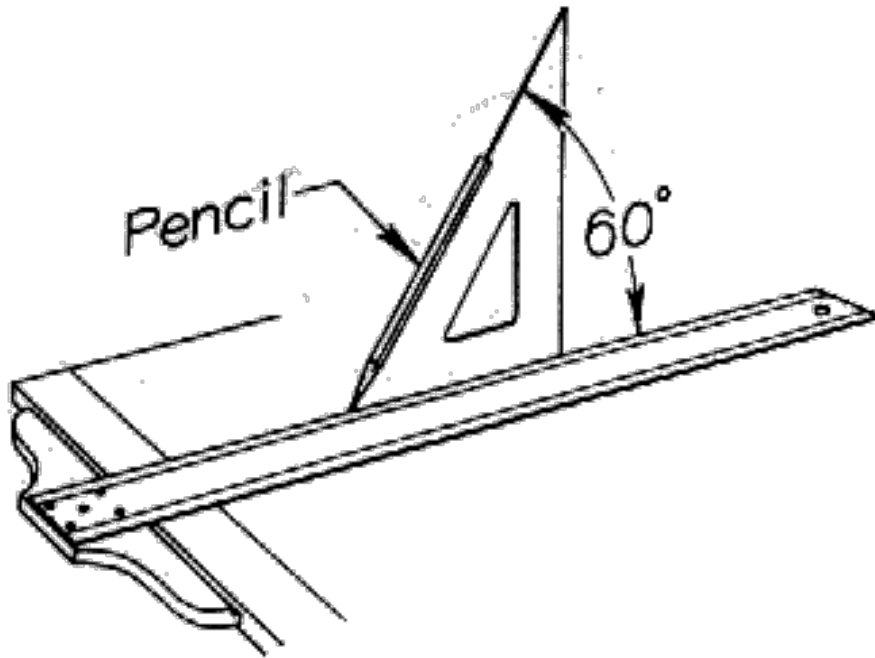
Draw a Vertical Line

1. Set T-square as before. Place any triangle on T-square edge.

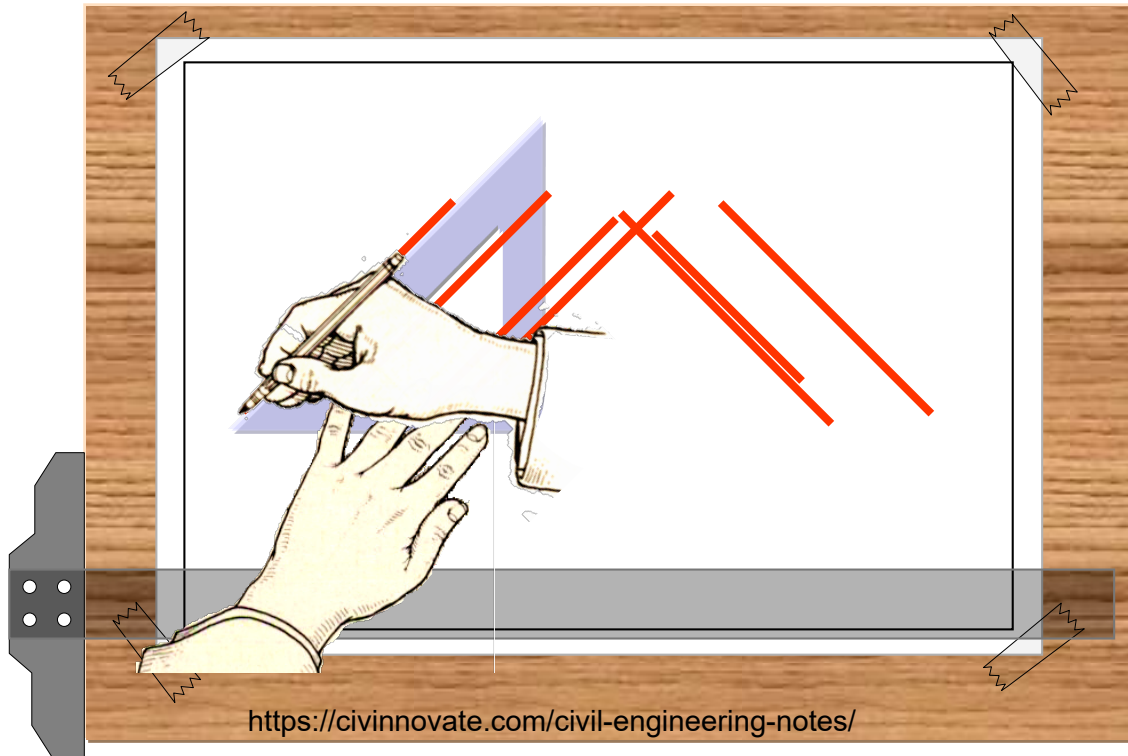2. Slide your left hand to hold both T-square and triangle in position.
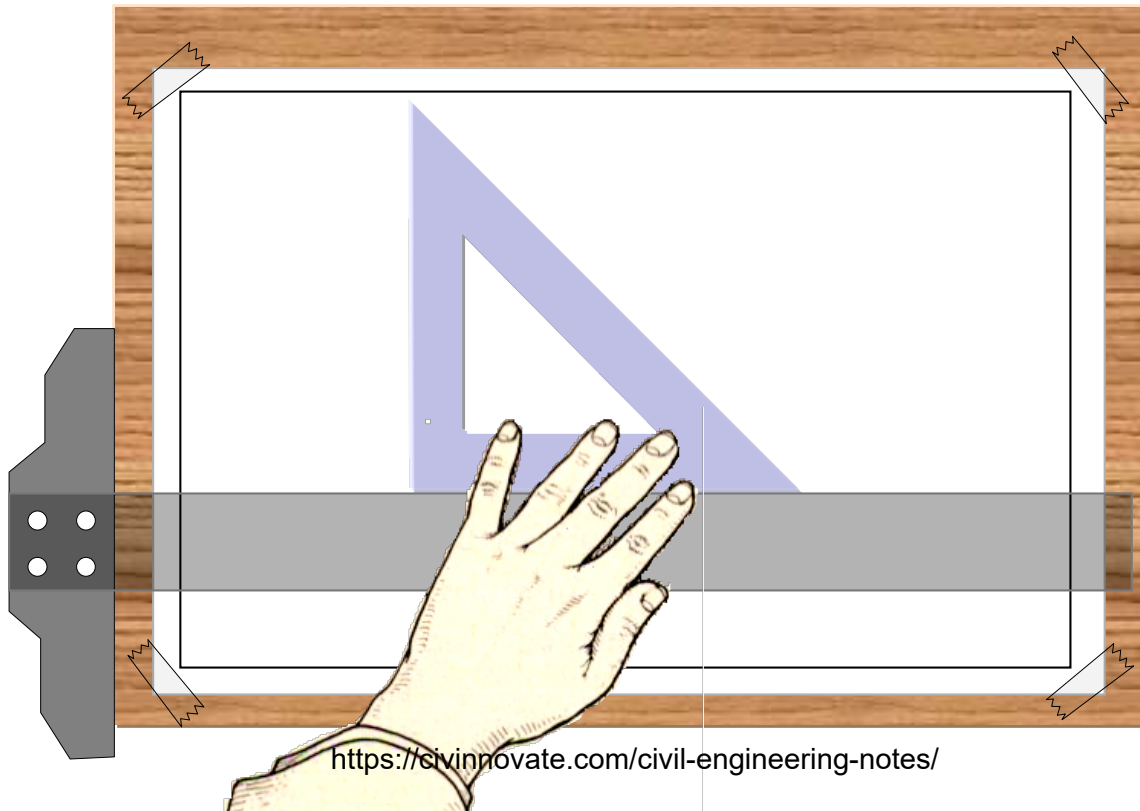
Draw a Vertical Line

3. Lean the pencil to the triangle.

4. Draw the line upward while rotating the pencil slowly.
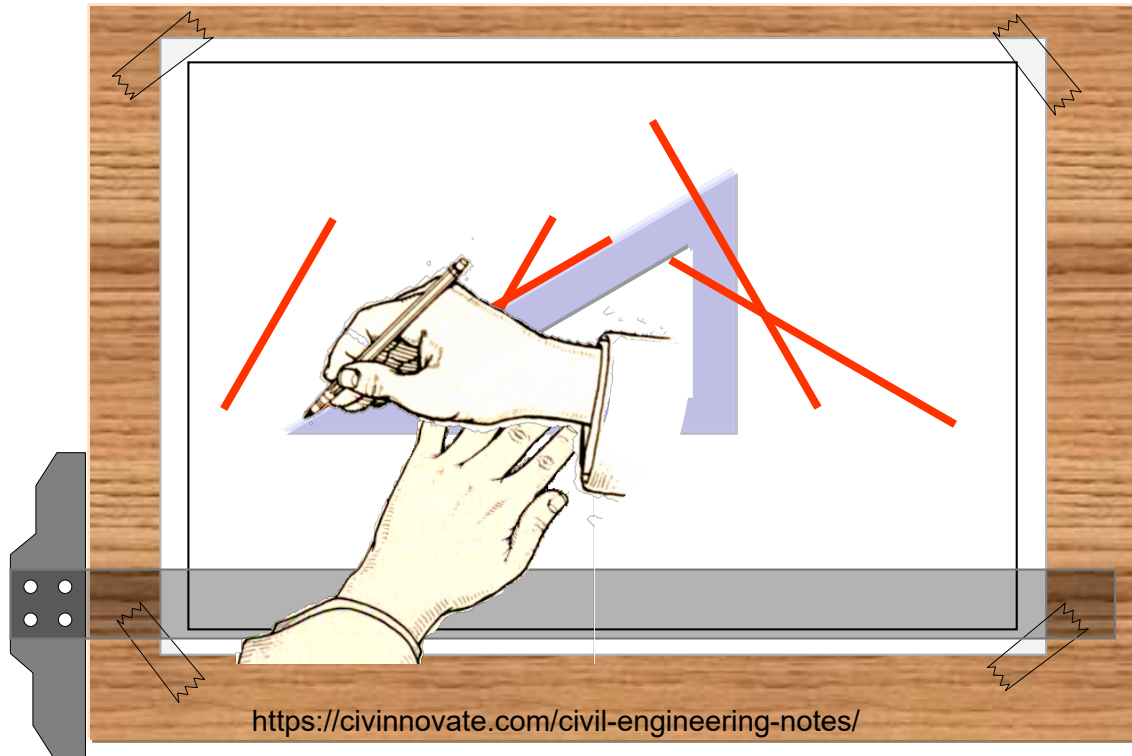
60°

Draw a line at 45º with horizontal

1. Place 45º triangle on the T-square edge and press them firmly against the paper.

2. Draw the line in the direction as shown below.

Draw a line at angle 30º and 60º

1. Place 30º-60º triangle on the T-square edge and press them firmly against the paper.

2. Draw the line in the direction as shown below.

Draw the lines at 15° increment
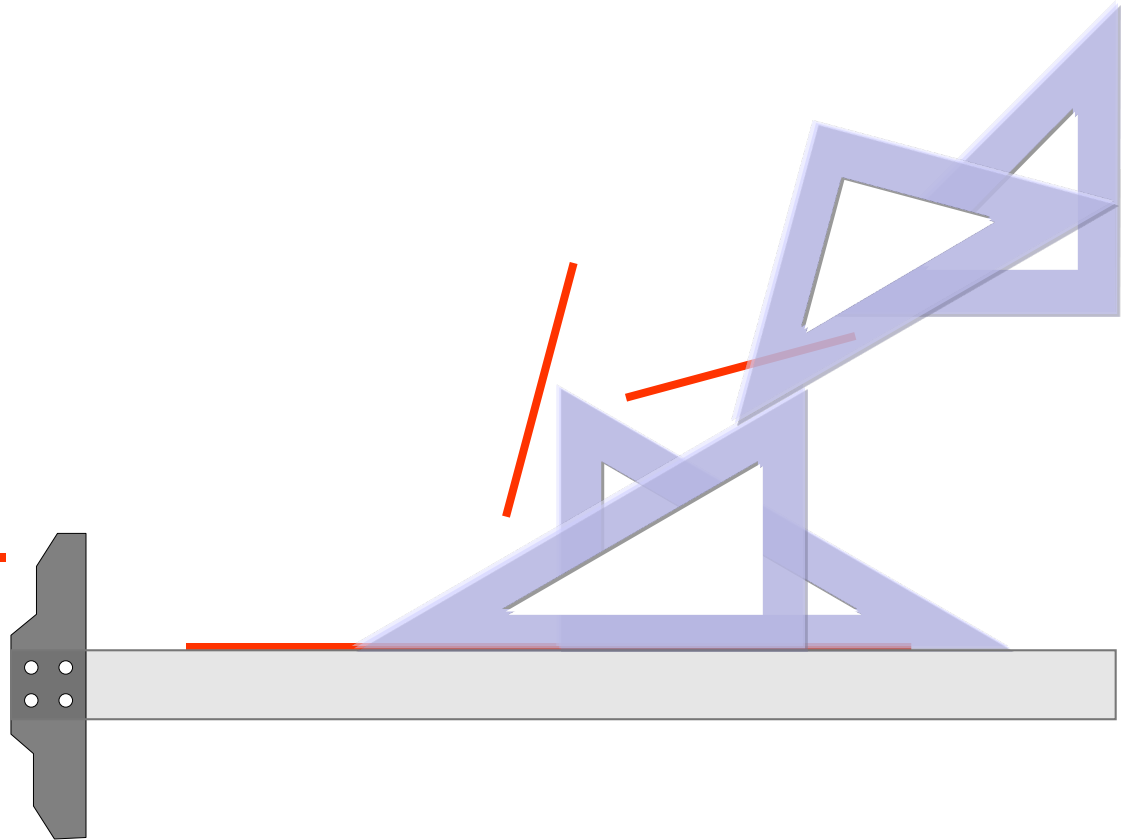
0 deg.

15 deg. = −30 + 45 deg

30 deg. ⎤
⎟
45 deg. ⎬ Already
⎟ demonstrated.
60 deg. ⎦

75 deg. = 30 + 45 deg

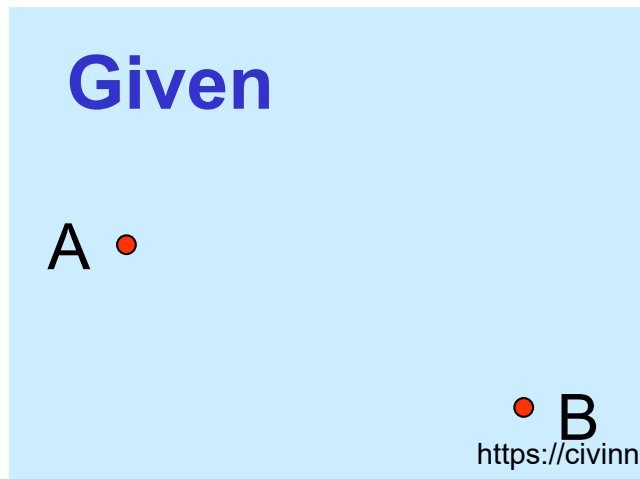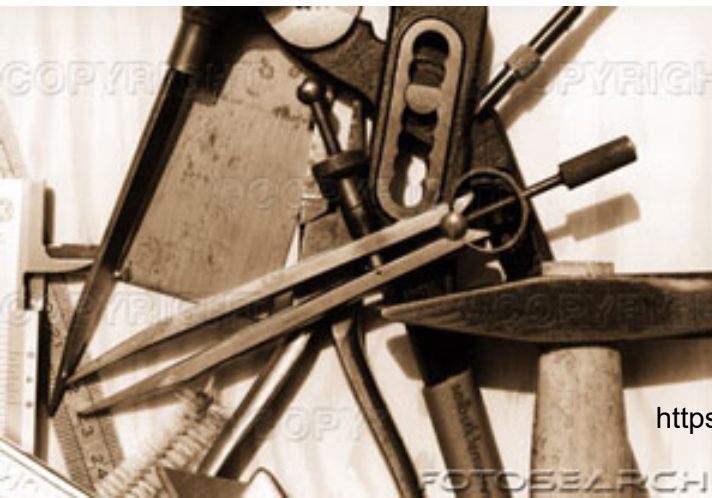90 deg. Already
demonstrated.

