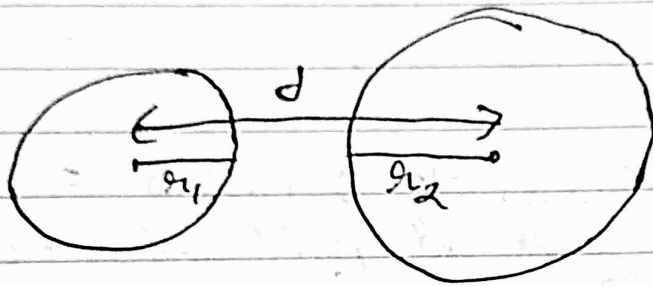


NOTES

Number of ^{Common} tangents & the relative positions of circles are directly related.

Consider 2 circles. C_1, C_2

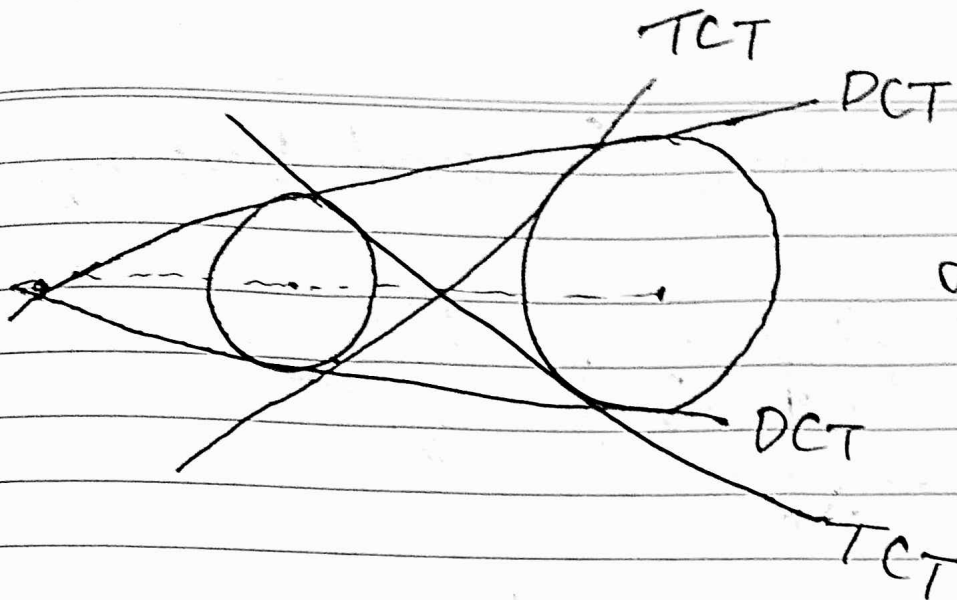
Case I



If the distance d between centres is more than $r_1 + r_2$
 $d > r_1 + r_2 \Rightarrow$

Then the circles are separate in 2d space far away.

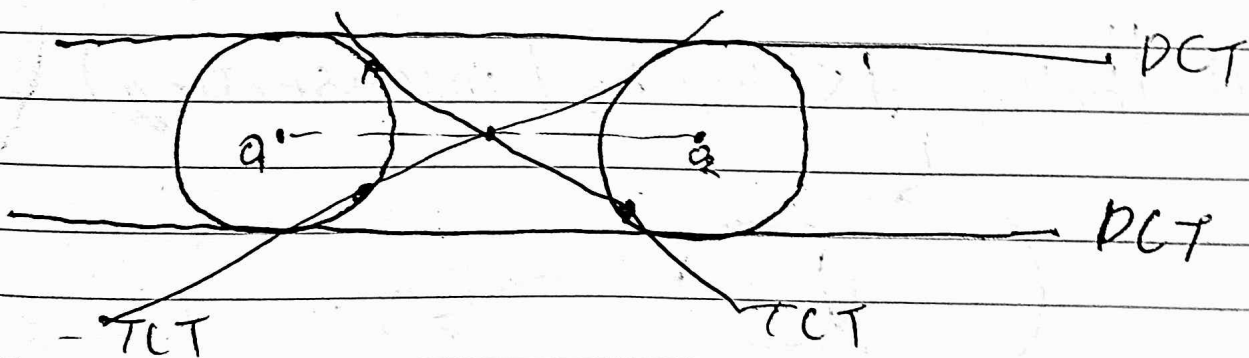
No. of common tangents = 4



Case (I)
 $d > r_1 + r_2$

We will have
 2 Direct common tangents (DCT)
 + 2 Transverse common tangents (TCT)

