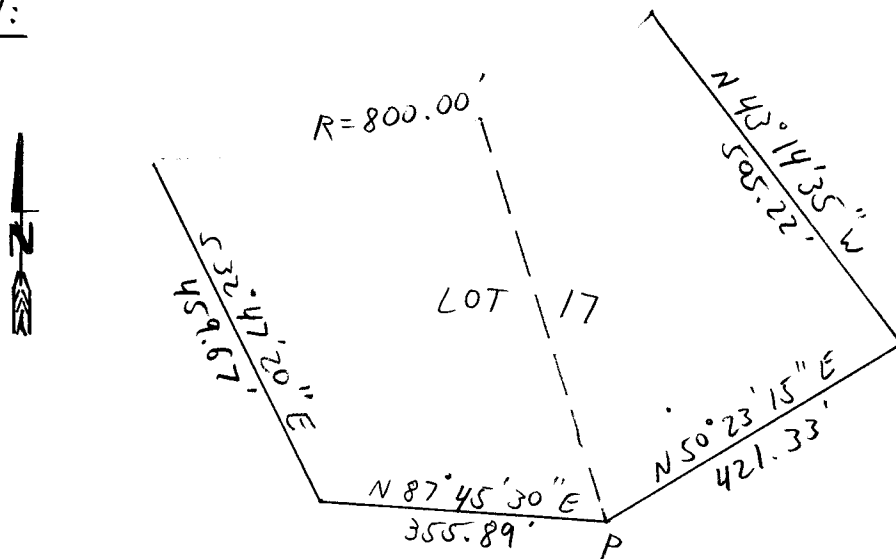


GIVEN:

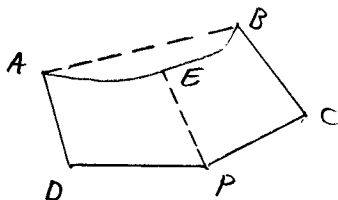


FIND:

LENGTH (TO 0.01') AND BEARING (TO 01'') OF LINE PASSING THROUGH POINT P WHICH DIVIDES LOT 17 INTO TWO EQUAL AREA PARCELS.

SOLUTION:

ASSIGN POINTS TO CORNERS



ASSUME COORDS OF POINT A: $N_A = 5000.00$
 $E_A = 5000.00$

COMPUTE COORDS OF OTHER POINTS:

$$N_D = 5000 - 459.67 \cos(32^\circ 47' 20'')$$

$$N_D = 4613.568$$

$$E_D = 5000 + 459.67 \sin(32^\circ 47' 20'')$$

$$E_D = 5248.932$$

$$N_P = 4613.568 + 355.89 \cos(87^\circ 45' 30'')$$

$$N_P = 4627.488$$

$$E_P = 5248.932 + 355.89 \sin(87^\circ 45' 30'')$$

$$E_P = 5604.550$$

$$N_c = 4627.488 + 421.33 \cos(50^\circ 23' 15'')$$

$$N_c = 4896.125$$

$$E_c = 5604.550 + 421.33 \sin(50^\circ 23' 15'')$$

$$E_c = 5929.132$$

$$N_B = 4896.125 + \cos(43^\circ 14' 35'') 505.22$$

$$N_B = 5264.155$$

$$E_B = 5929.132 - 505.22 \sin(43^\circ 14' 35'')$$

$$E_B = 5583.008$$

INVERSE B \rightarrow A:

$$N_B - N_A = 5264.155 - 5000 = 264.155$$

$$E_B - E_A = 5583.008 - 5000 = 583.008$$

$$\text{BEARING} = \tan^{-1}\left(\frac{583.008}{264.155}\right) \Rightarrow S65^\circ 37' 31'' W$$

$$\text{DIST} = \sqrt{583.008^2 + 264.155^2} \Rightarrow 640.060'$$

COMPUTE AREA BY COORDS:

$$\begin{aligned} \text{AREA} = \frac{1}{2} [& -(5000(5248.932 - 5583.008) + 5264.155(\\ & (5000 - 5929.132) + 4896.125(5583.008 - 5604.550) + \\ & + 4627.488(5929.132 - 5248.932) + 4613.568(\\ & (5604.550 - 5000))] \Rightarrow \text{AREA} = 365,098.6581 \text{ FT}^2 \end{aligned}$$