Draw the line passing through two given points

1. Place the pencil tip at one of the points.

2. Place the triangle against the pencil tip.

3. Swing the triangle around the pencil tip until its edge align with the second point.

4. Draw a line.

Given

A •

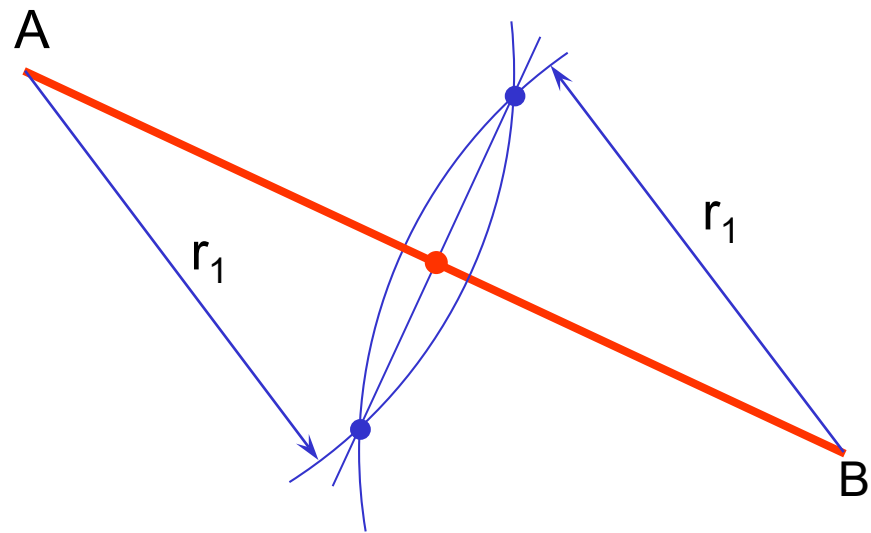• B

A

B

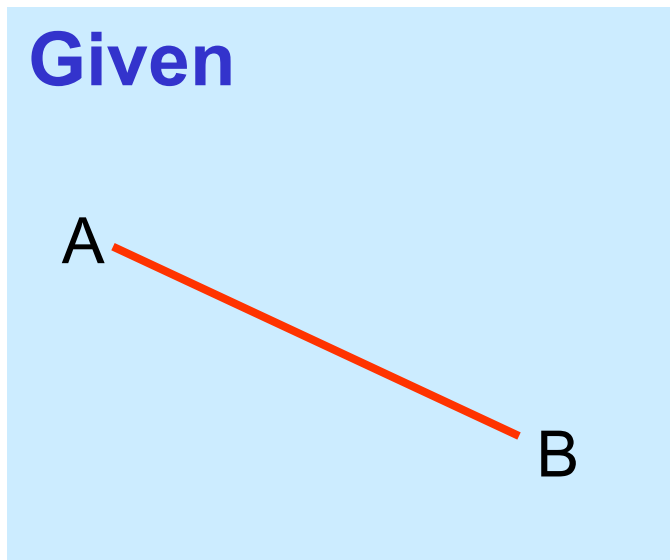https://civinnovate.com/civil-engineering-notes/
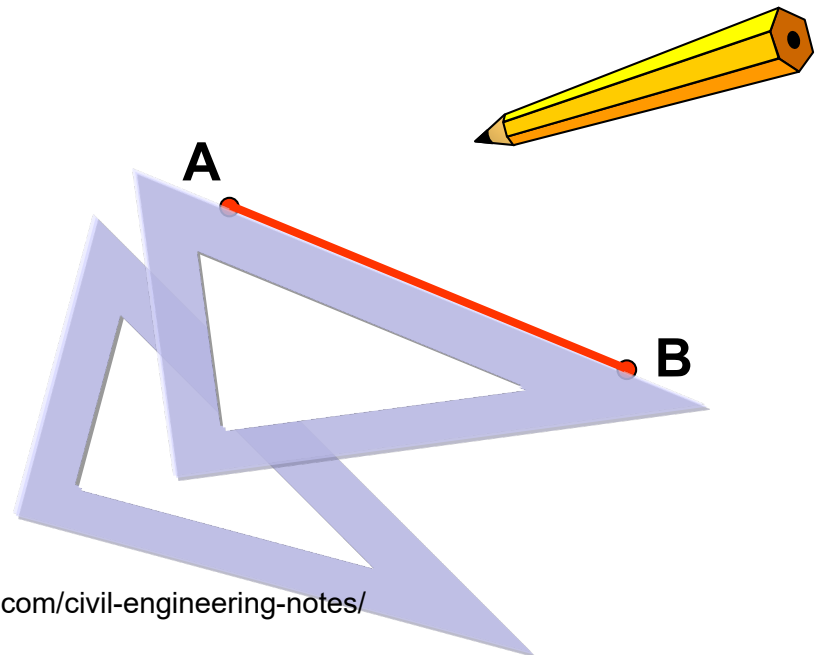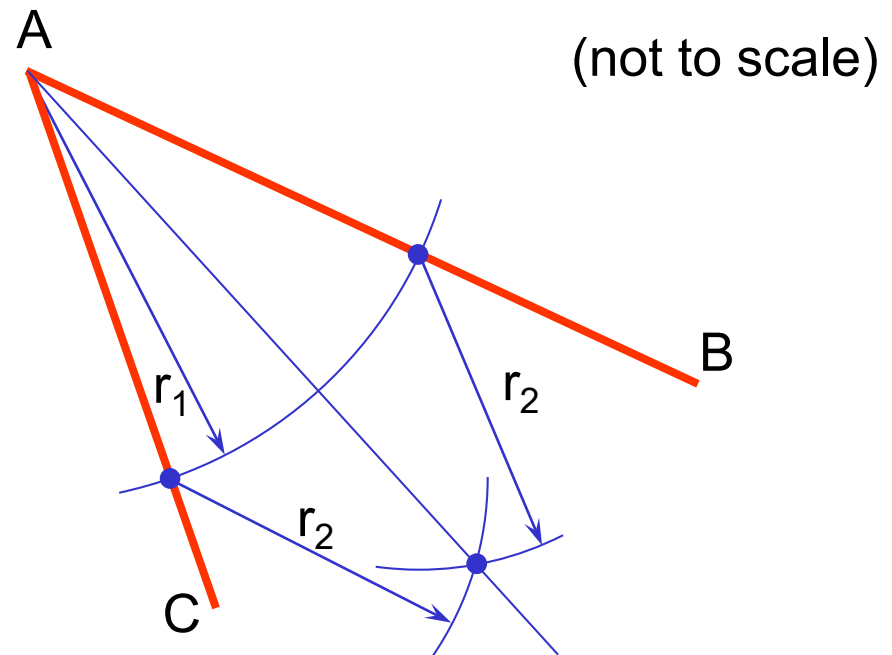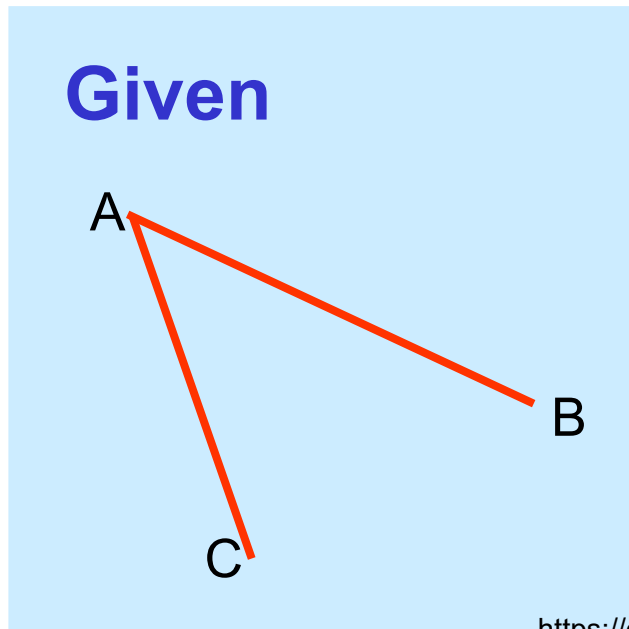
Applied Geometry

To Bisect a Line

1. Swing two arcs of any radius greater than half-length of the line with the centers at the ends of the line.

2. Join the intersection points of the arcs with a line.

3. Locate the midpoint.

Given

A

B

A

r_1

r_1

B

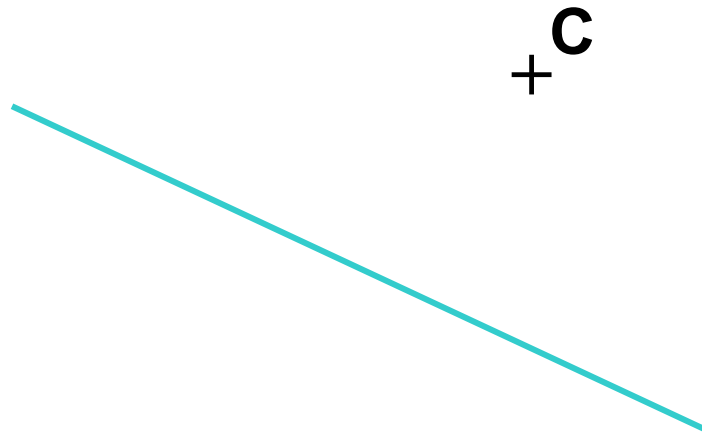https://civinnovate.com/civil-engineering-notes/

(not to scale)

To Bisect an Angle

1. Swing an arc of any radius whose centers at the vertex.

2. Swing the arcs of any radius from the intersection points between the previous arc and the lines.
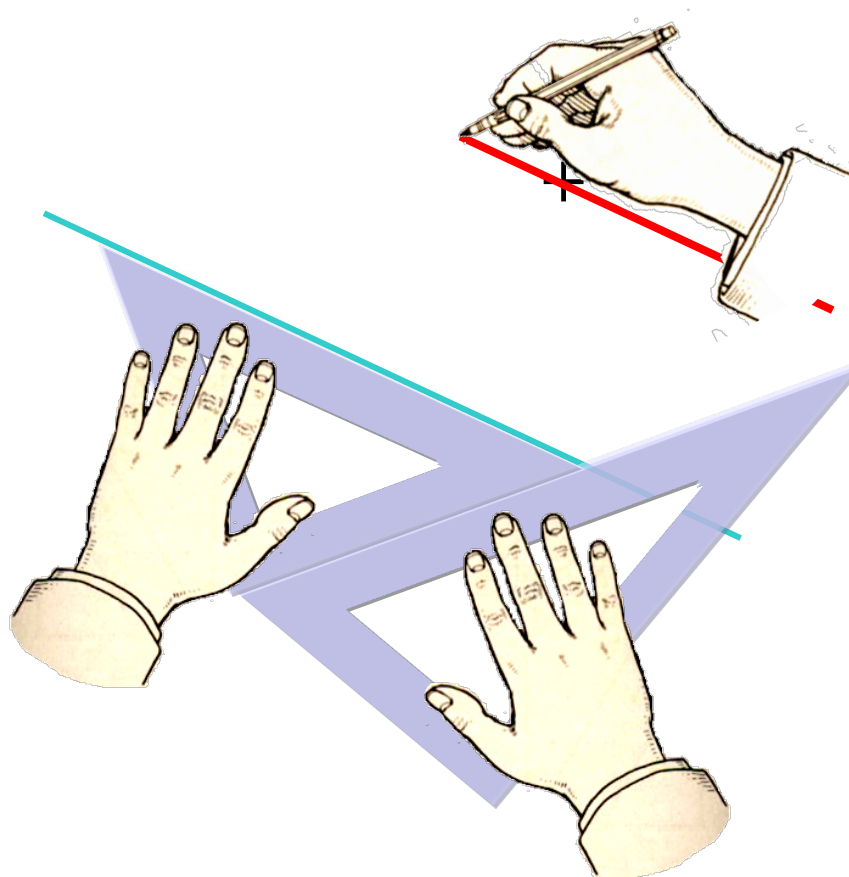
3. Draw the line.

Given

A

B

C

A

B

C

r_1

r_2

r_2

(not to scale)

To draw the line parallel to a given line and passes through a given point

Given

+C

To draw the line parallel to a given line and passes through a given point
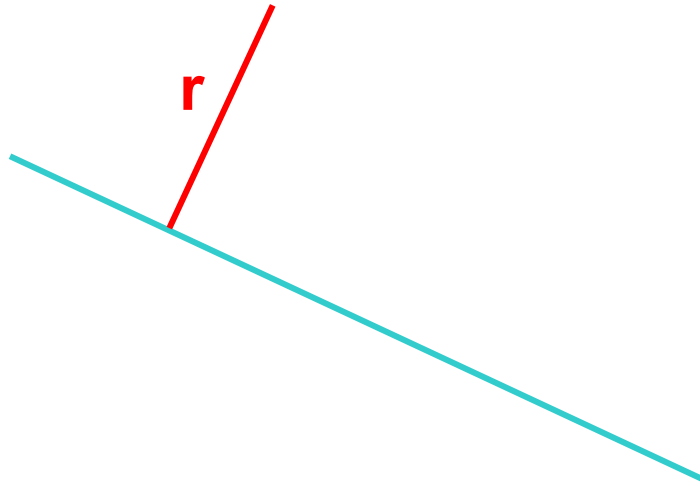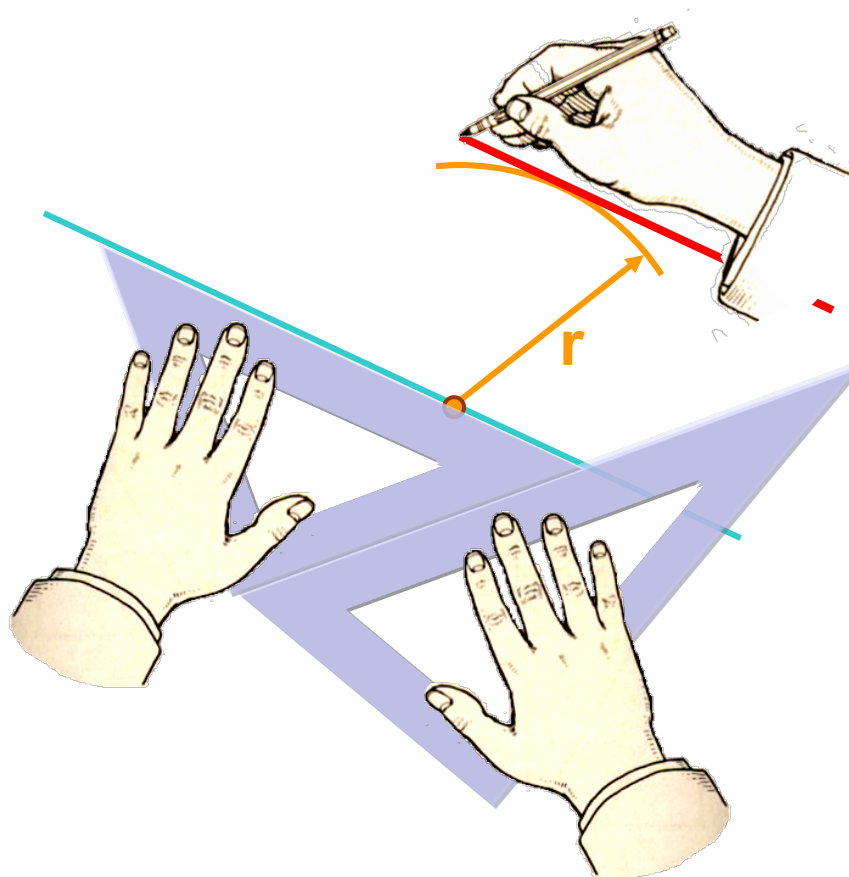
Given