S.p. Case $r = r_1 = r_2$, $d > 2r$

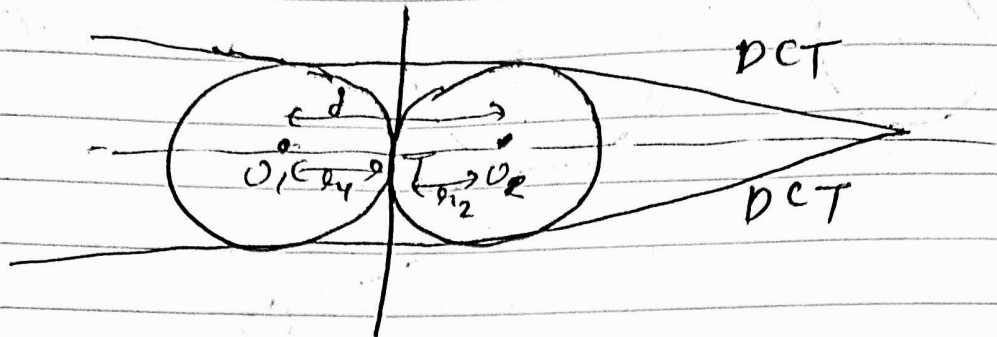


DCT's never meet.

TCT's meet at midpoint of centres)

Yet no. of ^{common} tangents = $\boxed{4}$

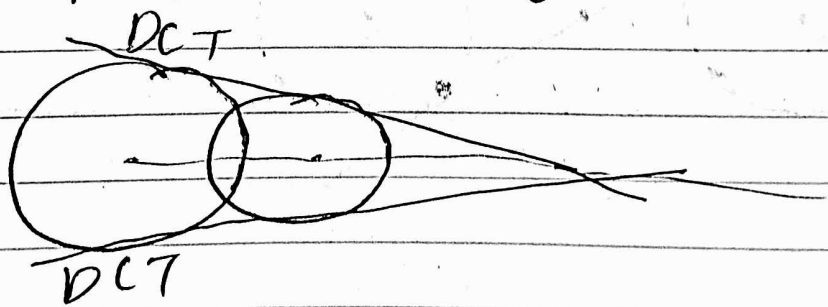
Case II $d = r_1 + r_2$ (external touching)



= 2 DCTs + one common tangent that touches both circles at SAME point. (T)

Total common Tangents = 3

Case III $|r_1 - r_2| < d < r_1 + r_2$ (intersecting)



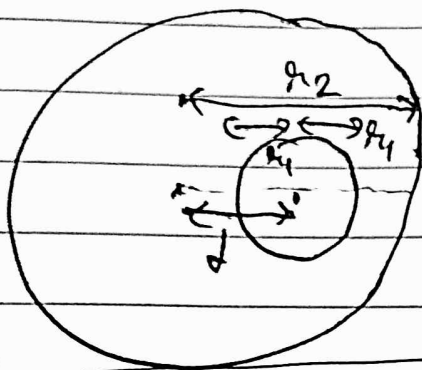
= 2 DCT's only

Total common tangents = 2

Case IV

$$d < |r_1 - r_2|$$

[one circle inside another]

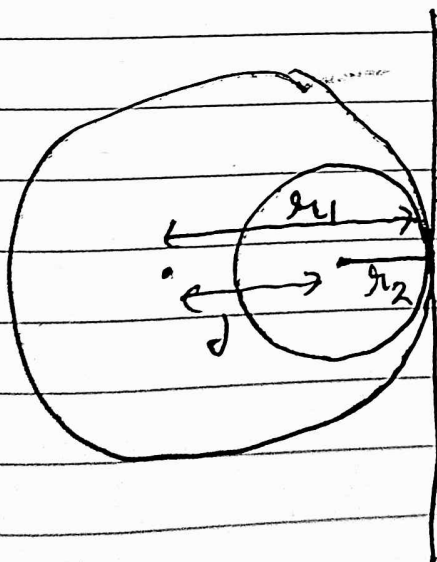


Total common
Tangents = 0

Case V

$$d = |r_1 - r_2|$$

[Internal touching]



$d = r_1 - r_2$ [$r_1 > r_2$]
in general

$$d = |r_1 - r_2|$$

Total tangents
= 1

Tangent touching both circles at the same point.