SUBTRACT AREA OF SECTOR ABE TO GET AREA OF LOT 17:

$$\text{AREA OF SECTOR} = R^2 \left(\frac{\pi I}{360} - \frac{\sin(I)}{2} \right)$$

$$C = 2R \sin \frac{I}{2} \Rightarrow 640.060 = 2(800) \sin \frac{I}{2}$$

$$\sin \frac{I}{2} = 0.4000375$$

$$\frac{I}{2} = 23.58052281$$

$$I = 47.16104561$$

$$I = 47^\circ 09' 40''$$

$$\text{AREA OF SECTOR} = 800^2 \left(\frac{\pi(47.16104561)}{360} - \frac{\sin(47.16104561)}{2} \right) = 28,751.28633 \text{ FT}^2$$

$$\begin{aligned} \text{AREA OF LOT 17} &= 365,098.6581 - 28,751.28633 = \\ &= 336,347.3718 \text{ FT}^2 \end{aligned}$$

DIVIDE BY 2 FOR REQUIRED AREA:

$$336,347.3718 / 2$$

$$A_{\text{REQ'D}} = 168,173.6859 \text{ FT}^2$$

COMPUTE \angle DPC:

$$\angle \text{DPC} = 180^\circ - 87^\circ 45' 30'' - 50^\circ 23' 15''$$

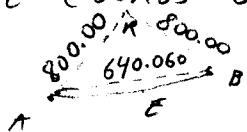
$$\angle \text{DPC} = 142^\circ 37' 45''$$

BEGIN ITERATIONS OF BEARING/DISTANCE OF DIVIDING LINE:

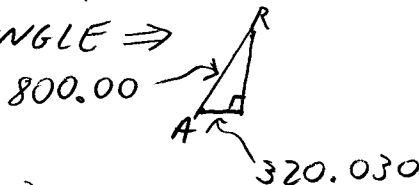
$$\text{BISECT } \angle \text{DPC}: 142^\circ 37' 45'' / 2 = 71^\circ 18' 52'' 5$$

$$\begin{aligned} \text{COMPUTE BEARING P} \rightarrow \text{E}: 71^\circ 18' 52'' 5 - 50^\circ 23' 15'' \\ = N 20^\circ 55' 37'' 5 W \end{aligned}$$

COMPUTE COORDS OF RADIAL POINT R



$\triangle ABR$ IS ISOSCELES, PERPENDICULAR BISECTOR OF AB MAKES A RIGHT TRIANGLE \Rightarrow



$$\angle A = \cos^{-1} \left(\frac{320.03}{800.00} \right) = 66^\circ 25' 10''$$

$$\begin{aligned} \text{BEARING A} \rightarrow \text{R} &= 66^\circ 25' 10'' - 65^\circ 37' 31'' \\ &= N 0^\circ 47' 39'' W \end{aligned}$$

$$N_R = 5000 + 800 \cos(0^\circ 47' 39'')$$

$$N_R = 5799.923$$

$$E_R = 5000 - 800 \sin(0^\circ 47' 39'')$$

$$E_R = 4988.911$$

INVERSE P → R:

$$N_P - N_R = 4627.488 - 5799.923 = -1172.435$$

$$E_P - E_R = 5604.55 - 4988.911 = 615.639$$

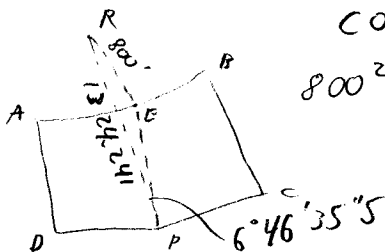
$$\tan^{-1} \left(\frac{1172.435}{615.639} \right) = 62^\circ 17' 47''$$

$$90^\circ - 62^\circ 17' 47'' = N 27^\circ 42' 13'' W$$

$$DIST_{P \rightarrow R} = \sqrt{1172.435^2 + 615.639^2} = 1324.241'$$

COMPUTE ∠ RPE: $27^\circ 42' 13'' - 20^\circ 55' 37'' S$

$$\angle RPE = 6^\circ 46' 35'' S$$



COSINE LAW TO SOLVE DIST_{P→E}:

$$800^2 = 1324.241^2 + PE^2 - 2(1324.241)(PE) * \cos(6^\circ 46' 35'' S)$$

$$0 = PE^2 - 2629.979522 PE + 1113614.226$$

QUADRATIC FORMULA:

$$\frac{2629.979522 \pm \sqrt{2629.979522^2 - 4(1)(1113614.226)}}{2(1)}$$

$$PE = 2099.581' \text{ OR } 530.398' \Rightarrow \text{USE } 530.398'$$

COMPUTE COORDS OF E:

$$N_E = 4627.488 + 530.398 \cos(20^\circ 55' 37'' S)$$

$$N_E = 5122.899$$

$$E_E = 5604.55 - 530.398 \sin(20^\circ 55' 37'' S)$$

$$E_E = 5415.103$$

COMPUTE AREA OF FIGURE AEPD:

$$A = \frac{1}{2} \left[-[5000.00(5248.932 - 5415.103) + 5122.899(5000 - 5604.55) + 4627.488(5415.103 - 5248.932) + 4613.568(5604.55 - 5000)] \right] \Rightarrow A = 184,908.3738 \text{ FT}^2$$

