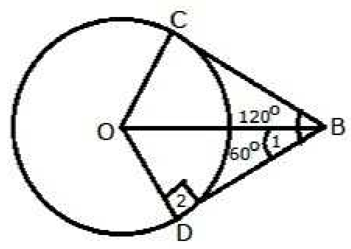
(3) to prove $BC + BD = BO$

$2BC = BO$



proof $\angle 2 = 90°$ (r ⊥ tangent)

$\angle 1 = \frac{1}{2} \angle CBD$ (tangents are equally inclined to line join. centre of ⊙ to external point)

$= \frac{1}{2} \times 120°$

$= 60°$

In rt $\triangle ODB$

$\cos 60° = \frac{BD}{BO}$

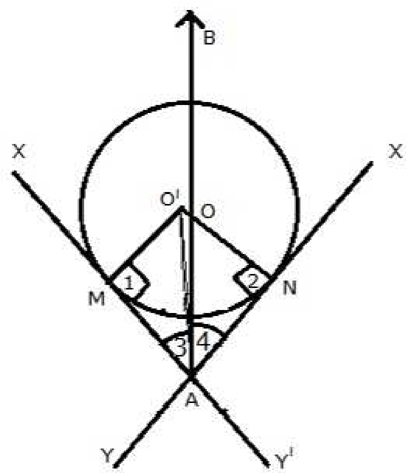
$\frac{1}{2} = \frac{BD}{BO}$

$\Rightarrow BO = 2BD \Rightarrow BO = BD + BD$

But $BC = BD$ (tangents from same external point)

$BO = BC + BD$

(4) to prove - AB bisector of $\angle XAX'$ passes through centre of ⊙, O'



Proof Suppose AB does not pass thro. O'

join O'A, O'M, O'N

$\triangle O'MA \cong \triangle O'N$ by RHS prop

$\begin{bmatrix} \angle 1 = \angle 2 = 90° \\ O'A = O'A \\ O'M = O'N \text{ radii} \end{bmatrix}$

$\angle 3 = \angle 4$ (cpct)

But this is possible only if O' lies on AB [∵ AB is bisector of $\angle XAX'$]

∴ AB passes through centre of ⊙