Repeat

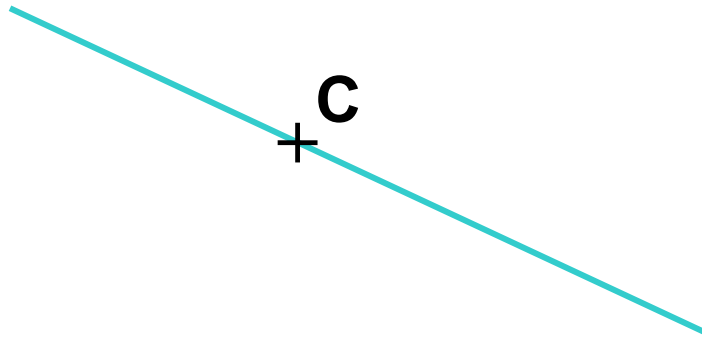# To draw the line parallel to a given line with a specified distance

Given distance = r

r

To draw the line parallel to a given line with a specified distance
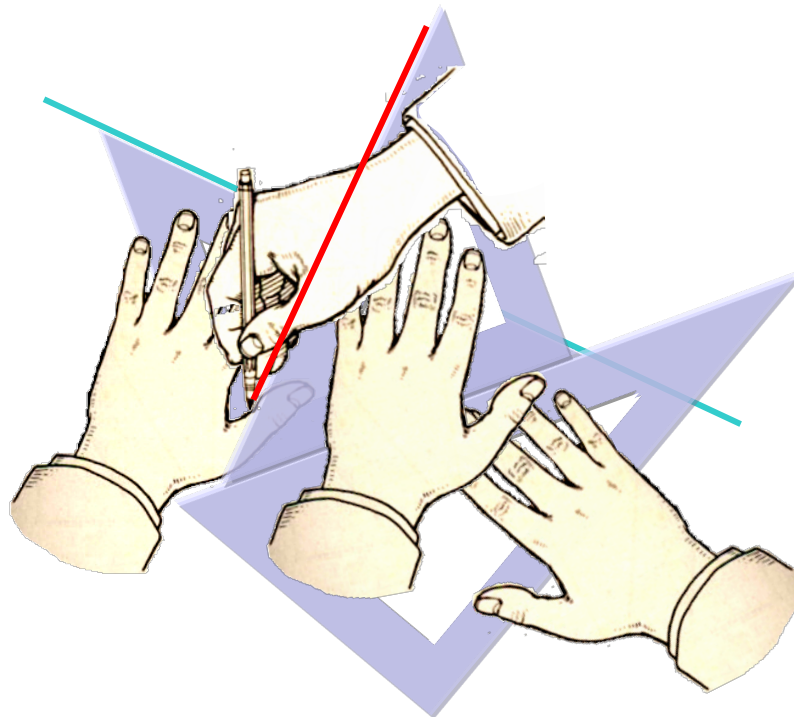
Given distance = r

Repeat

To draw the line perpendicular to a given line at a given point

Revolve method

C

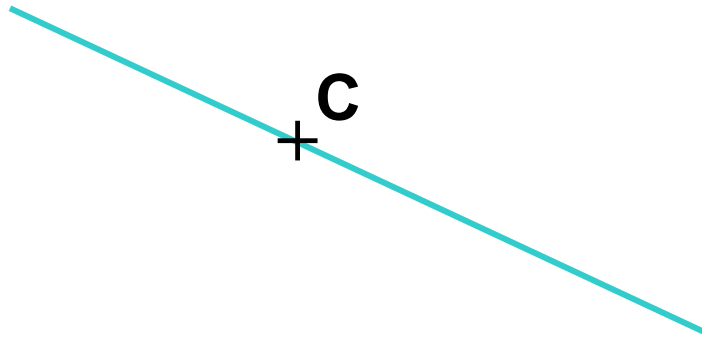# To draw the line perpendicular to a given line at a given point

Revolve method

Repeat

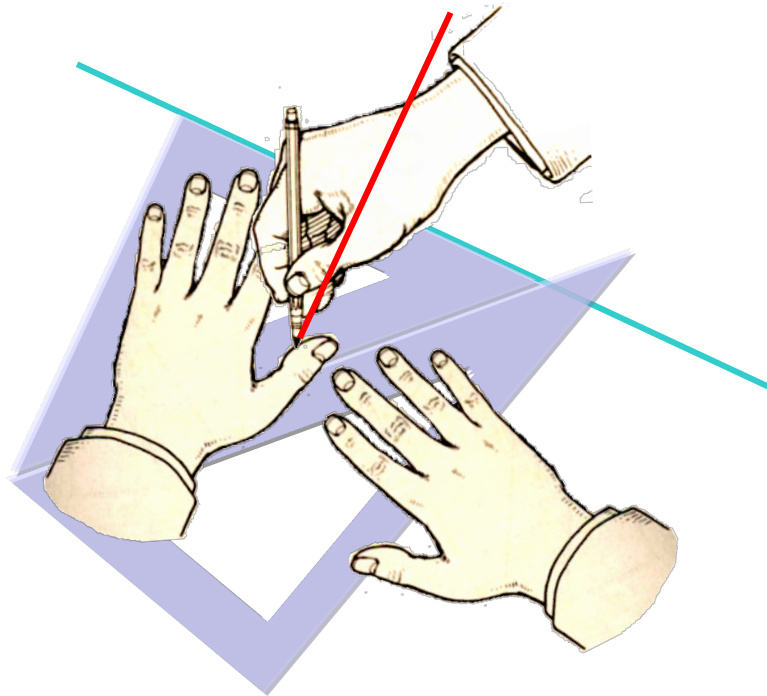# To draw the line perpendicular to a given line at a given point

Adjacent-sides method

C

To draw the line perpendicular to a given line at a given point
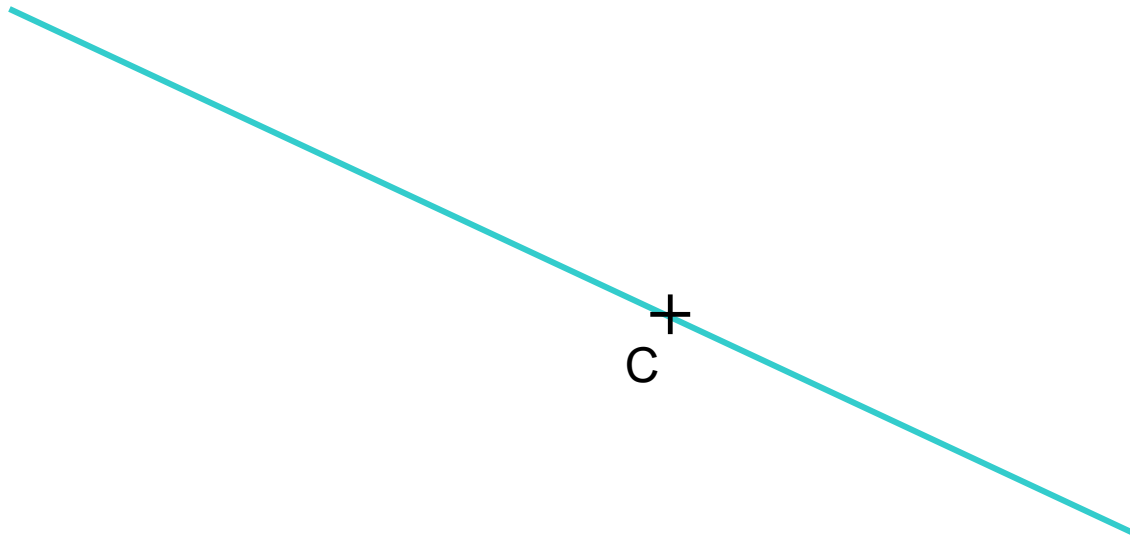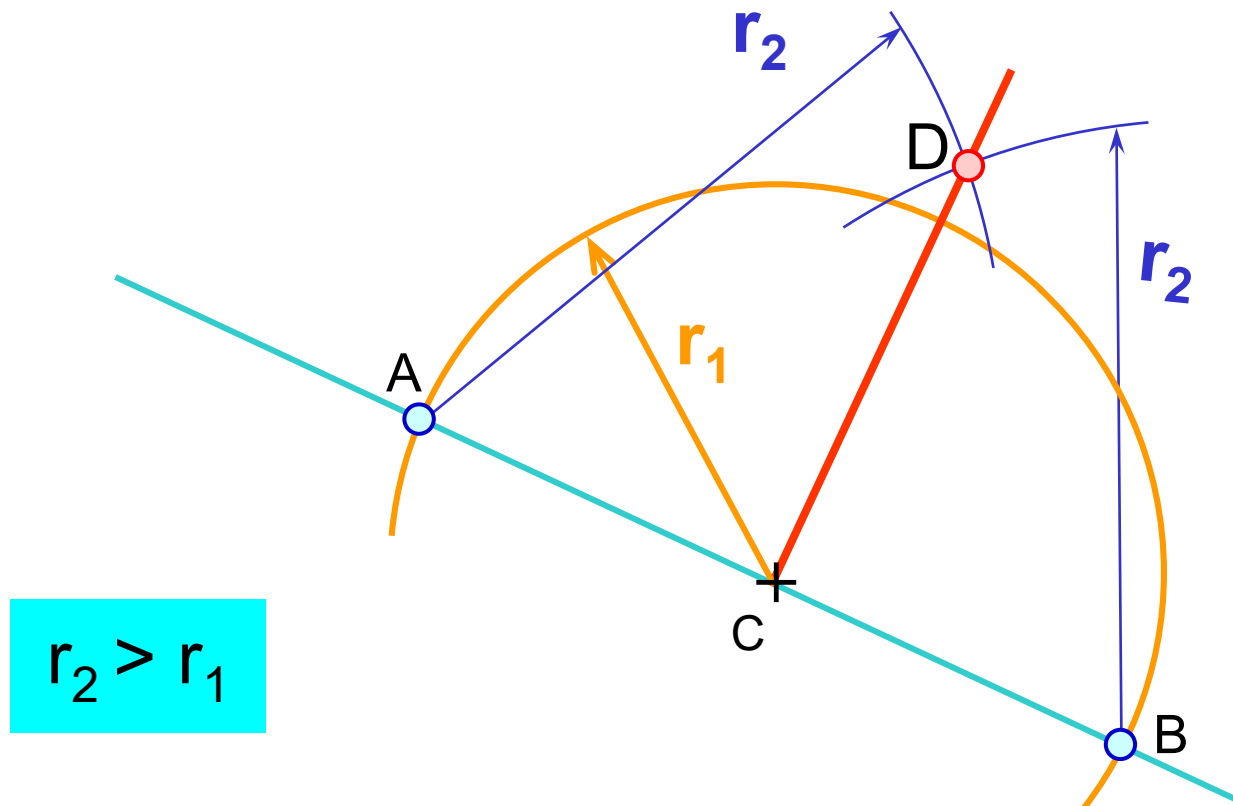
Adjacent-sides method

Repeat

To draw the line perpendicular to a given line at a given point

Using Compass

+

C

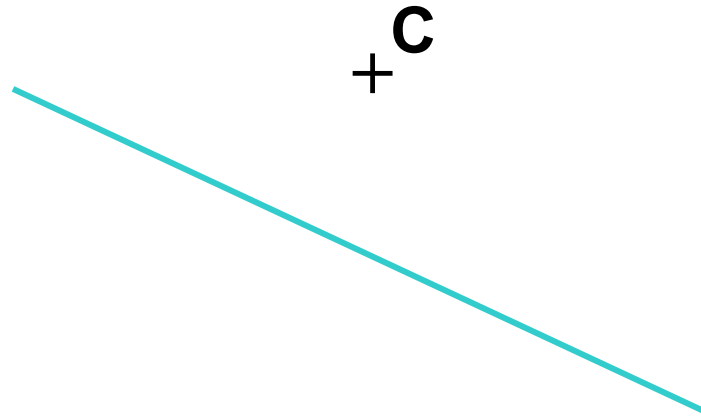# To draw the line perpendicular to a given line at a given point
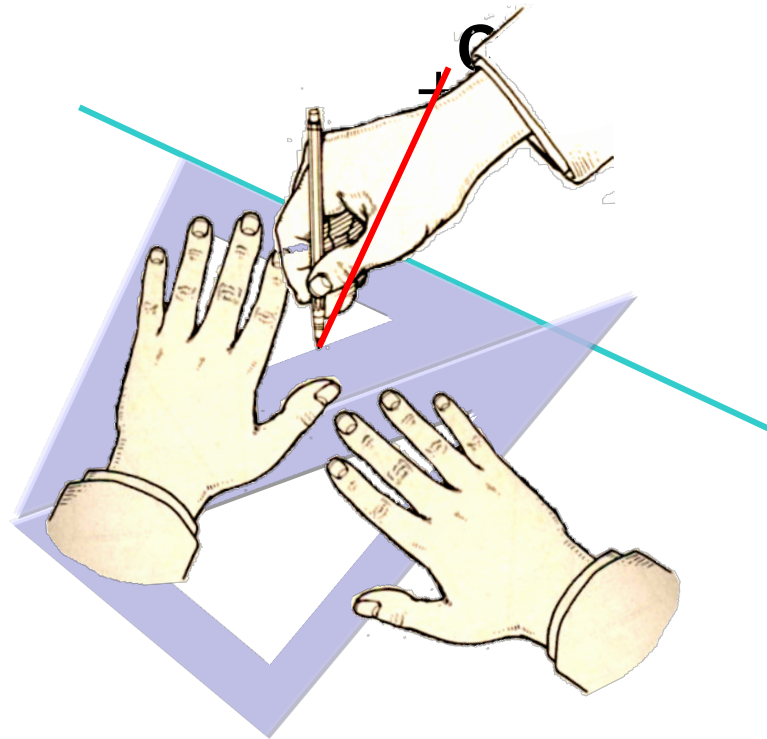
Using Compass

$r_2 > r_1$

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Repeat

To draw the line perpendicular to a given line from a point not on the line

Adjacent-sides method

+C

To draw the line perpendicular to a given line from a point not on the line
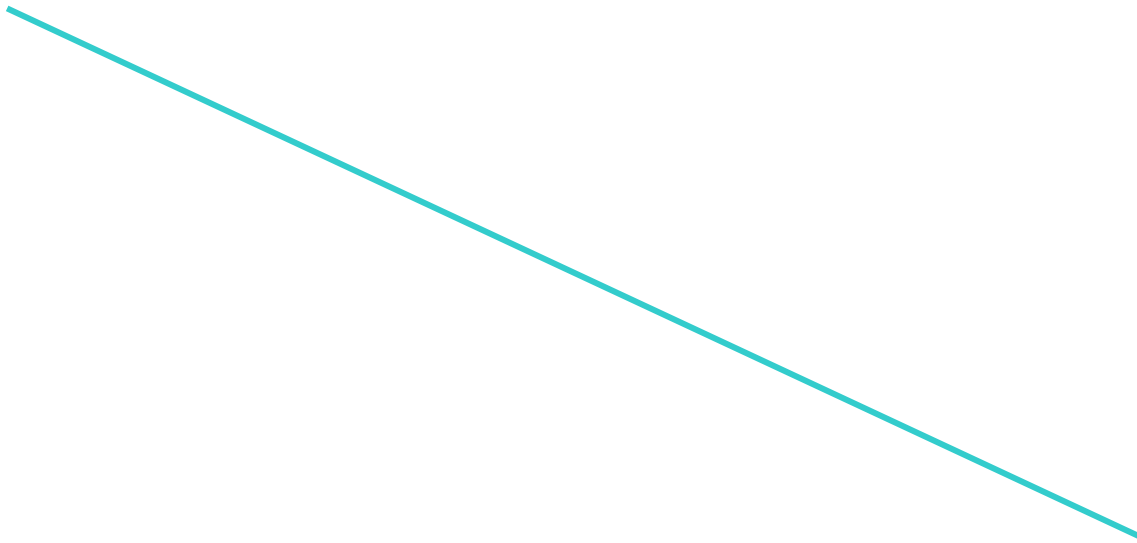
Adjacent-sides method

