



FAKULTET TEHNIČKIH NAUKA
DEPARTMAN ZA GRAĐEVINARSTVO I GEODEZIJU
LABORATORIJA ZA GEODEZIJU



INŽENJERSKA GEODEZIJA 1

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Vežba 1

- Uputstvo
 - Zadatak uraditi samostalno
 - Podatke prikazati tabelarno

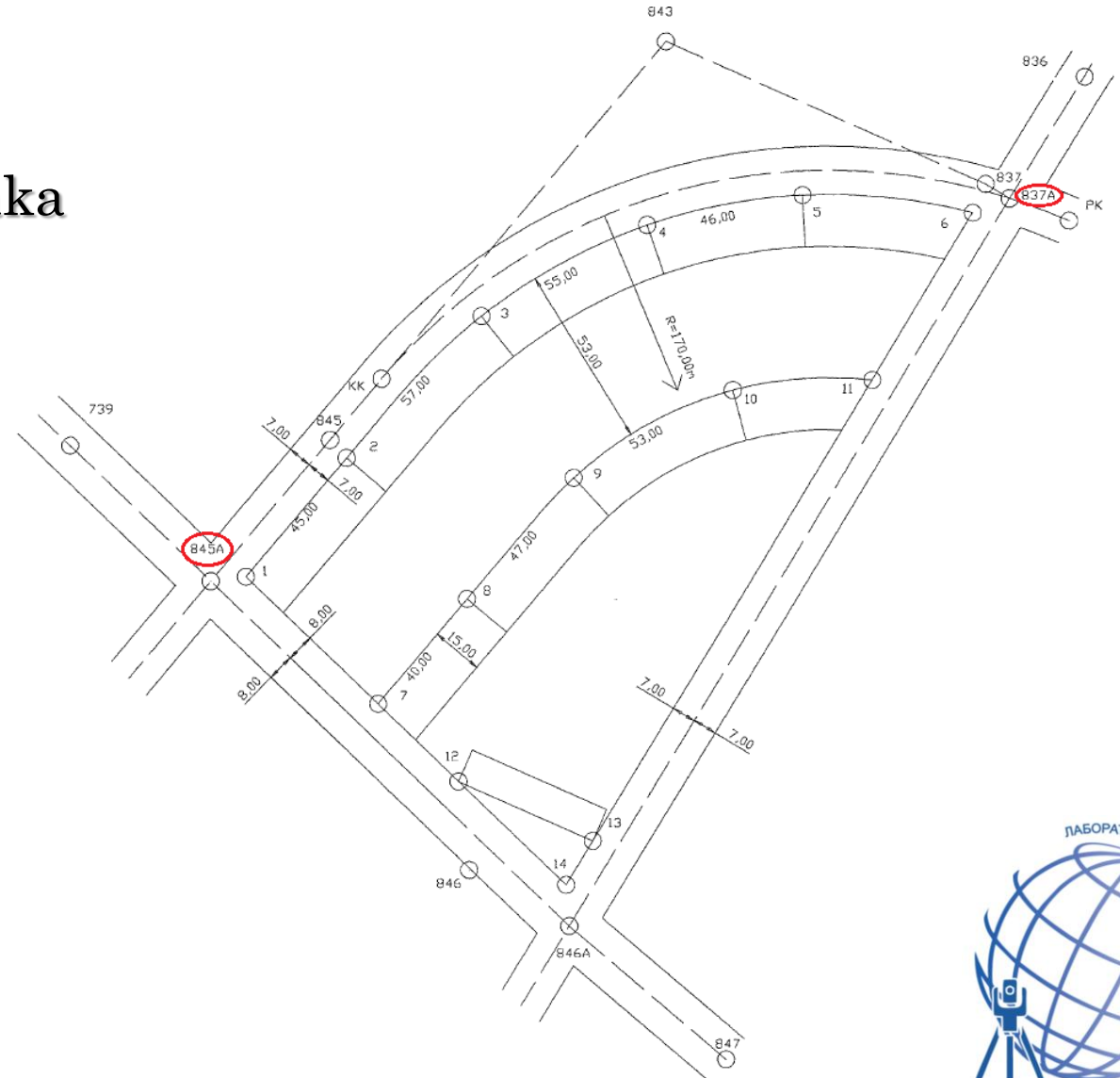
Br. Tačke	Y	X
1	5000.00	5000.00
2	3200.00	2555.55