COMPUTE DIST. $A \rightarrow E$:

$$\text{DIST}_{A \rightarrow E} = \sqrt{(5122.899 - 5000)^2 + (5415.103 - 5000)^2}$$

$$\text{DIST}_{A \rightarrow E} = 432.914 \text{ FT.}$$

SUBTRACT AREA OF SECTOR TO GET AREA OF DIVIDED LOT:

$$C = 2R \sin \frac{I}{2} \quad 432.914 = 2(800) \sin \frac{I}{2}$$

$$\sin \frac{I}{2} = 0.270571346$$

$$\frac{I}{2} = 15.6982681 \Rightarrow I = 31^\circ 23' 47'' 5$$

$$A_{\text{SECTOR}} = 800^2 \left(\frac{\pi (31^\circ 23' 47'' 5)}{360} - \frac{\sin(31^\circ 23' 47'' 5)}{2} \right)$$

$$A_{\text{SECTOR}} = 8644.761521 \text{ FT}^2$$

$$A_{\text{DIVIDED LOT}} = 184908.3738 - 8644.761521 =$$

$$= 176,263.6123 \text{ FT}^2$$

$$\text{vs. } 168,173.6859 \text{ FT}^2$$



INTERMEDIATE ITERATIONS NOT FORMALLY WRITTEN OUT...



ASSUME BEARING OF PE = N 24° 15' 15" W

$$\angle RPE = 27^\circ 42' 13'' - 24^\circ 15' 15''$$

$$\angle RPE = 3^\circ 26' 58''$$

COSINE LAW TO SOLVE DIST $P \rightarrow E$:

$$800^2 = 1324.241^2 + PE^2 - 2(1324.241)(PE) * \cos(3^\circ 26' 58'')$$

$$0 = PE^2 - 2643.683683 PE + 1113614.226$$

$$\frac{2643.683683 \pm \sqrt{2643.683683^2 - 4(1)(1113614.226)}}{2(1)}$$

$$PE = 2117.864 \text{ FT. OR } 525.819 \text{ FT.} \Rightarrow \text{USE } 525.819 \text{ FT.}$$

COMPUTE COORDS OF E:

$$N_E = 4627.488 + 525.819 \cos(24^\circ 15' 15'')$$

$$N_E = 5106.894$$

$$E_E = 5604.550 - 525.819 \sin(24^\circ 15' 15'')$$

$$E_E = 5388.551$$

COMPUTE AREA OF FIGURE AEPD:

$$A = \frac{1}{2} \left[-[5000(5248.932 - 5388.551) + 5106.894(5000 - 5604.55) + 4627.488(5388.551 - 5248.932) + 4613.568(5604.55 - 5000)] \right] \Rightarrow A = 175,124.9933 \text{ FT}^2$$

COMPUTE DIST A→E:

$$\text{DIST. A} \rightarrow \text{E} = \sqrt{(5388.551 - 5000)^2 + (5106.894 - 5000)^2}$$

$$\text{DIST. A} \rightarrow \text{E} = 402.9866 \text{ FT}$$

SUBTRACT AREA OF SECTOR TO GET AREA OF DIVIDED LOT:

$$C = 2R \sin \frac{I}{2} \Rightarrow 402.9866 = 2(800) \sin \frac{I}{2}$$

$$\sin \frac{I}{2} = 0.25186663$$

$$\frac{I}{2} = 14.58799727^\circ \Rightarrow I = 29^\circ 10' 33'' 5$$

$$A_{\text{SECTOR}} = 800^2 \left(\frac{\pi(29^\circ 10' 33'' 5)}{360} - \frac{\sin 29^\circ 10' 33'' 5}{2} \right)$$

$$A_{\text{SECTOR}} = 6951.450557 \text{ FT}^2$$

$$A_{\text{DIVIDED LOT}} = 175124.9933 - 6951.450557$$

$$A_{\text{DIVIDED LOT}} = 168,173.5427 \text{ FT}^2$$

vs.

$$A_{\text{REQ'D}} = 168,173.6859 \text{ FT}^2 \checkmark$$

LENGTH & BEARING OF DIVIDING LINE:

N 24° 15' 15" W

525.82 FT.