Repeat

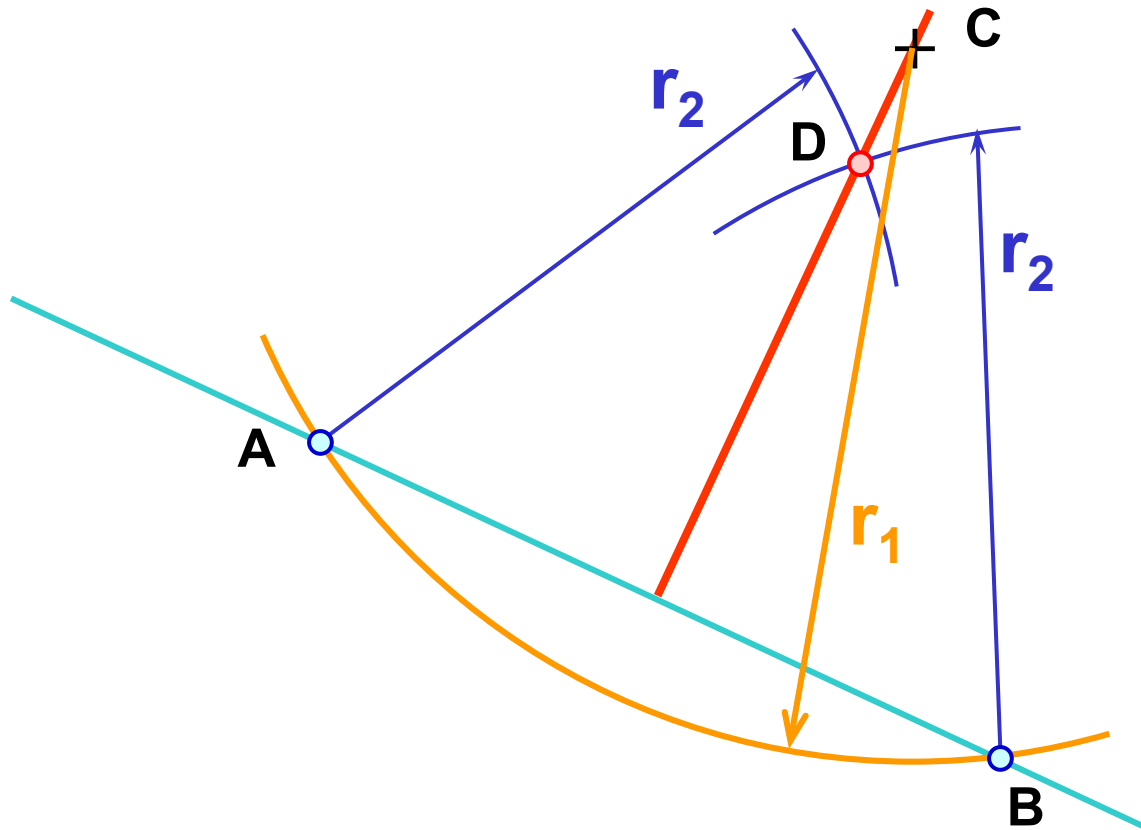# To draw the line perpendicular to a given line from a point not on the line

Using compass

+ C

To draw the line perpendicular to a given line from a point not on the line

Using compass

Note:
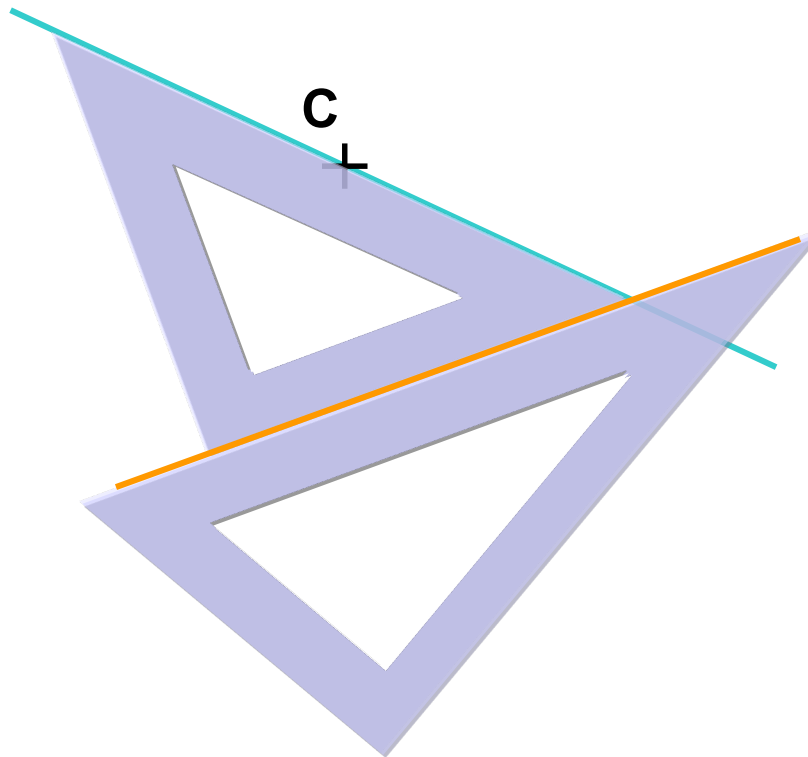**You can also use revolve method. How ? Try by yourself !!!**

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Repeat

To draw a line making 15° with a given line and pass through a given point.

Given

C
⊥

To draw a line making 15° with a given line and pass through a given point.

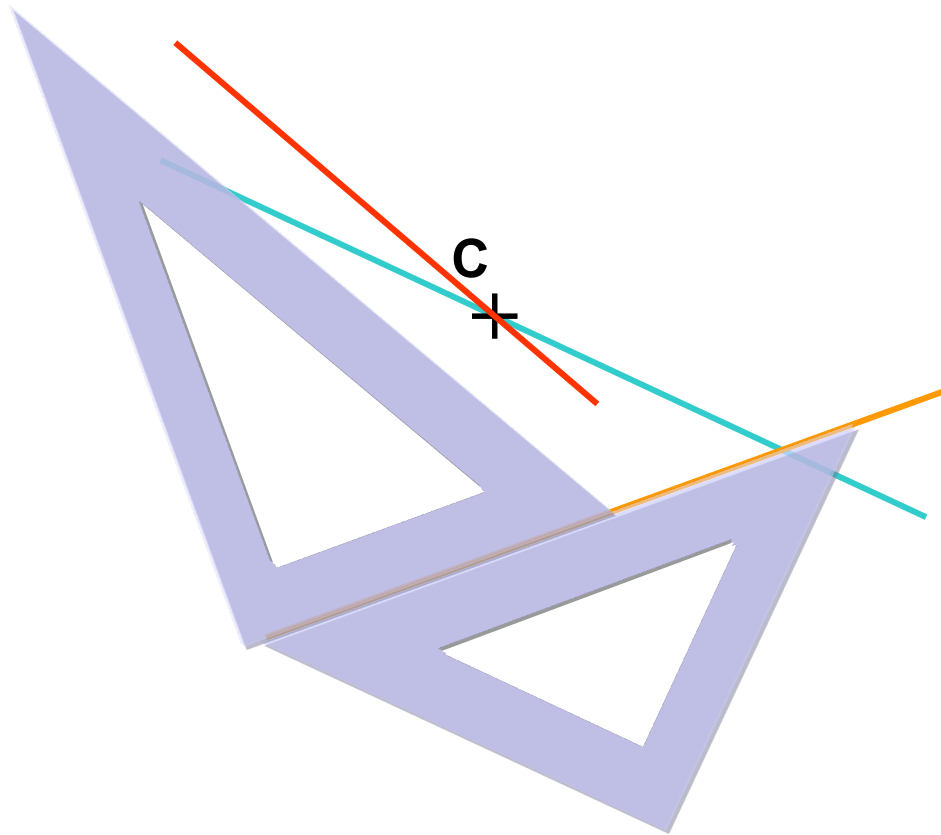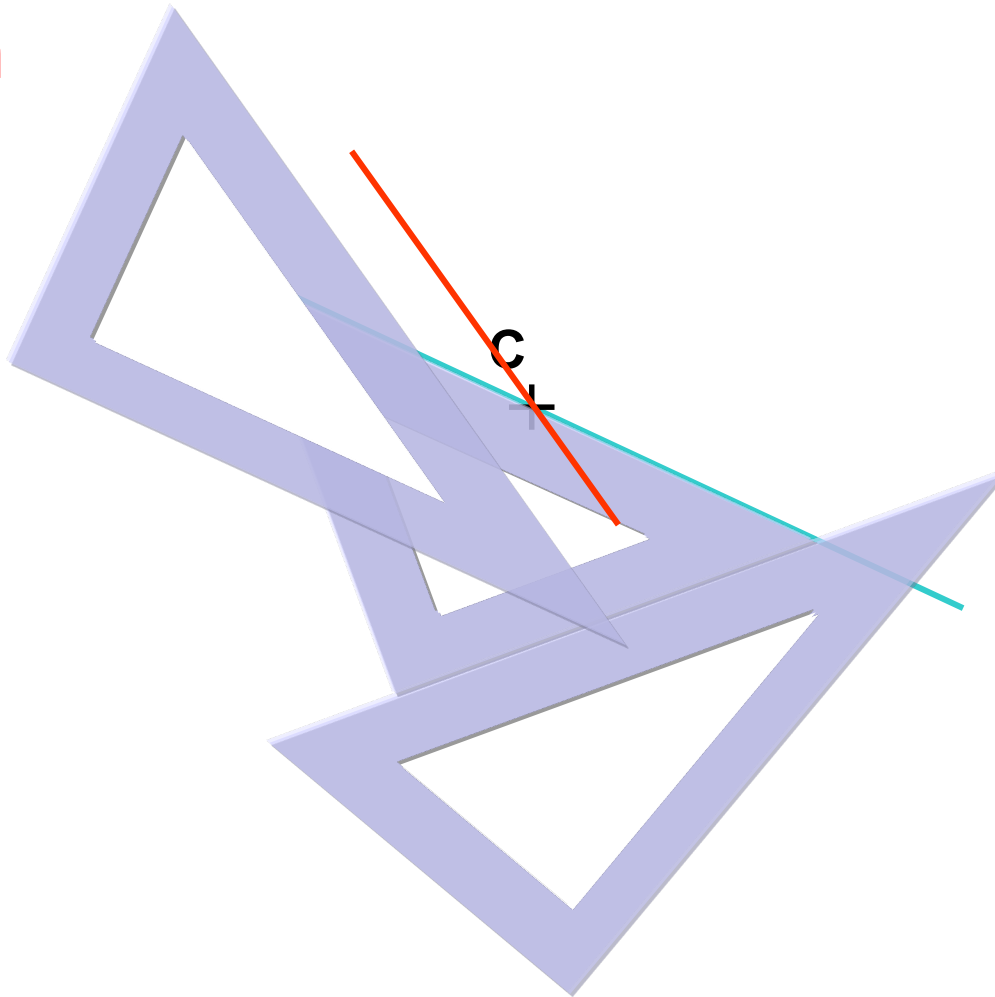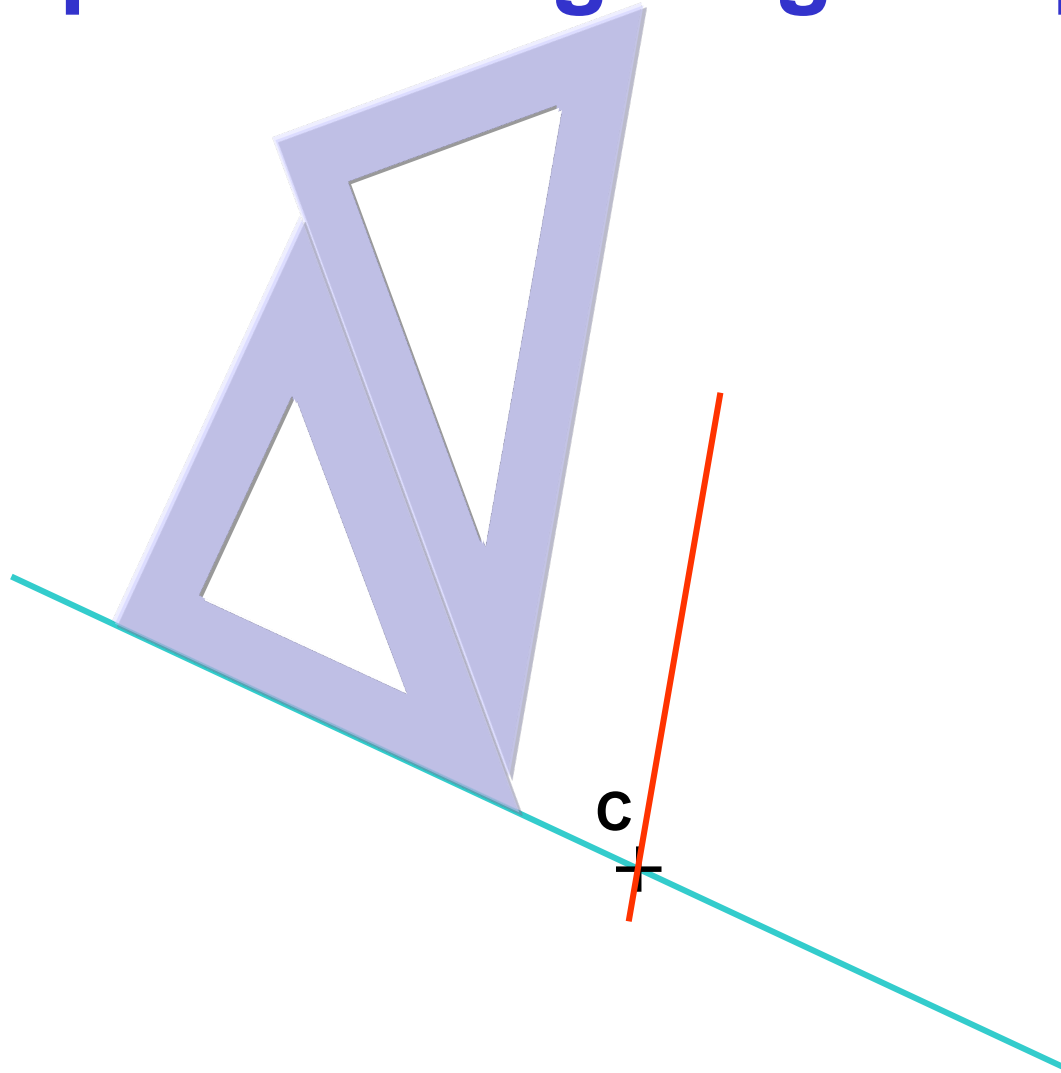**Given**