Stanica	Vizura	α [° ' "]	d [m]
ST1	OR1	0 00 00	/
	T1	vrednost	vrednost



Vežba 1

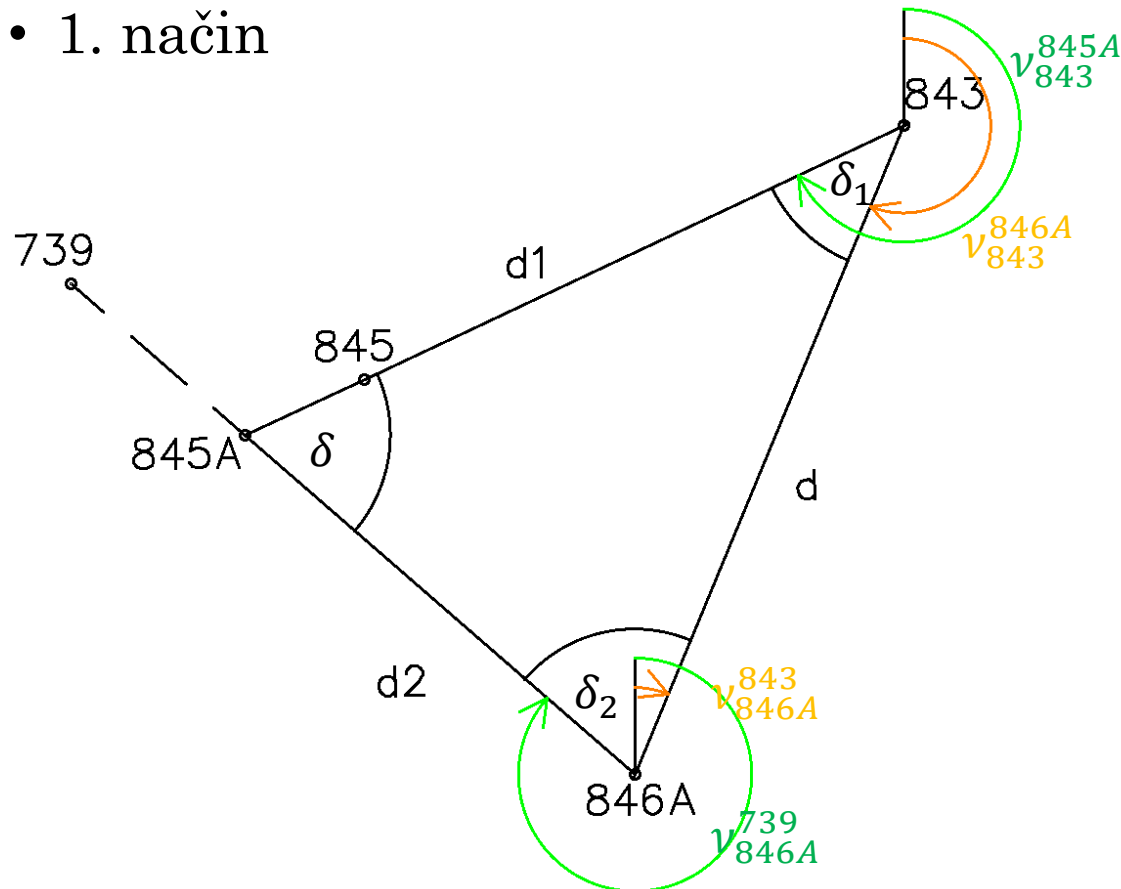
- Analitička razrada bloka
 - Izračunati koordinate osovinskih tačaka -Koordinate 845A i 837A
 - Koordinate detaljnih tačaka prednje frontove lamela prve zgrade - Koordinate 1, 2, 3, 4, 5, 6
 - Koordinate detaljnih tačaka prednje frontove lamela druge zgrade - Koordinate 7, 8, 9, 10, 11
 - Podatke za obeležavanje -Polarno obeležavanje 12 i 13



Vežba 1

• Računanje koordinata TAČKE 845A

• 1. način



$$\varphi_1 = v_{843}^{845} =$$

$$\varphi_2 = v_{846A}^{739} =$$

$$\delta_1 = v_{843}^{845} - v_{843}^{846A} =$$

$$\delta_2 = 360^\circ - (v_{846A}^{739} - v_{846A}^{843}) =$$

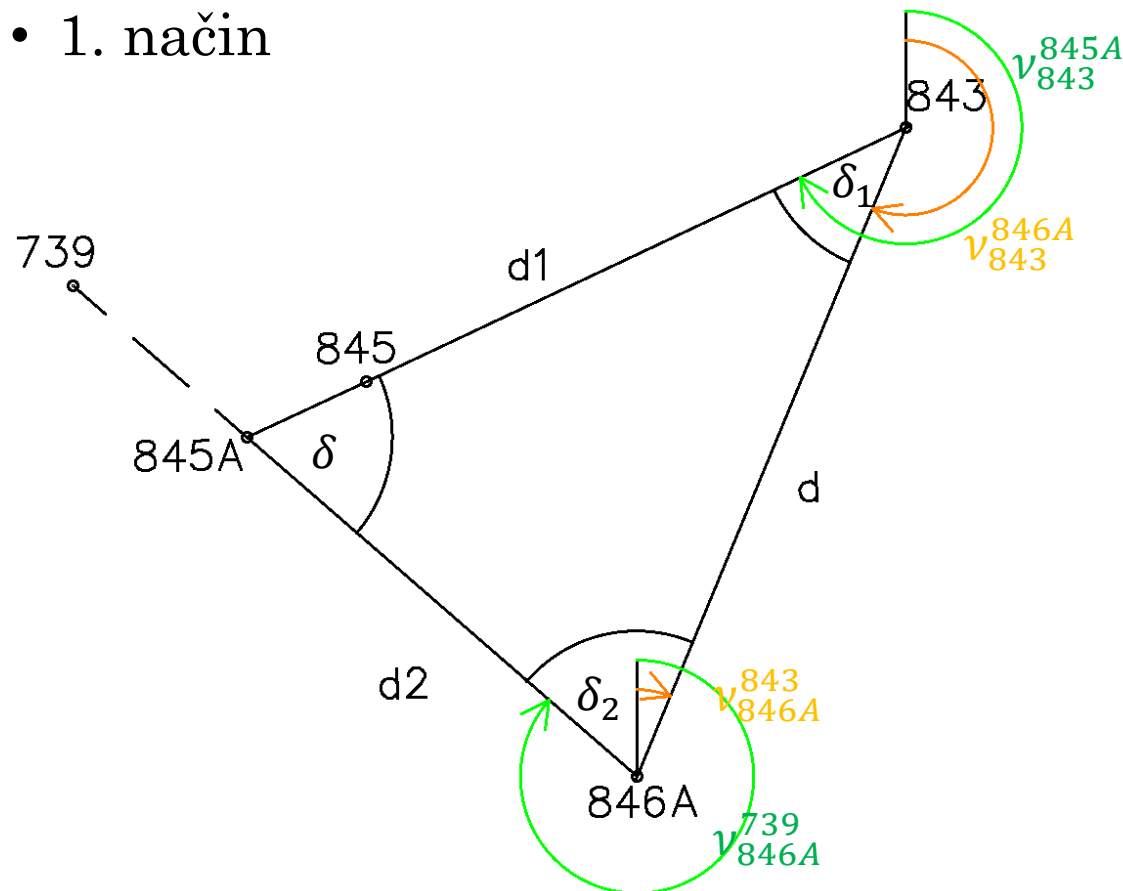
$$\delta = 180^\circ - (\delta_1 + \delta_2) =$$

