EQUAL CHORD SOLUTION

Calculate the sides of triangle ABC: $AB = \sqrt{13}, BC = \sqrt{17}, AC = \sqrt{8}$

The angles of triangle ABC are:

$$\cos A = \frac{(\sqrt{13})^2 + (\sqrt{8})^2 - (\sqrt{17})^2}{2 \cdot \sqrt{13} \cdot \sqrt{8}} = 78^\circ 41' 24.2''$$

$$\cos B = \frac{(\sqrt{13})^2 + (\sqrt{17})^2 - (\sqrt{8})^2}{2 \cdot \sqrt{13} \cdot \sqrt{17}} = 42^\circ 16' 25.3''$$

$$\cos C = \frac{(\sqrt{8})^2 + (\sqrt{17})^2 - (\sqrt{13})^2}{2 \cdot \sqrt{8} \cdot \sqrt{17}} = 59^\circ 02' 10.5''$$

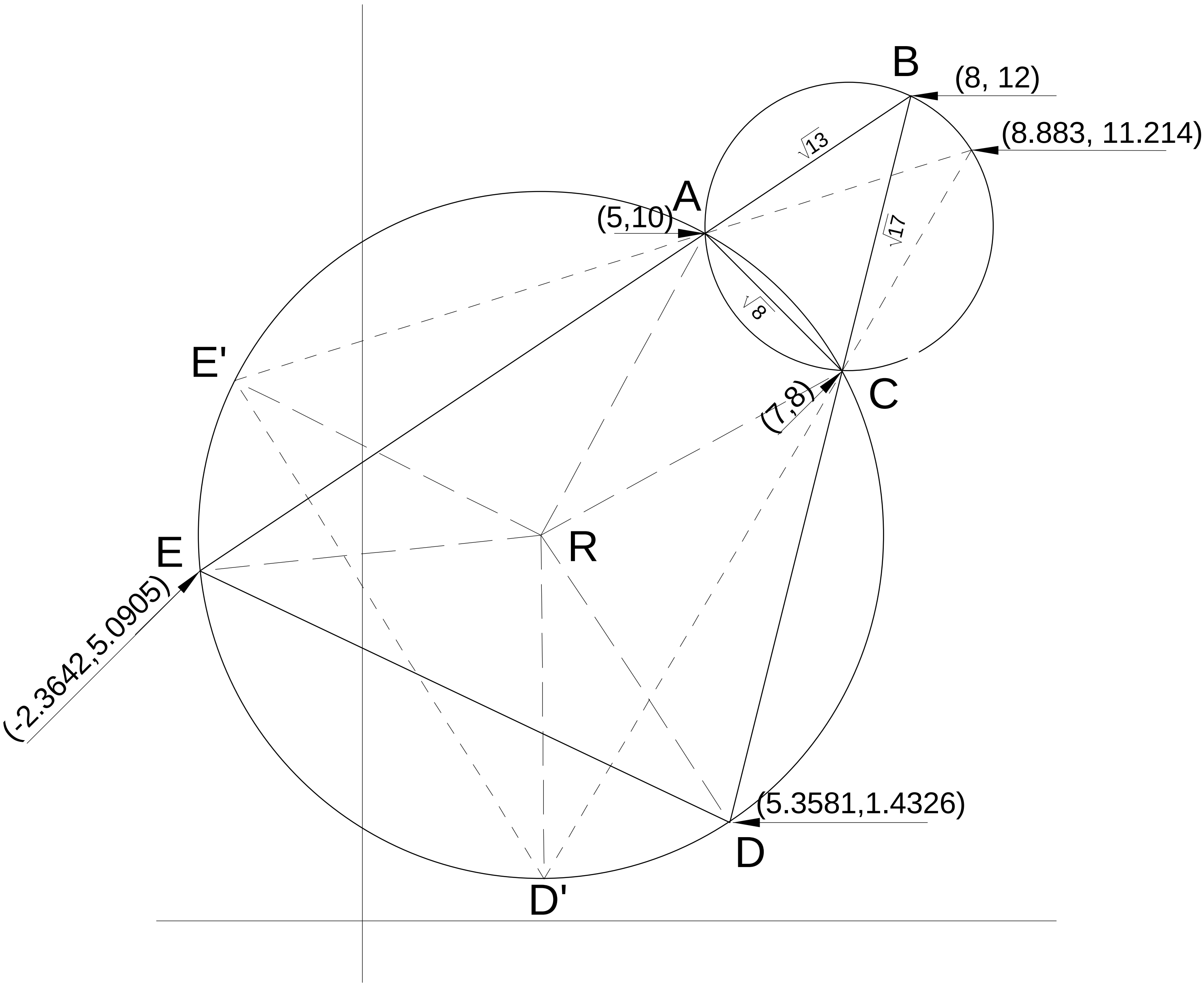
In triangle RAC, $\cos ARC = \dfrac{5^2 + 5^2 - (\sqrt{8})^2}{2 \cdot 5 \cdot 5} = \cos 32^\circ 51' 35.6''$ making angles RAC and RCA = 73°34'12.2"

The bearing of line AB = arctan 3/2 = N 56°18'35.8" E, which makes line AC 180° – 56°18'35.8" – 78°41'24.2" = S 45°00'00.0" E, which checks its coordinates. Line AR is then S 28°34'12.2" W. Angle EAR which equals angle REA= 56°18'35.8" – 28°34'12.2" = 27°44'23.6" so angle ERA=124°31'12.8" and EA= $2 \cdot 5 \cdot \sin 62^\circ 15' 36.4'' = 8.8507$ and point E is S 56°18'35.8" 8.8507 from point A, or (–2.3642, 5.0905).

Starting again from line CA being N 45°00'00.0" W, line CB is N 14°02'10.5" E and line RC is S 61°25'47.8" W so angle RCD = angle RDC = 47°23'37.3" and angle DRC = 85°12'45.4" and CD= $2 \cdot 5 \cdot \sin 42^\circ 36' 22.7'' = 6.76957$, making point D S 14°02'10.5" W 6.76957 from C, or (5.3581, 1.4326) and therefore DE $= \sqrt{[5.3581 - (-2.3642)]^2 + [1.4326 - 5.0905]^2} = 8.5448$

With point B moving to B' (8.883, 11.214), the angles of triangle AB'C are A = 62°21'41.7", B'=42°16'24.5", and C= 75°21'53.7"
Angle RCD' = 180°–75°21'53.7"–73°34'12.2" = 31°03'54.1" and angle CRD = 117°52'11.8". Angle E'AR which equals angle RE'A= 180° – 62°21'41.7" – 73°34'12.2" = 44°04'06.1" so angle E'RA = 91°51'47.8" and angle E'RD' = 117°24'24.8" (The first solution could have been done using this technique, too, instead of calculating coordinates) and E'D' = $2 \cdot 5 \cdot \sin 58^\circ 42' 12.4''$ = 8.5449, the same as ED, except for rounding errors.

In fact, wherever point B moves along the circle between A and C, the resulting chord ED will be the same length.



B
(8, 12)
(8.883, 11.214)
A
(5,10)
√13
√17
√8
E'
C
(7,8)
E
R
(-2.3642,5.0905)
(5.3581,1.4326)
D
D'