

PROBLEM CORNER

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Background

We are given two disconnected circles, C_1 , and C_2 centered at O_1 and O_2 , respectively. Point $A = (x, y) \in \mathbb{R}^2$ is outside both circles, and we construct two pairs of tangent lines from A toward circles C_1 and C_2 , respectively. We label those points of tangency as B, C, D , and E , respectively; (see Figure 1). If $\angle BAC = \angle DAE$, we call point A an equal viewpoint.

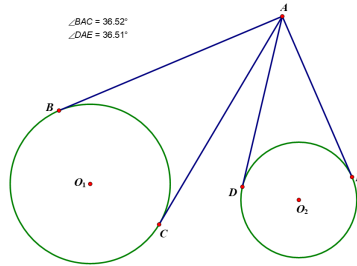


Figure 1. Equal viewpoint A .

Problem 1.

We consider two circles C_1 of $x^2 + y^2 - 1 = 0$, and C_2 of $(x - 2)^2 + y^2 - 1 = 0$. Find the locus of equal viewpoints.

Problem 2.

We consider two non-intersecting and different sizes of circles C_1 of $x^2 + y^2 - 1 = 0$, and C_2 of $(x - 4)^2 + y^2 = 4$. Find the locus of equal viewpoints.

Problem 3.

We consider two intersecting circles with different radii of circles C_1 of $x^2 + y^2 - 1 = 0$, and C_2 of $(x - 2)^2 + y^2 = 4$. Find the locus of equal viewpoints.