$$\delta = v_{739}^{846A} - v_{845}^{846} =$$

Vežba 1

- Računanje koordinata TAČKE 845A

- 1. način



$$\varphi_1 = v_{843}^{845} = 219^\circ 50' 12''$$

$$\varphi_2 = v_{846A}^{739} = 313^\circ 48' 14''$$

$$\delta_1 = v_{843}^{845} - v_{843}^{846A} = 33^\circ 52' 13''$$

$$\delta_2 = 360^\circ - (v_{846A}^{739} - v_{846A}^{843}) = 52^\circ 09' 45''$$

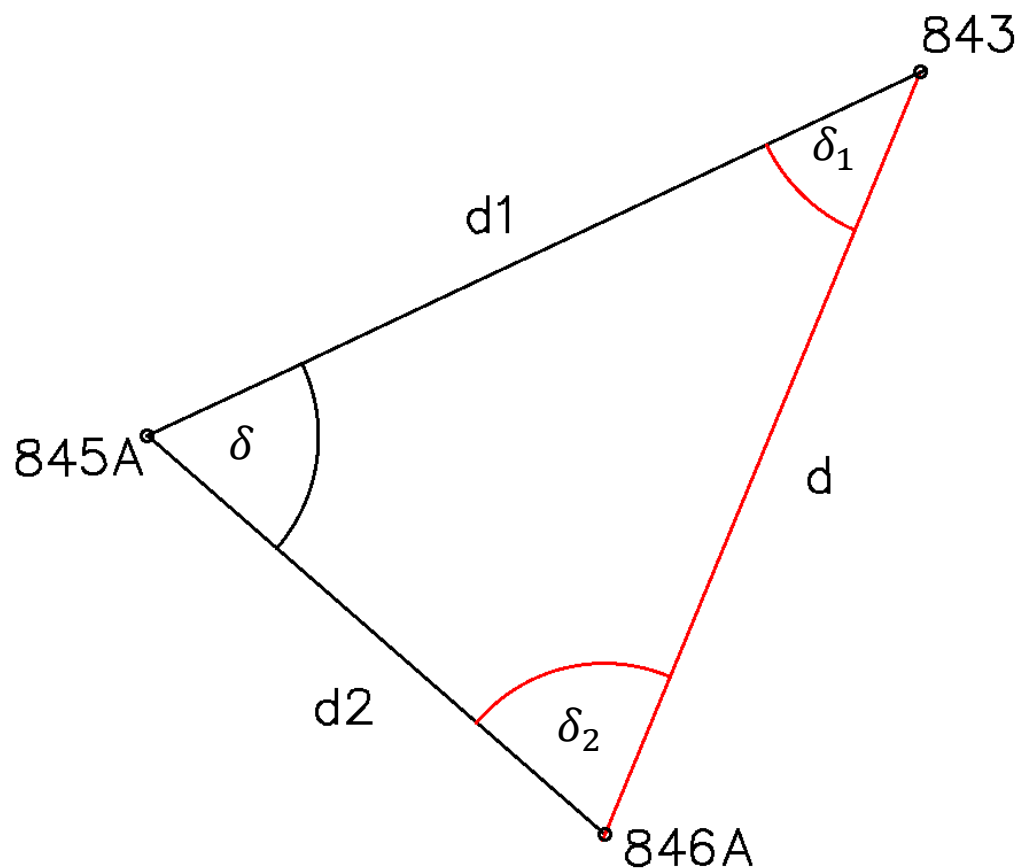
$$\delta = 180^\circ - (\delta_1 + \delta_2) = 93^\circ 58' 02''$$

