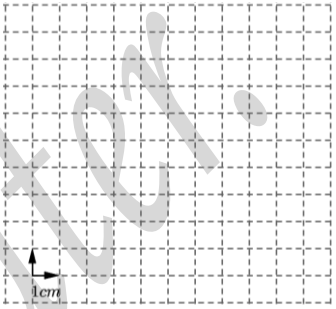
Tangents to a circle through an exterior point

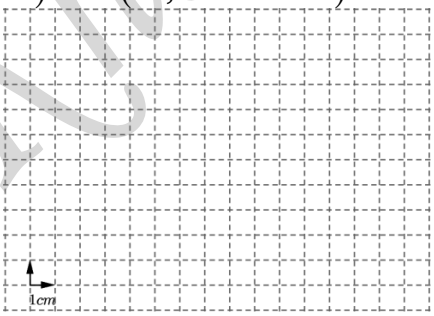
Let (C) be a circle of center O and radius $r\,cm$, where A is any point in the plane.

1- How many tangents can be drawn from a point A:
   a) Inside the circle? …… c) Outside the circle? ……
   b) On the circle? ……



2- Let (T) be the tangent at a point A on the circle (C) of center O.
   a. What is the value of the angle formed by the straight line (T) and the radius $[OA]$? ……
   b. Construct (T)
   ……
   ……

3- Let A & B be the points of intersection of the circles $s(O,3cm)$ & $n(O',OO'=4cm)$.



   a. Trace the circles and plot the points A & B.
   b. Plot P the symmetric of O with respect to O'.
   c. What do the angles $P\hat{A}O$ & $P\hat{B}O$ represent?
   ……
   d. Deduce the measure of $P\hat{A}O$ & $P\hat{B}O$.
   ……
   ……

4- Consider the circle $\psi(O,3cm)$ and the point A so that $OA=5cm$
   a. Devise a method to trace the tangents (T_1) & (T_2) from A to (ψ) at R & N respectively.
   ……
   ……
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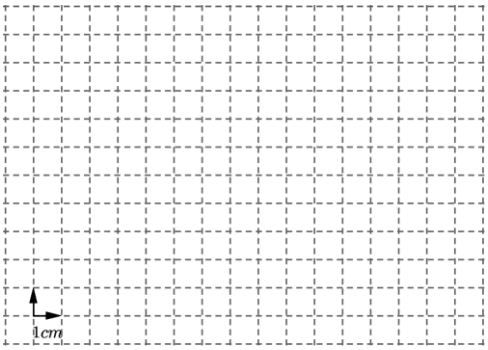
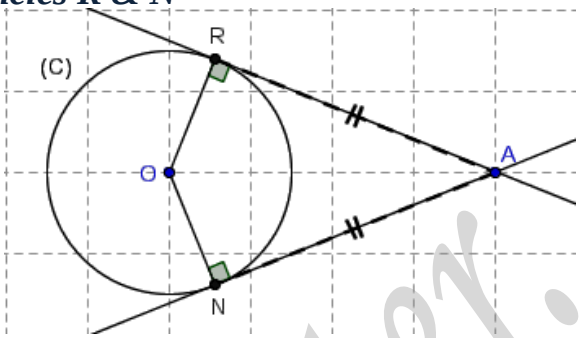


   b. What does each of the following represent:
   i. $R\hat{A}N$: ……
   ii. $R\hat{O}N$: ……
   iii. $[RN]$: ……
   c. Prove that: $[AO)$ is the bisector of $R\hat{A}N$: ……
   ……
   ……
   ……
   ……
   d. Deduce that $[OA)$ is the bisector of $R\hat{O}N$: ……
   ……
   e. What is the relative position of (OA) with respect to $[RN]$?
   ……
   ……

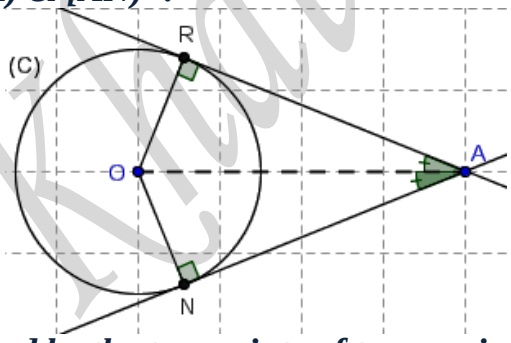
If (*AR*) & (*AN*) are two tangents drawn from a point *A* to a circle (*C*) of center *O* at *R* & *N* resp. Then,

1. ***A is equidistant from the two points of tangencies R & N***



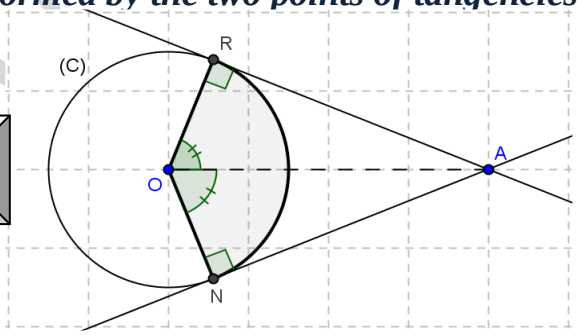
Or, $AR = AN$.

2. ***Line joining point of intersection of the two tangents and center of (C) bisects:***
   a. ***The angle formed by the two tangents"[AR) & [AN)".***



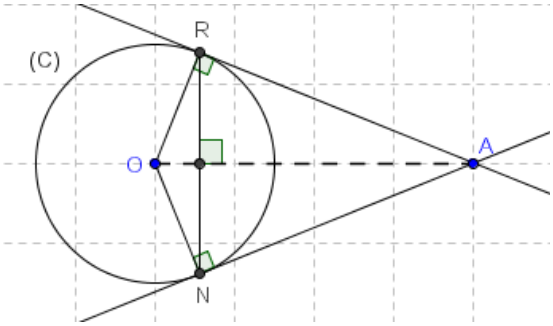
Or, $[AO)$ is the bisector of the angle $R\hat{A}N$.

   b. ***The central angle intercepting the arc formed by the two points of tangencies.***



Or, $[OA)$ is the bisector of the angle $R\hat{O}N$.

3. ***Line joining point of intersection of the two tangents and center of (C) is the perpendicular bisector of the chord joining points of tangencies.***



Or, (OA) is the $\perp$ bisector of $[RN]$

4. ***Line joining point of intersection of the two tangents and center of (C) is the axis of symmetry of the figure formed by (C) and the two tangents.***