C

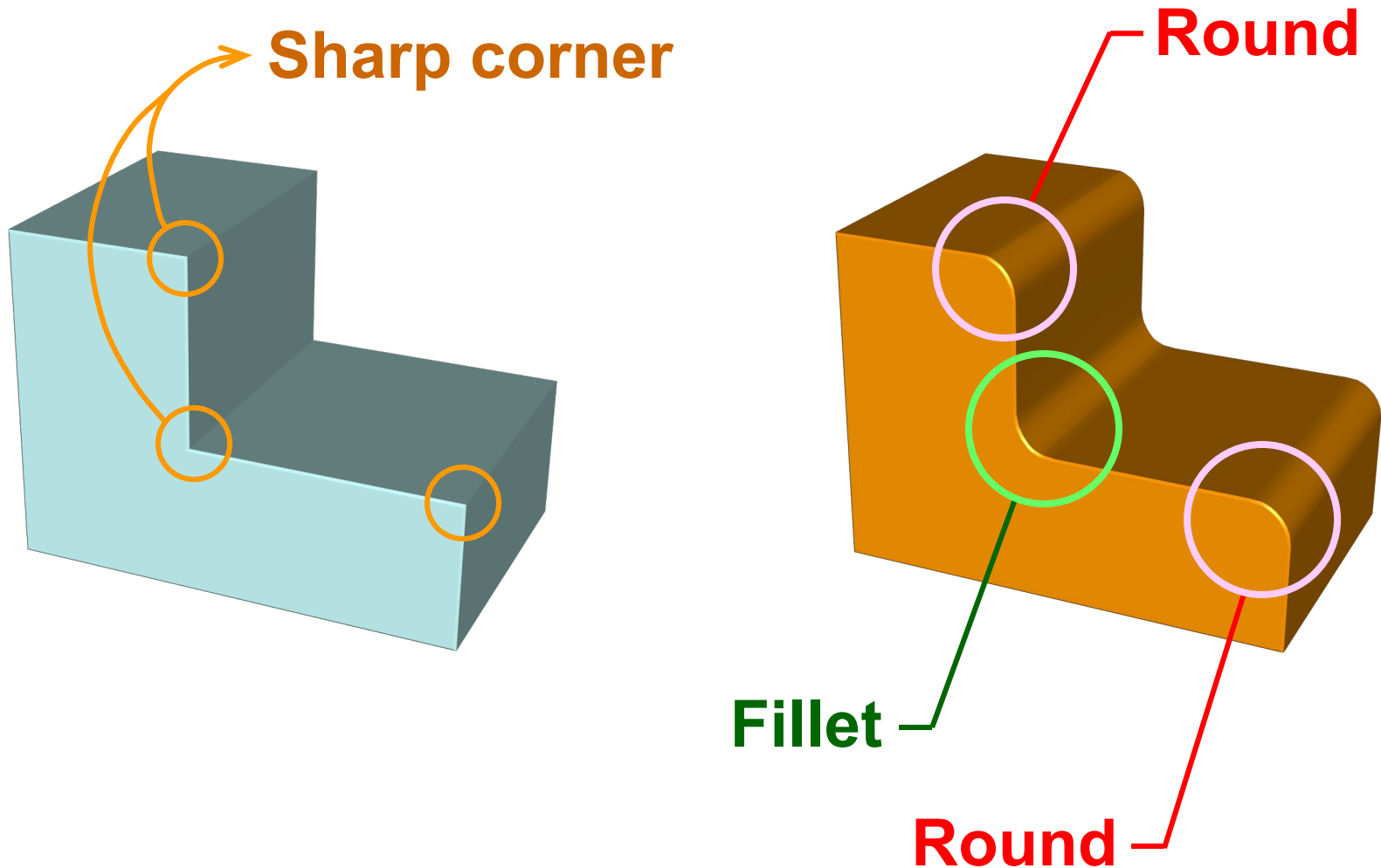# To draw a line making 30° with a given line and pass through a given point.

Given

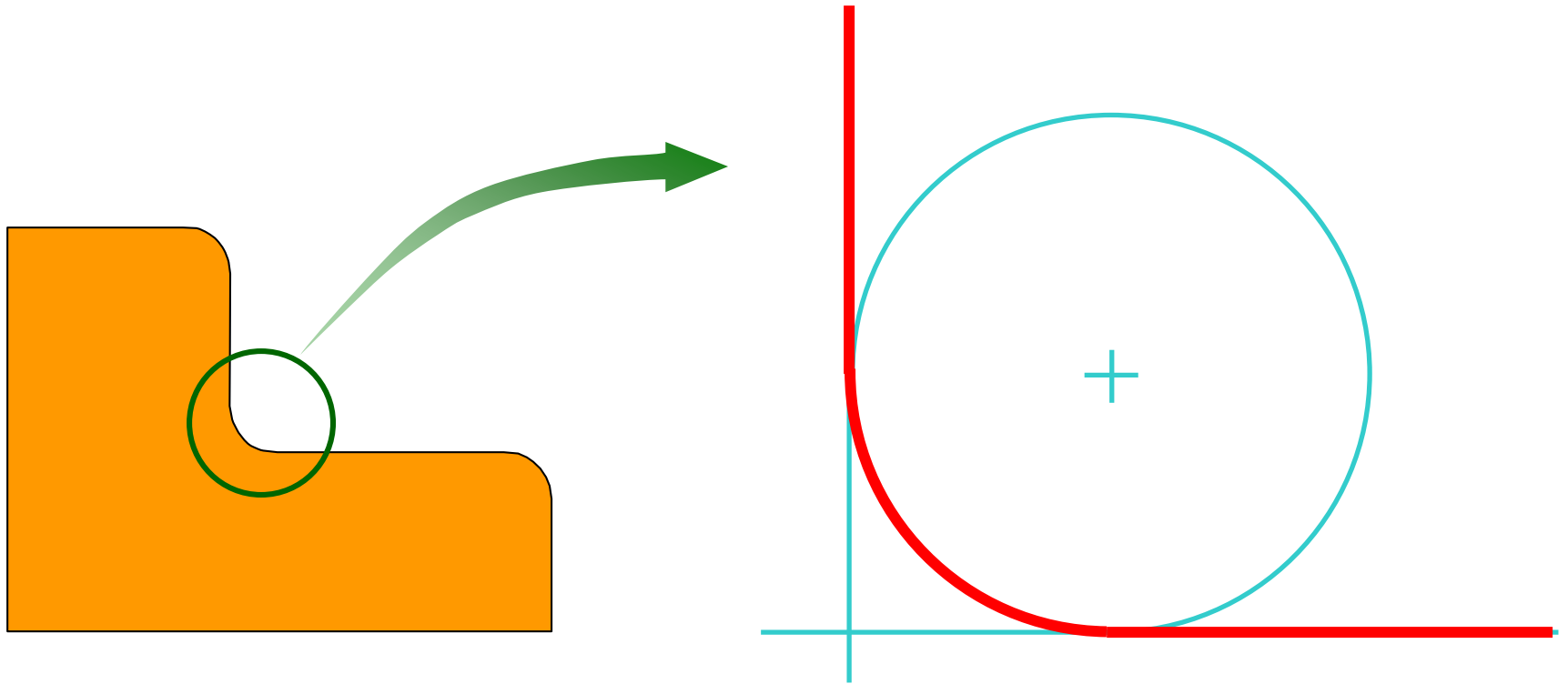# To draw a line making 75° with a given line and pass through a given point.

Given

C

FILLET AND ROUND

Sharp corner

Round

Round

Fillet

FILLET AND ROUND

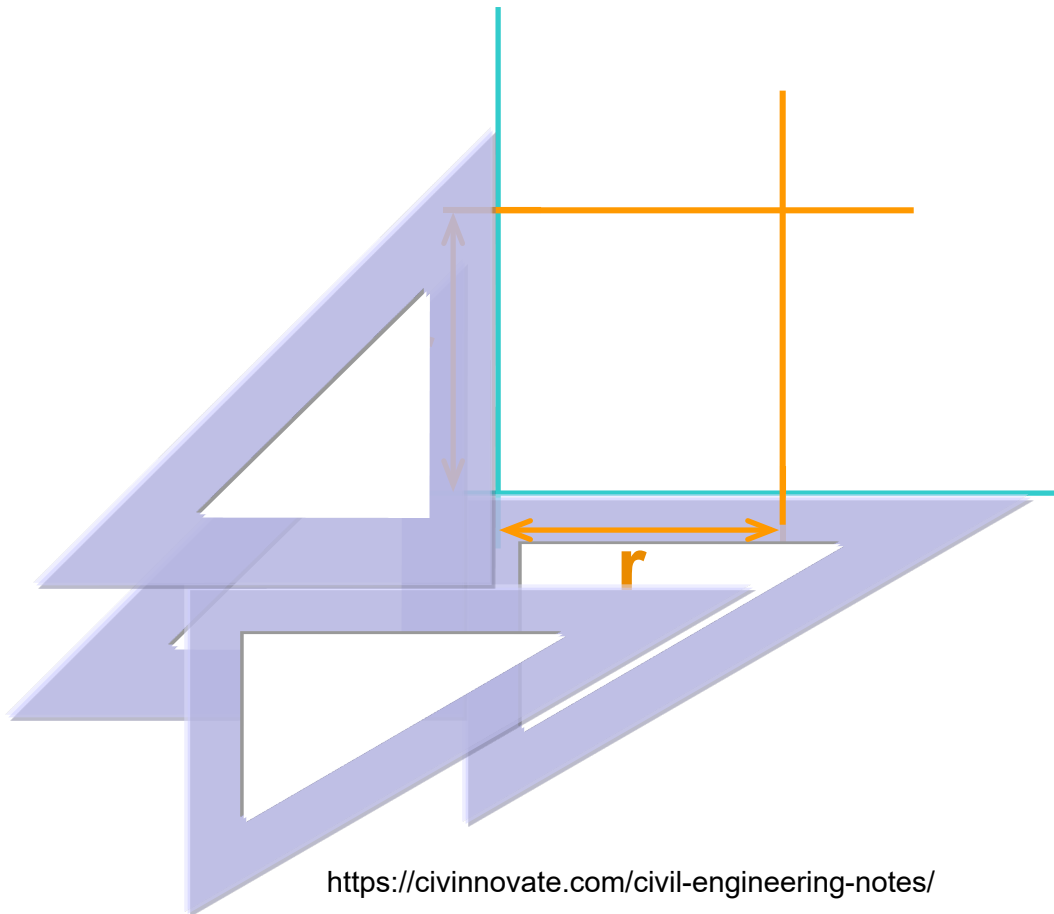**To draw the arc,** we must find the location of the center of that arc.

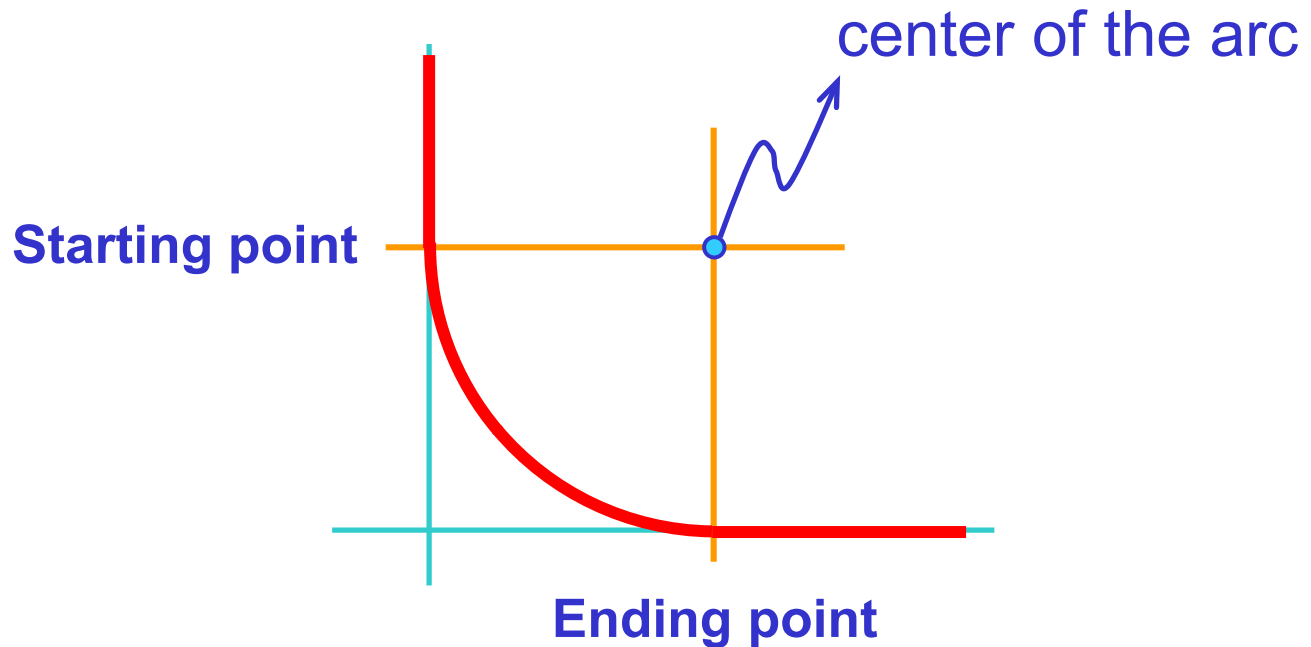*How do we find the center of the arc?*

To draw an arc of given radius tangent to two <u>perpendicular</u> lines
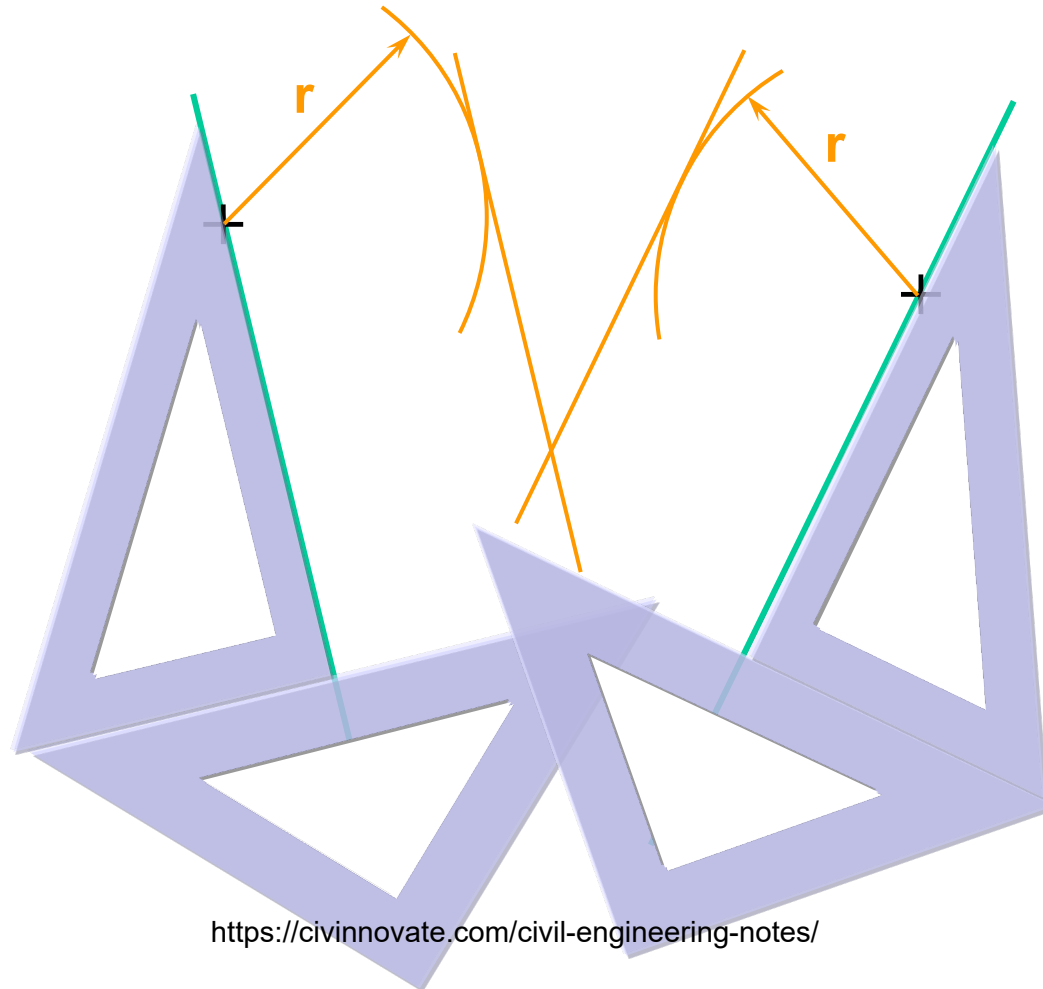
Given   arc radius r