$$\delta = v_{739}^{846A} - v_{845}^{843} = 93^\circ 58' 02''$$



Vežba 1

DATO: d , δ_1 , δ_2



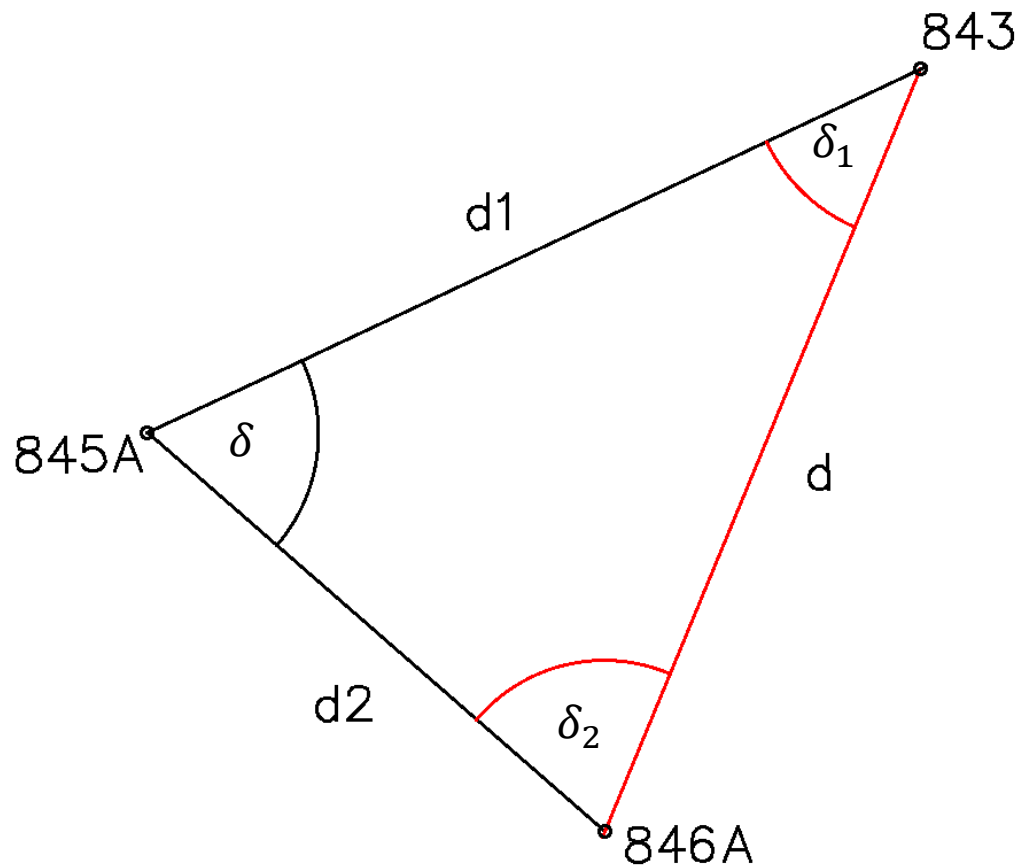
$$\frac{d_2}{\sin\delta_1} = \frac{d_1}{\sin\delta_2} = \frac{d}{\sin\delta} = m$$

$$d_1 = m * \sin\delta_2 =$$

$$d_2 = m * \sin\delta_1 =$$

Vežba 1

DATO: d , δ_1 , δ_2



$$\frac{d_2}{\sin\delta_1} = \frac{d_1}{\sin\delta_2} = \frac{d}{\sin\delta} = m$$

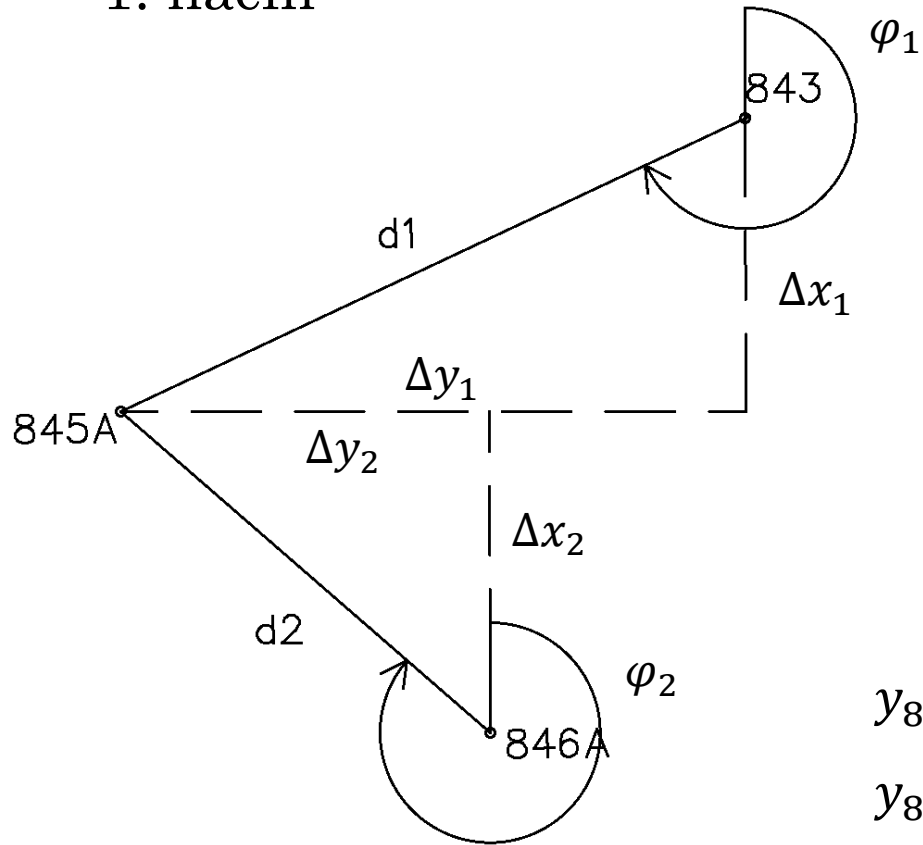
$$d_1 = m * \sin\delta_2 = 204.49\text{m}$$

