Answers for the Fall 2018 Trig-Star Problem Corner in *The Tarheel Surveyor*

Find:

Arc Length AE = 48

Distance AB = 108.72

Distance BC = 199.19

Distance DE = 159.25

Cord Length AE = 46.91'

Arc length AE

$$AE = \frac{42°18'22''}{360°}(2\pi R) = \frac{42.308056°}{360°}(2 \times 3.14593 \cdot 650')$$

$$AE = 47.997' = [48']$$

$$\angle BAF + ABF = 180° - \angle ABF = 180° - 90°21'18''$$
$$= 89°36'42''$$

$$\text{Tan}\tfrac{1}{2}\angle BAF - ABF = \frac{(BF - AF)\tan\tfrac{1}{2}(89°36'42'')}{(BF + AF)}$$

$82.81 - 69.93$

$82.81 + 69.93$

$$4.790504° = \frac{(12.88)\tan(44.8225°)}{152.74} = 4°47'25''$$

$$\angle BAF - \frac{89°36'42''}{2} + 4°47'25'' = 49°36'44''$$

$$\angle ABF = \frac{89°36'42''}{2} - 4°47'25'' = 40°01'56''$$

$$\frac{BF \sin \angle AFB}{\sin \angle BAF} \qquad \frac{82.81 \cdot \sin 90°21'18''}{\sin 49°36'44''} \qquad \frac{A:}{108.72'}$$

$$\angle FBC + \angle BCF = 180° - \angle BFC = 180° - 121°50'52''$$
$$= 58°09'08''$$

$58°09'08''$

$$\text{Tan}\tfrac{1}{2}(\angle FBC - BCF = \frac{(CF - BF)}{CF + BF}\tan\tfrac{1}{2}(\angle FBC + \angle BCF$$

$142.66 - 82.81$

$142.66 + 82.81$

$$8°23'46'' = \frac{(59.85)\tan\tfrac{1}{2}(58°09'08'')}{225.47}$$

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$\angle FBC = 29°04'34" + 8°23'46" = \boxed{37°28'20"}$

$\angle BCF = 29°04'34" - 8°23'46" = \boxed{20°40'48"}$

$$BC = \frac{FC \cdot \sin \angle BFC}{\sin \angle CBF} = \frac{142.66 \cdot \sin 121°50'53"}{\sin 37°28'20"}$$

$BC = \boxed{199.19}$

$\angle FED + \angle EDF = 180° - \angle EFD = 180° - 96°15'54"$

$= 83°44'06"$

$$\tan \tfrac{1}{2}(\angle FED - \angle EDF) = \frac{(DF - EF)}{DF + EF} \tan \tfrac{1}{2}(\angle FED + \angle EDF)$$

$(DF - EF) = 135.90 - 69.50 = 66.4$

$(\angle FED + \angle EDF) = 83°44'06"$

$DF + EF = 135.90 + 69.50$

$= 16°09'27"$

$\angle FED = 41°52'03" + 16°09'27" = 58°01'30"$

$\angle EDF = 41°52'03" = 16°09'27" = 25°42'36"$

$$DE = \frac{DF \cdot \sin \angle EFD}{\sin \angle FED} = \frac{135.90 \cdot \sin 96°15'54"}{\sin 58°01'30"}$$

$DE = \boxed{159.25}$

$AE \text{ chord} = 2(\sin \tfrac{1}{2} \angle AGE \cdot AG) = 46.91'$ ($AG = 65.00$, $\angle AGE = 42°16'29"$)