r

To draw an arc of given radius tangent to two <u>perpendicular</u> lines

Given arc radius r

center of the arc

Starting point

Ending point

To draw an arc of given radius tangent to two lines

Given   arc radius r
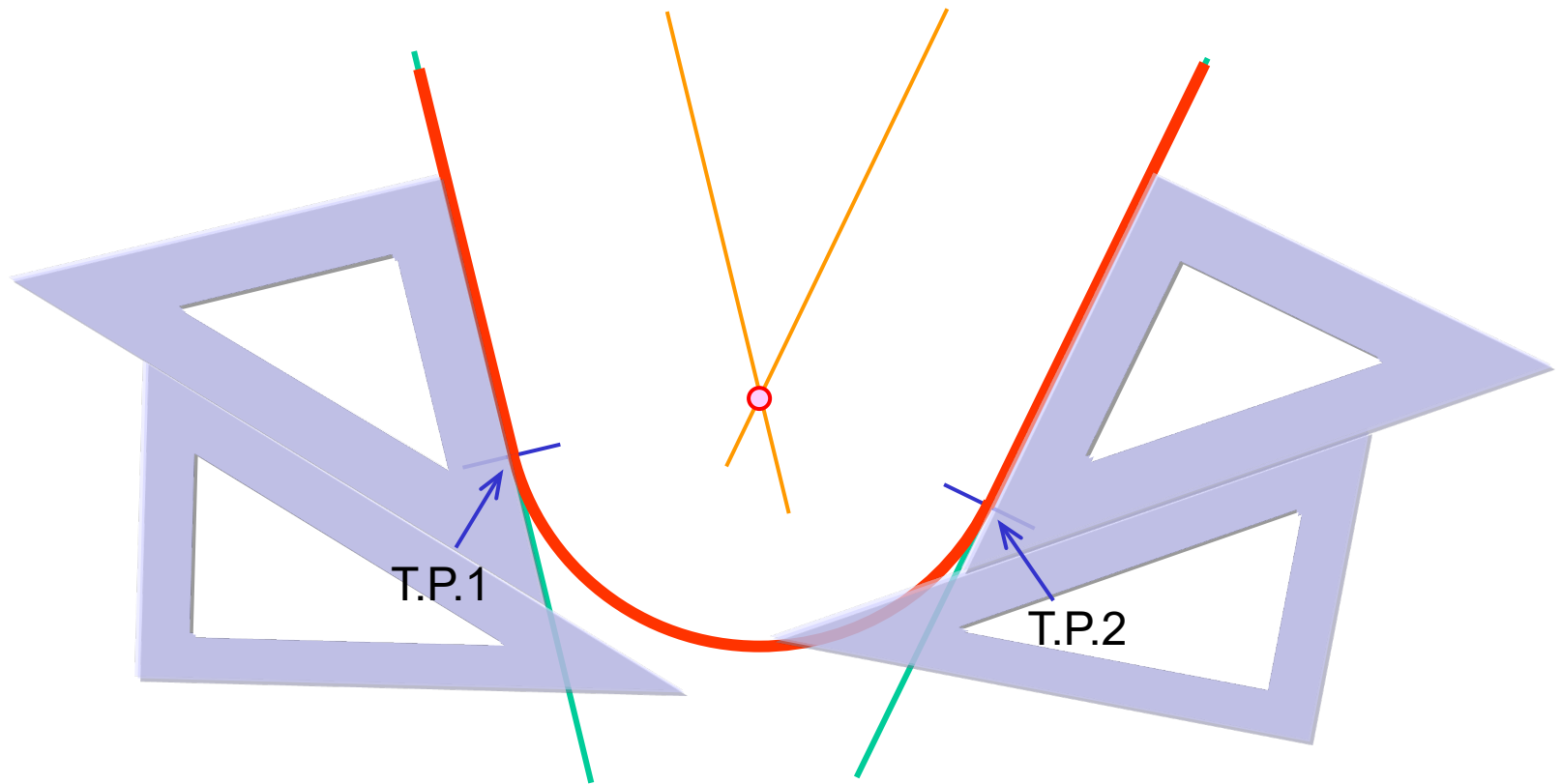
To draw an arc of given radius tangent to two lines

Given arc radius r

T.P.1

T.P.2
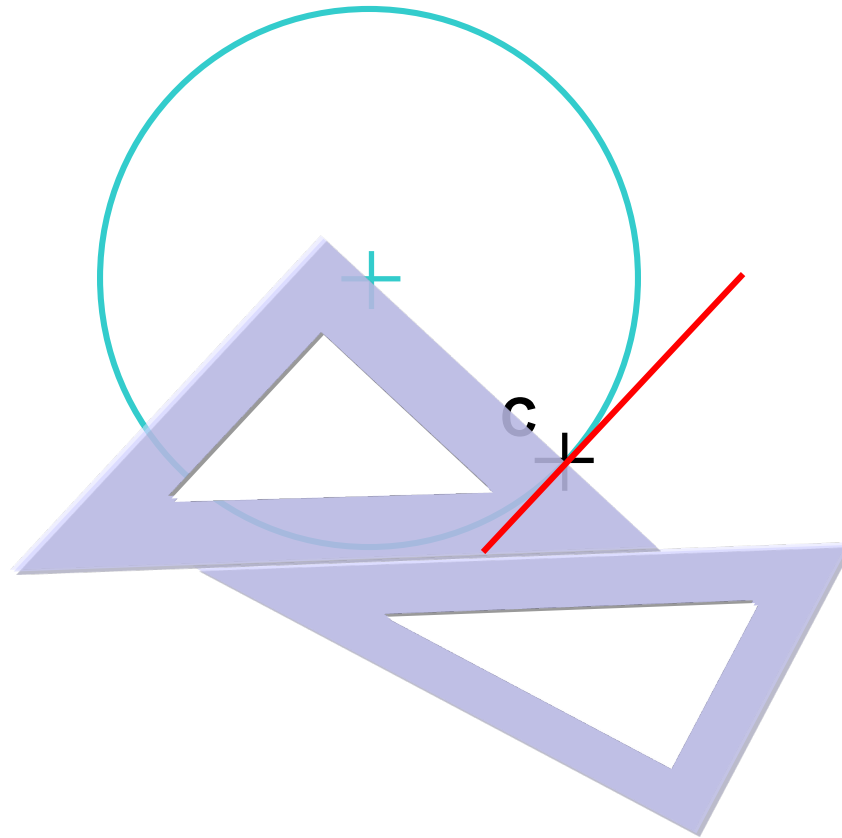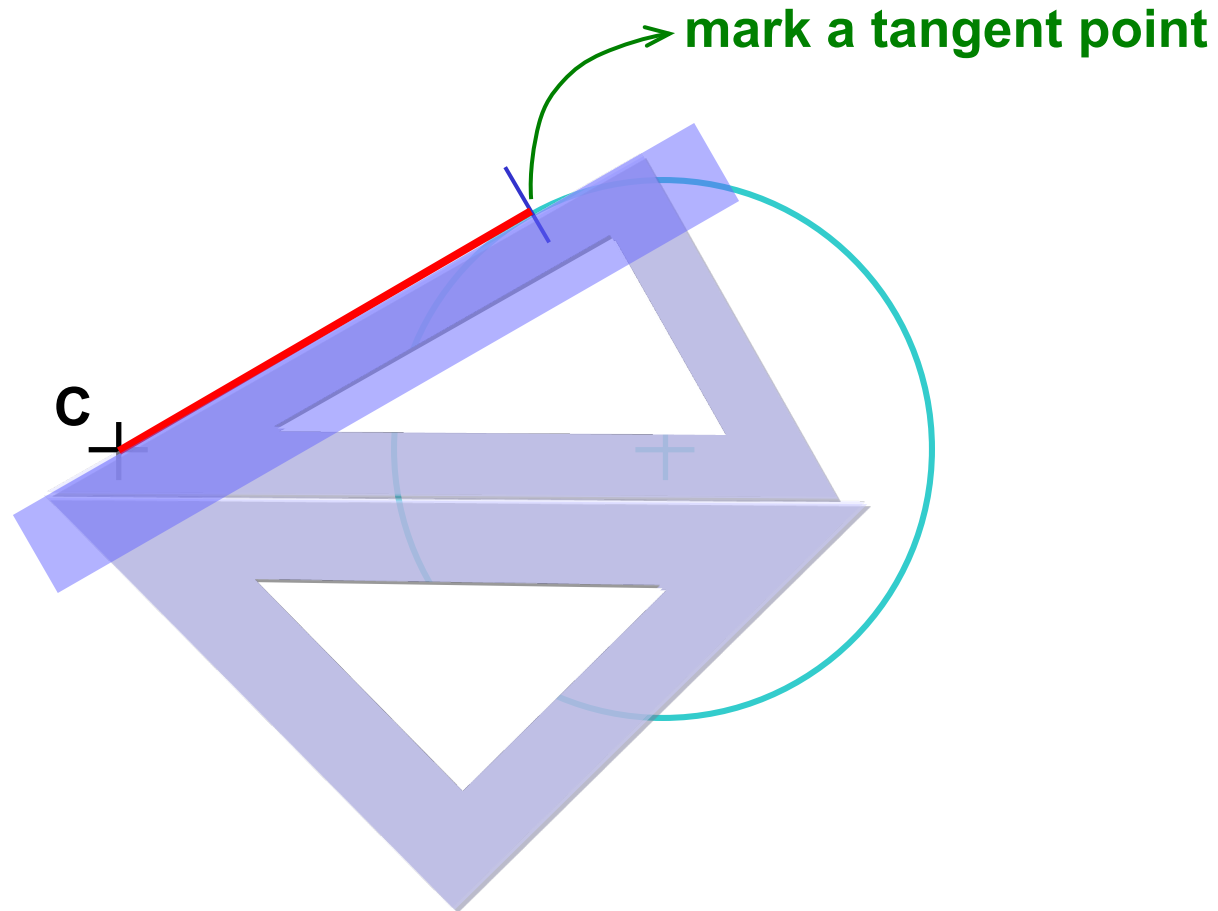
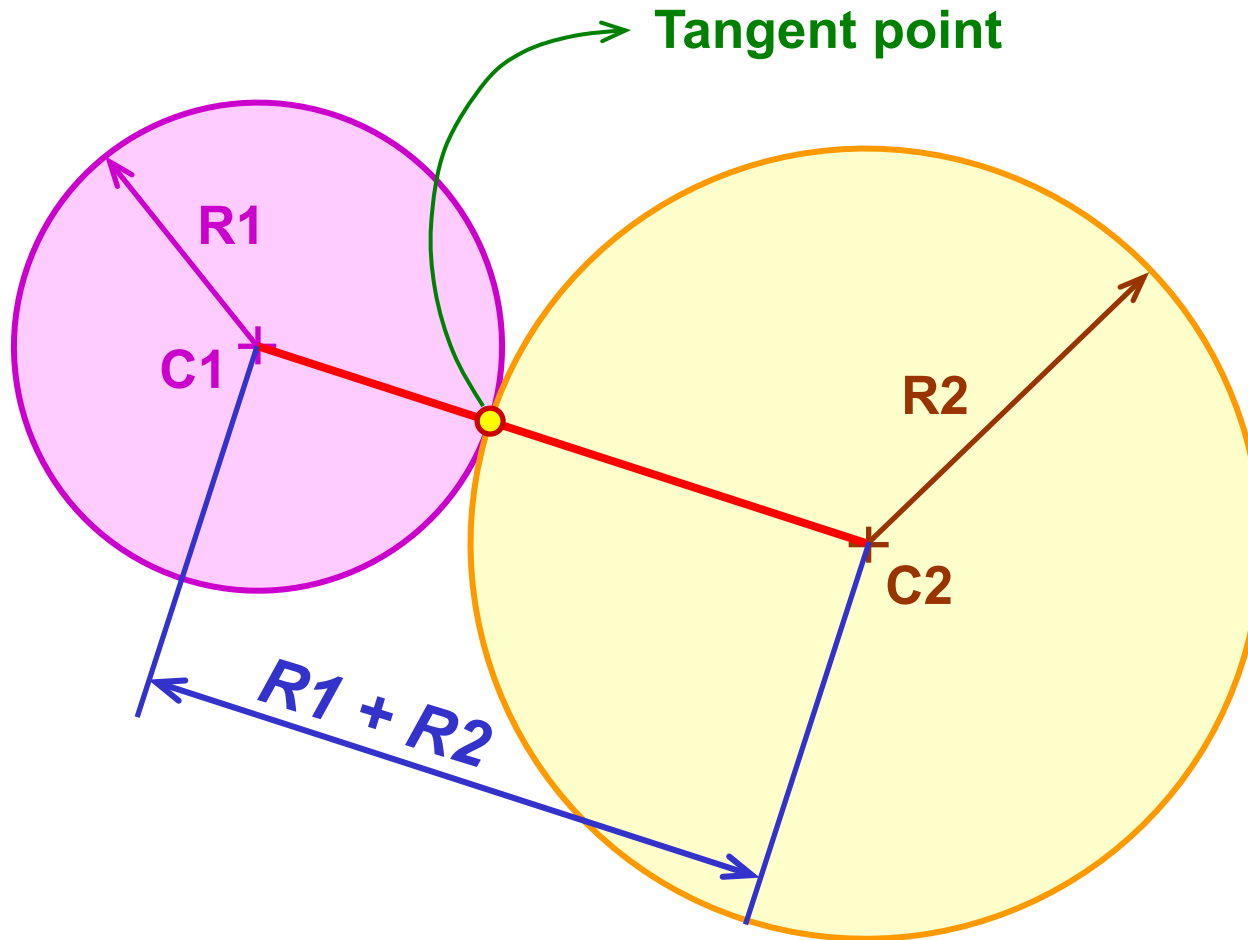# To draw a line tangent to a circle at a point on the circle