$$d_2 = m * \sin\delta_1 = 144.31\text{m}$$

Vežba 1

- Računanje koordinata **TAČKE 845A**

- 1. način



$$y_{845A} = y_{843} - \Delta y_1$$

$$y_{845A} =$$

$$\sin(\varphi_1 - 180^\circ) = \frac{\Delta y_1}{d_1}$$

$$\Delta y_1 = d_1 * \sin(\varphi_1 - 180^\circ)$$

$$\Delta y_1 =$$

$$\cos(\varphi_1 - 180^\circ) = \frac{\Delta x_1}{d_1}$$

$$\Delta x_1 = d_1 * \cos(\varphi_1 - 180^\circ)$$

$$\Delta x_1 =$$

$$x_{845A} = x_{843} - \Delta x_1$$

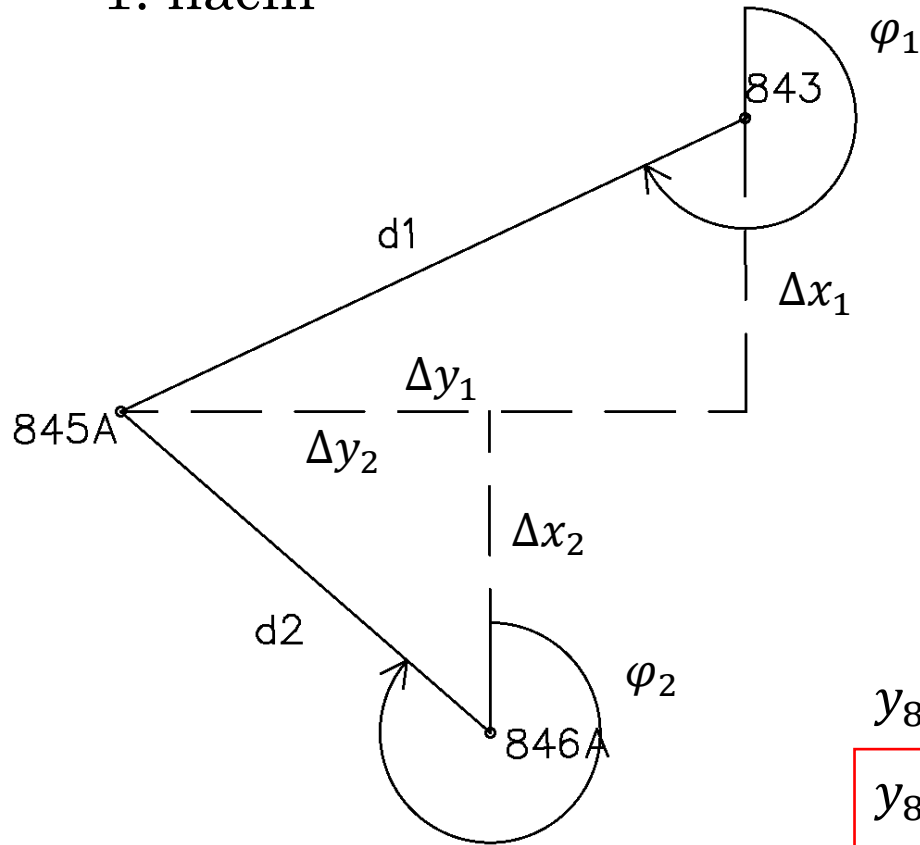
$$x_{845A} =$$



Vežba 1

- Računanje koordinata TAČKE 845A

- 1. način



$$y_{845A} = y_{843} - \Delta y_1$$

$$y_{845A} = 3247.20\text{m}$$

$$\sin(\varphi_1 - 180^\circ) = \frac{\Delta y_1}{d_1}$$

$$\Delta y_1 = d_1 * \sin(\varphi_1 - 180^\circ)$$

$$\Delta y_1 = 131.00\text{m}$$

$$\cos(\varphi_1 - 180^\circ) = \frac{\Delta x_1}{d_1}$$

$$\Delta x_1 = d_1 * \cos(\varphi_1 - 180^\circ)$$

$$\Delta x_1 = 157.02\text{m}$$

$$x_{845A} = x_{843} - \Delta x_1$$

$$x_{845A} = 8896.48\text{m}$$



Vežba 1

Kontrola:

$$\sin(360^\circ - \varphi_2) = \frac{\Delta y_2}{d_2}$$

$$\Delta y_2 = d_2 * \sin(360^\circ - \varphi_2)$$

$$\Delta y_2 =$$

$$y'_{845A} = y_{846A} - \Delta y_2$$

$$y'_{845A} =$$

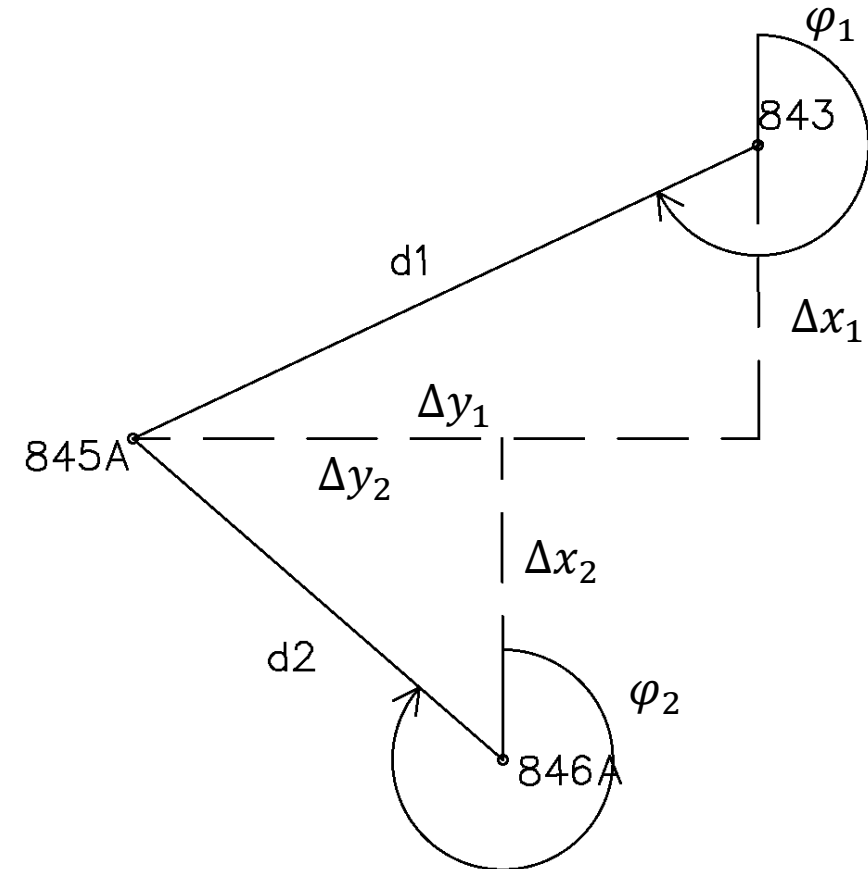
$$\cos(360^\circ - \varphi_2) = \frac{\Delta x_2}{d_2}$$

$$\Delta x_2 = d_2 * \cos(360^\circ - \varphi_2)$$

$$\Delta x_2 =$$

$$x'_{845A} = x_{846A} + \Delta x_2$$

$$x'_{845A} =$$



Vežba 1

Kontrola:

$$\sin(360^\circ - \varphi_2) = \frac{\Delta y_2}{d_2}$$

$$\Delta y_2 = d_2 * \sin(360^\circ - \varphi_2)$$

$$\Delta y_2 = 104.15\text{m}$$

$$y'_{845A} = y_{846A} - \Delta y_2$$

$$y'_{845A} = 3247.20\text{m}$$

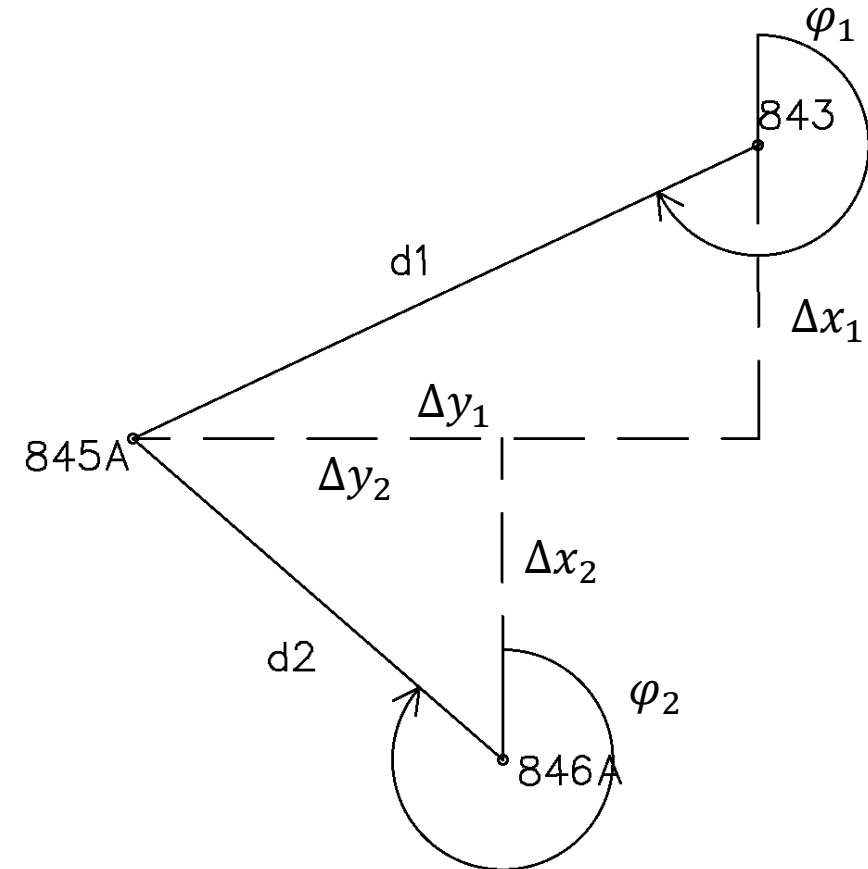
$$\cos(360^\circ - \varphi_2) = \frac{\Delta x_2}{d_2}$$

$$\Delta x_2 = d_2 * \cos(360^\circ - \varphi_2)$$

$$\Delta x_2 = 99.89\text{m}$$

$$x'_{845A} = x_{846A} + \Delta x_2$$

$$x'_{845A} = 8896.48\text{m}$$



Vežba 1

- Računanje koordinata **TAČKE 845A**

- 2. način -Presek pravaca napred sa tačaka 843(A) i 846(B)