Given

To draw a line tangent to a circle from a point outside the circle
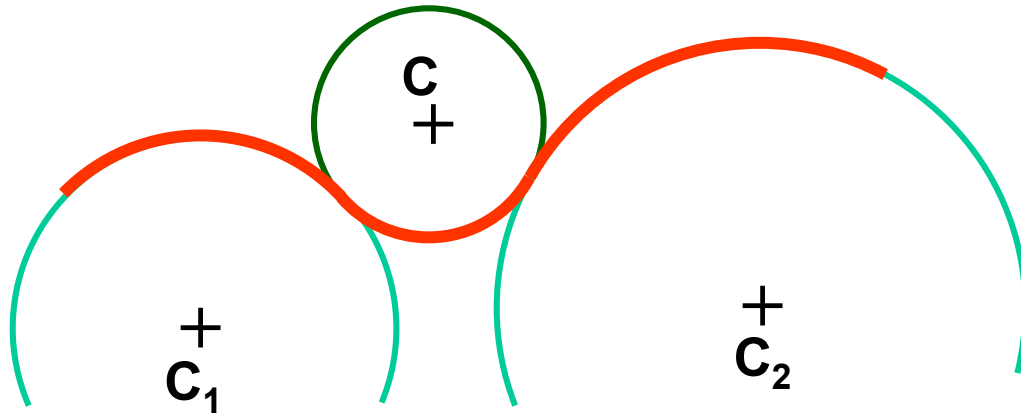
Given

mark a tangent point

C

When circle tangent to other circle

Tangent point

R1

C1

R2

C2

R1 + R2
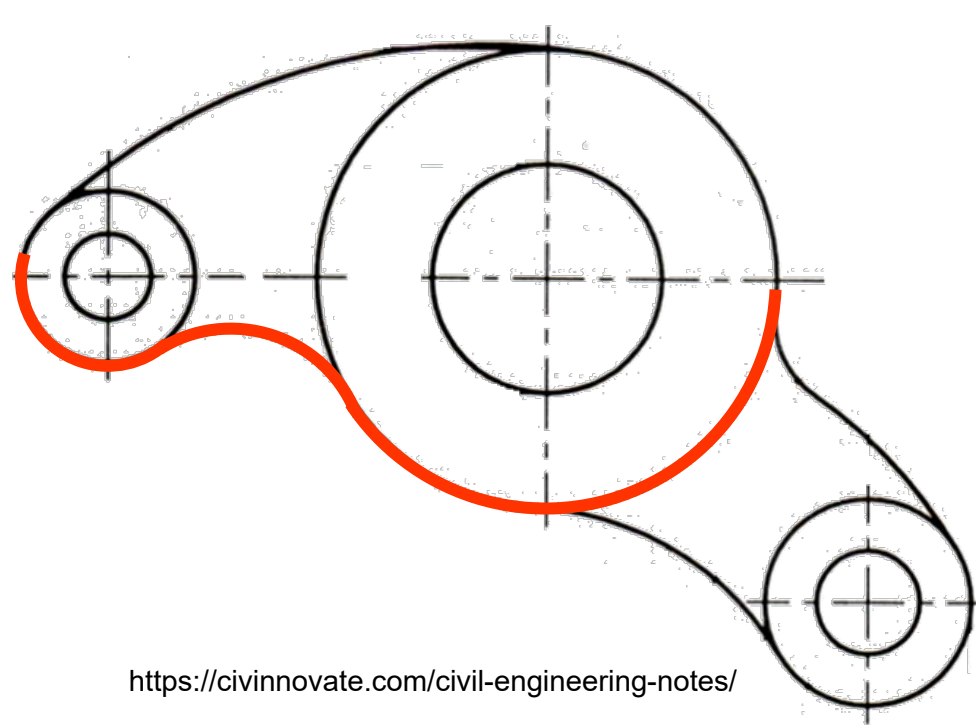
The center of two circles and tangent point lie on the same straight line !!!

To draw a circle tangent to two circles I

Given

Example
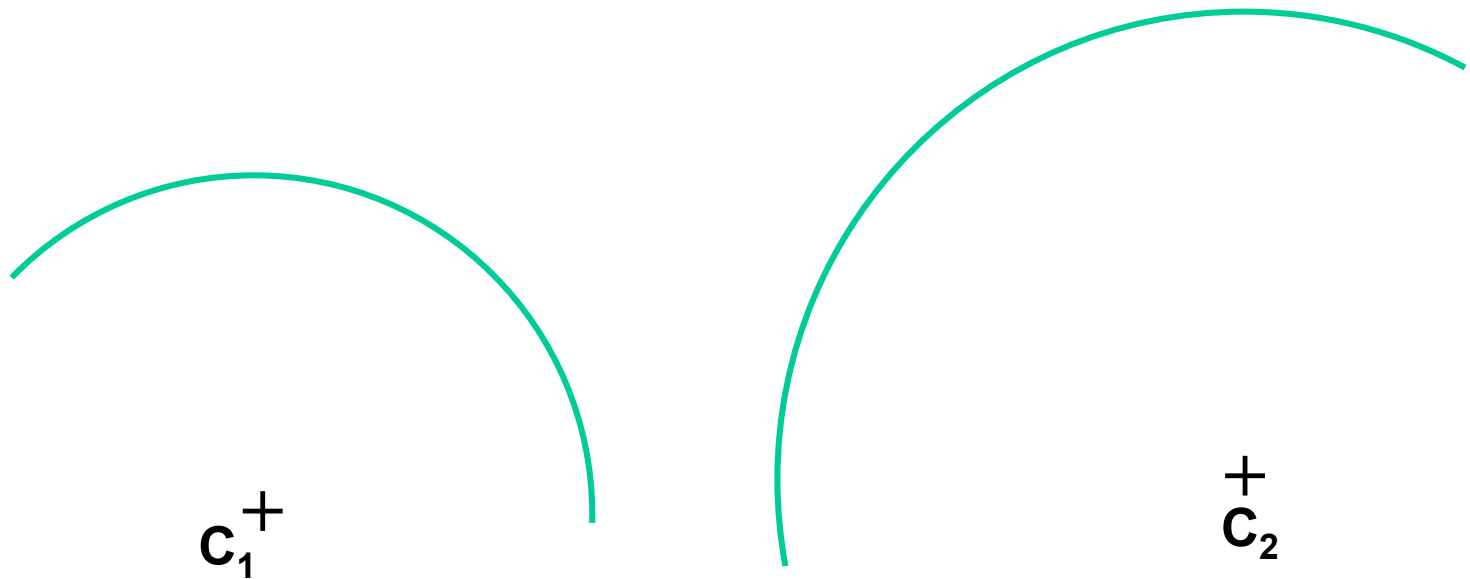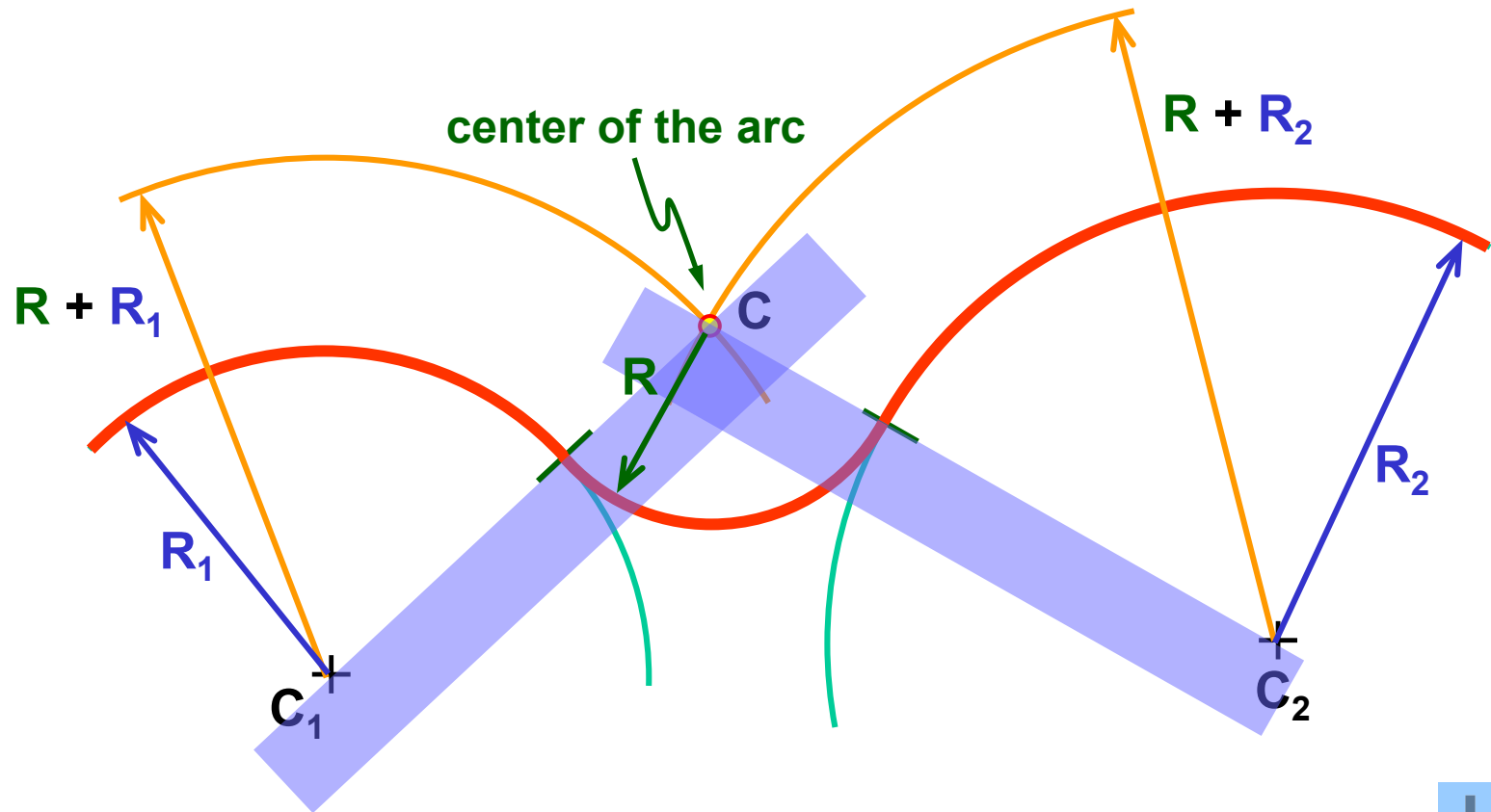
To draw a circle tangent to two circles I

Given Two circles and the radius of the third circle = R

$$c_1^+$$

$$c_2^+$$

To draw a circle tangent to two circles I

Given Two circles and the radius of the third circle = R

center of the arc

$R + R_1$

$R + R_2$

R

R_1

R_2

C

C_1

C_2

Repeat

When circle tangent to other circle

The center of two circles and tangent point must lie on the same straight line !!!

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To draw a circle tangent to two circles II

Given

Example

To draw a circle tangent to two circles II

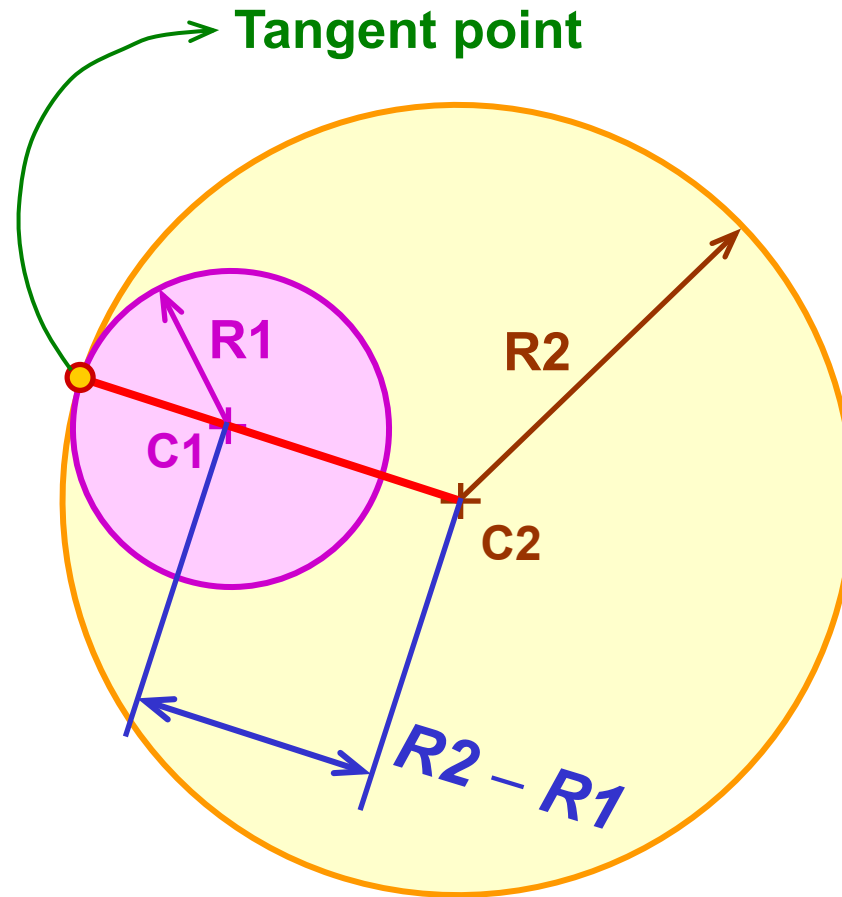**Given** Two circles and the radius of the third circle = R
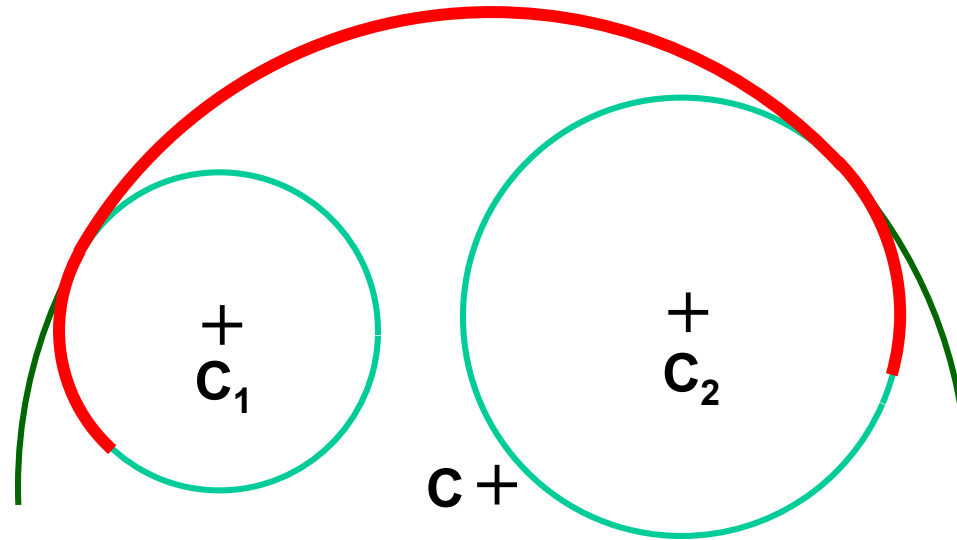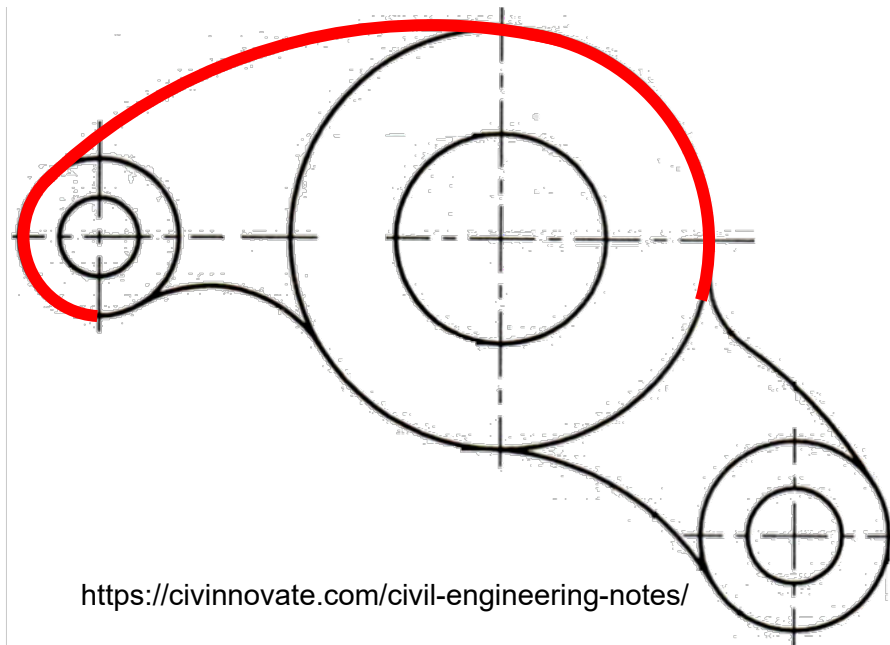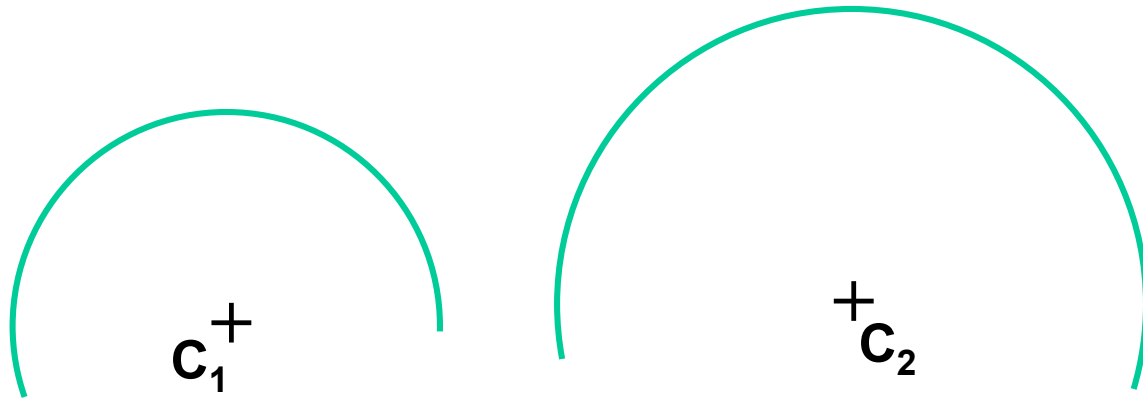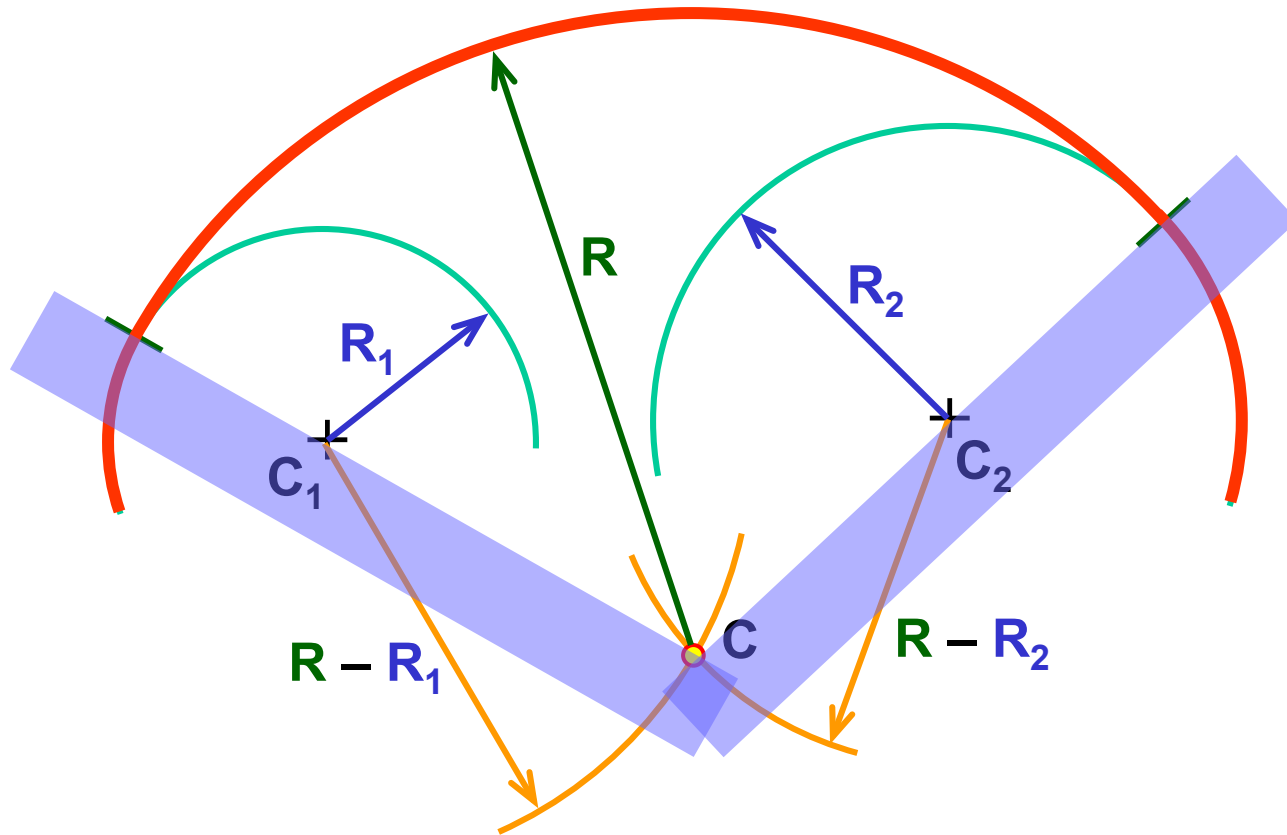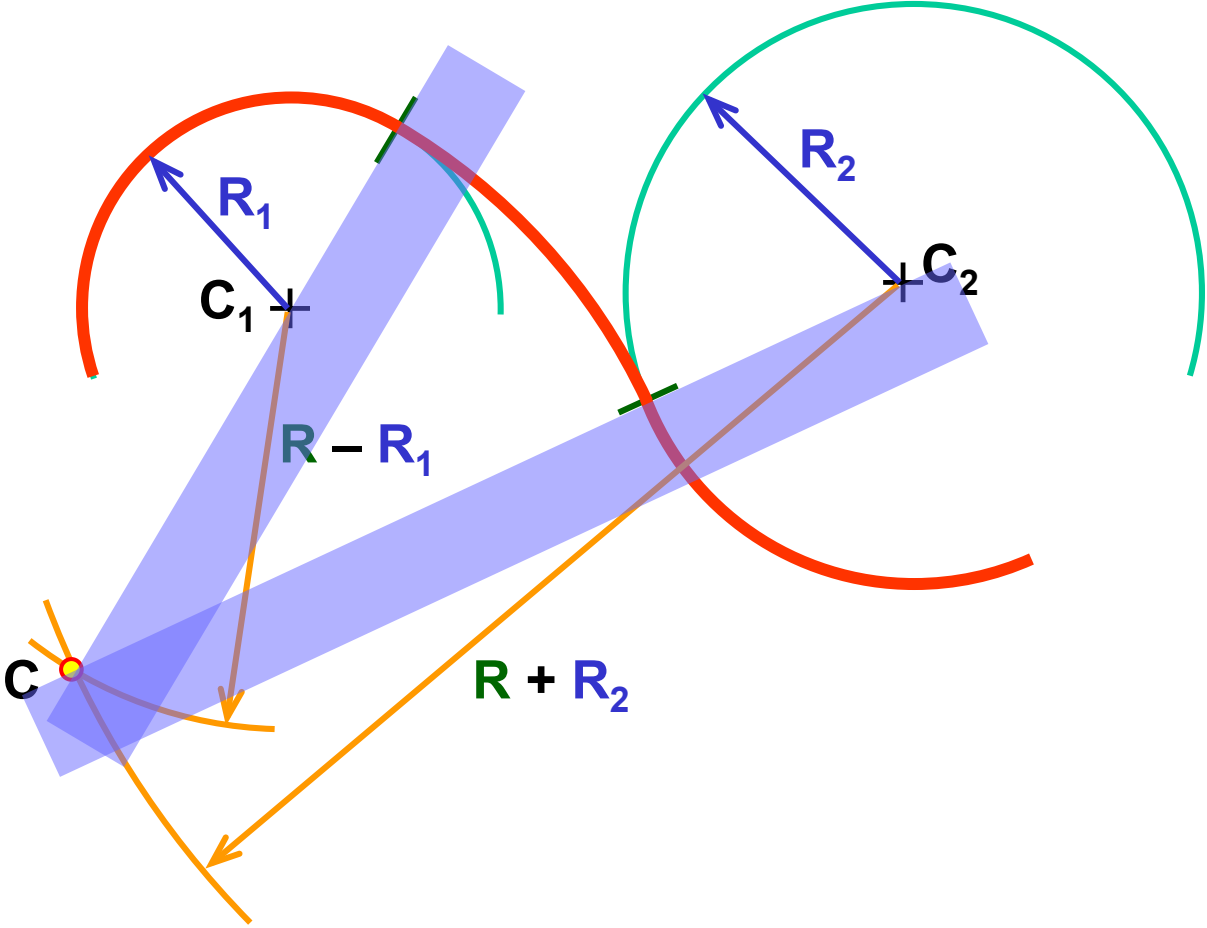

C_1

C_2

To draw a circle tangent to two circles II

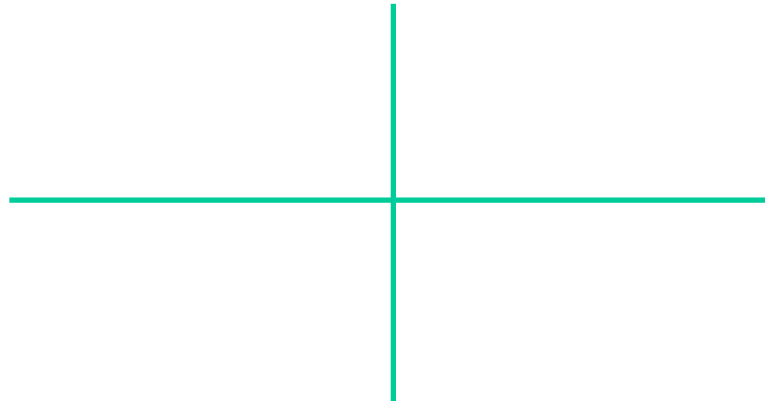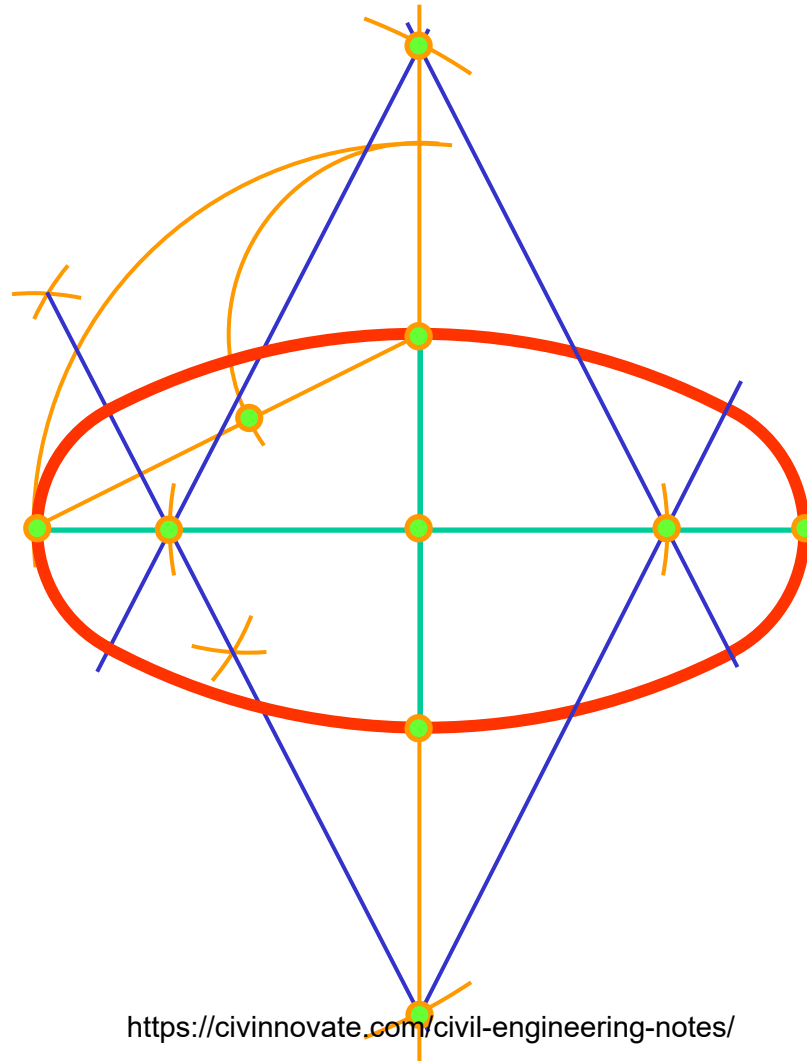**Given** Two circles and the radius of the third circle = R

Repeat

To draw a circle tangent to two circles III

Given Two circles and the radius of the third circle = R

R_1

R_2

C_1

C_2

$R - R_1$

C

$R + R_2$

To draw an approximate ellipse

Given **Major and minor axes**

To draw an approximate ellipse
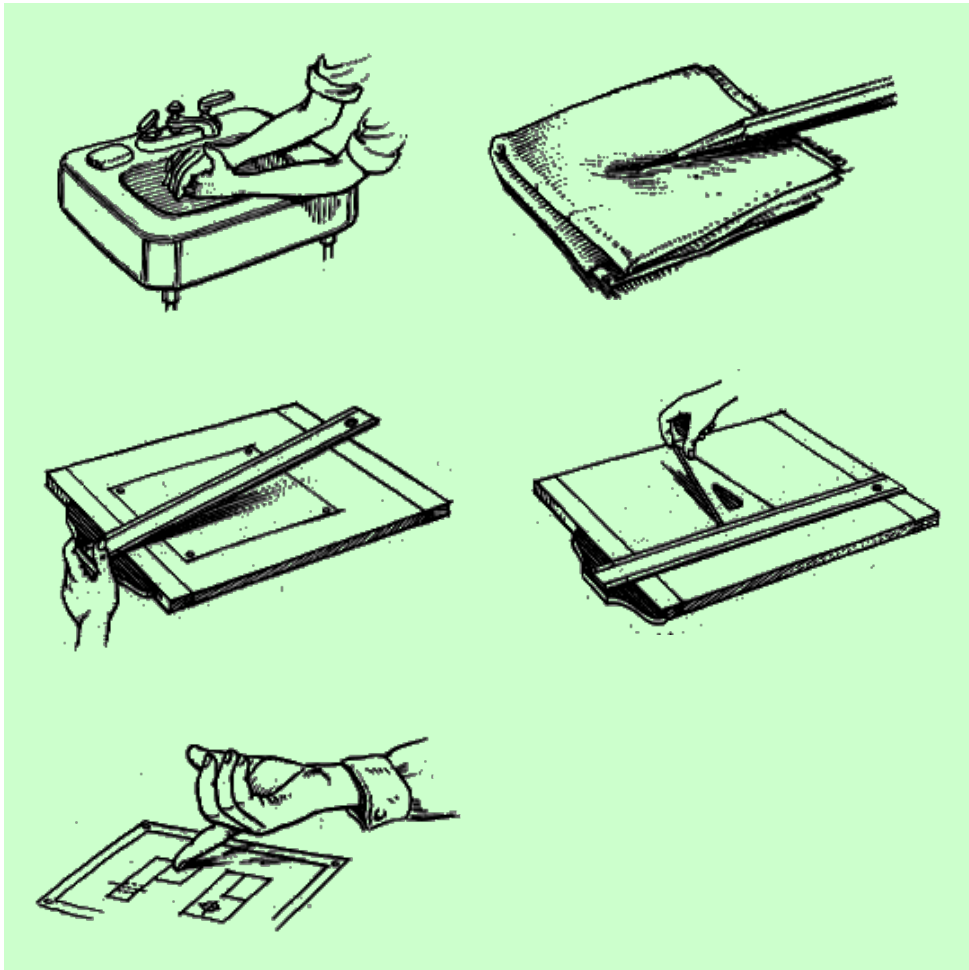
Given **Major and minor axes**

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Repeat

How to Keep Your Drawing Clean

Do

Don't

SWISH SWISH

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