- Tačke 843, 845 i 845A su na liniji

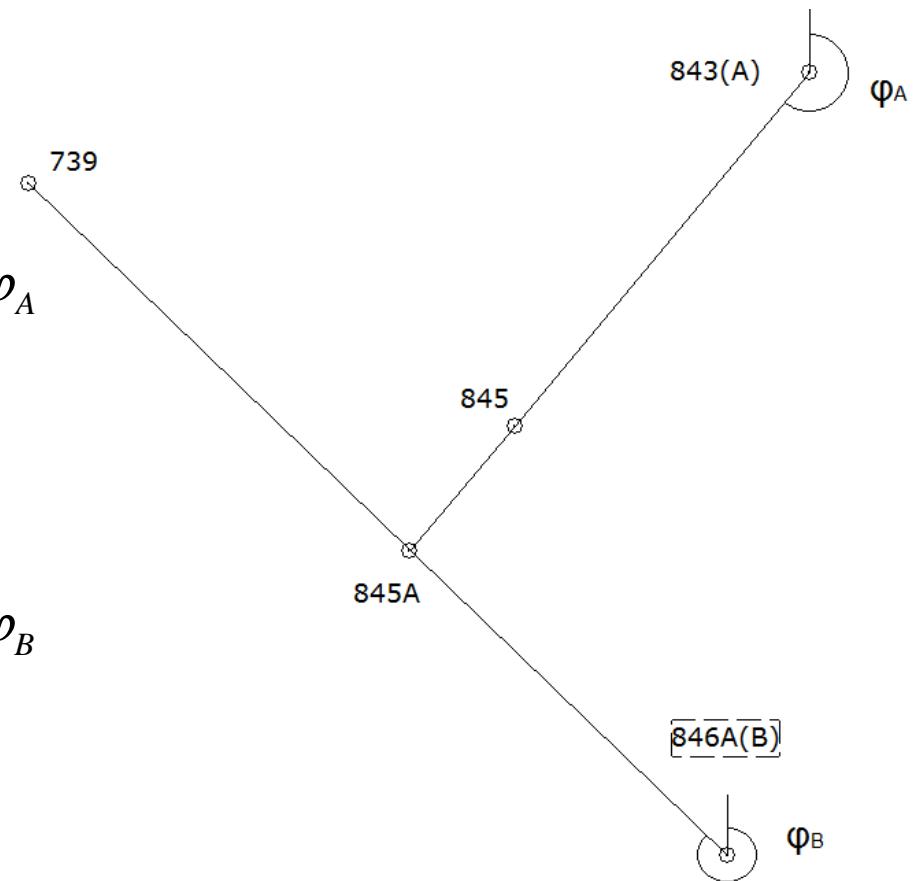
- Tačke 846A, 739 i 845A su na liniji

$$Y_{845A} = Y_A + \frac{\Delta y_B^A - \Delta x_B^A \tan \varphi_B}{\tan \varphi_A - \tan \varphi_B} \tan \varphi_A$$

$$X_{845A} = X_A + \frac{\Delta y_B^A - \Delta x_B^A \tan \varphi_B}{\tan \varphi_A - \tan \varphi_B}$$

$$Y_{845A} = Y_B + \frac{\Delta y_B^A - \Delta x_B^A \tan \varphi_A}{\tan \varphi_A - \tan \varphi_B} \tan \varphi_B$$

$$X_{845A} = X_B + \frac{\Delta y_B^A - \Delta x_B^A \tan \varphi_A}{\tan \varphi_A - \tan \varphi_B}$$

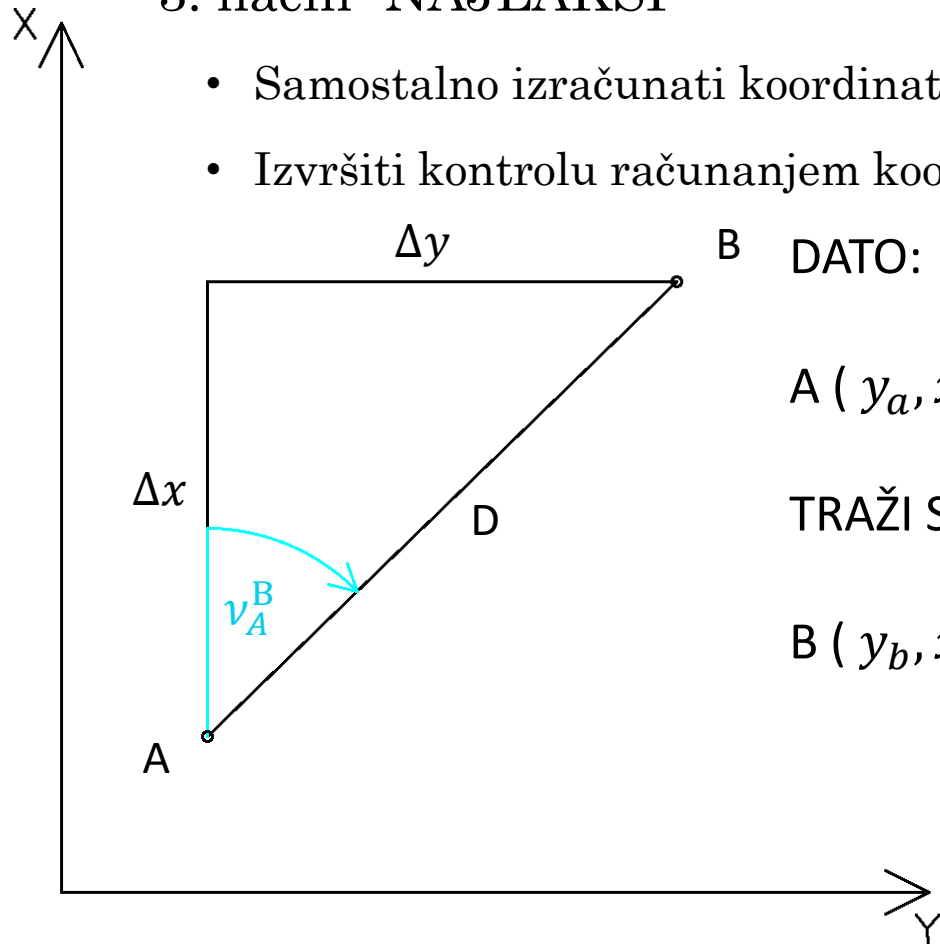


Vežba 1

• Računanje koordinata TAČKE 845A

• 3. način- NAJLAKŠI

- Samostalno izračunati koordinate tačke 845A preko tačke 843 (direkcionni ugao i dužina)
- Izvršiti kontrolu računanjem koordinata tačke 845A preko 846A



DATO:

$A (y_a, x_a), d, v_A^B$

TRAŽI SE:

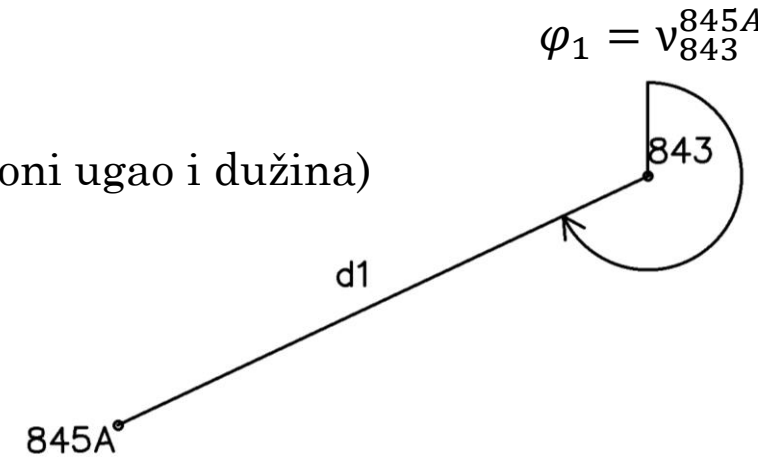
$B (y_b, x_b)$

$$\Delta y = D * \sin v_A^B$$

$$\Delta x = D * \cos v_A^B$$

$$y_B = y_A + \Delta y$$

$$x_B = x_A + \Delta x$$



$$y_{845A} = y_{843} + d_1 \sin \varphi_1$$

$$x_{845A} = x_{843} + d_1 \cos \varphi_1$$



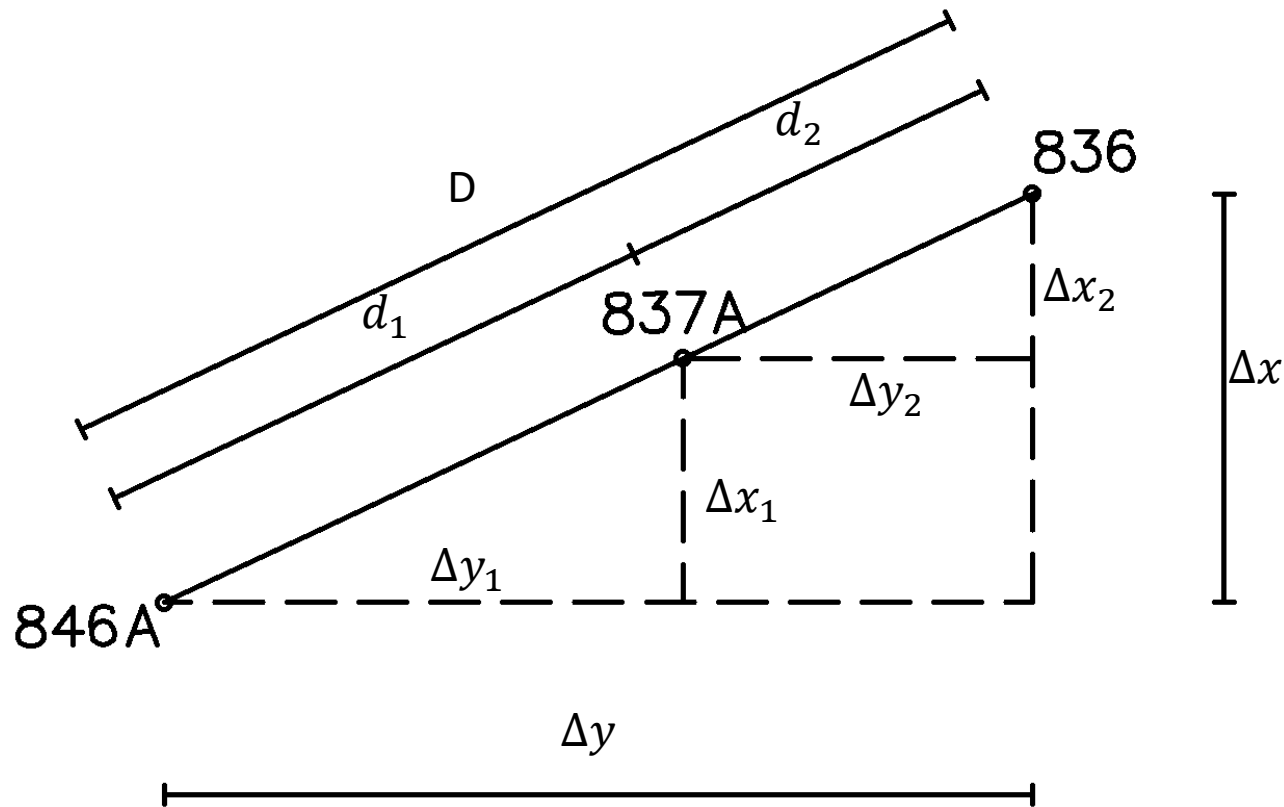
Vežba 1

- Računanje koordinata TAČKE 837A
 - Presek prave koju definišu tačke 846A i 836 i kružni luk
 - Do tačke 837A dolazimo računanjem kao tačke na liniji 846A-836



Vežba 1

- Računanje koordinata TAČKE 837A



$$\frac{\Delta y}{D} = \frac{\Delta y_1}{d_1} \quad \Delta y_1 = d_1 * \frac{\Delta y}{D}$$

$$\frac{\Delta x}{D} = \frac{\Delta x_1}{d_1} \quad \Delta x_1 = d_1 * \frac{\Delta x}{D}$$

$$\frac{\Delta y}{D} = \frac{\Delta y_2}{d_2} \quad \Delta y_2 = d_2 * \frac{\Delta y}{D}$$

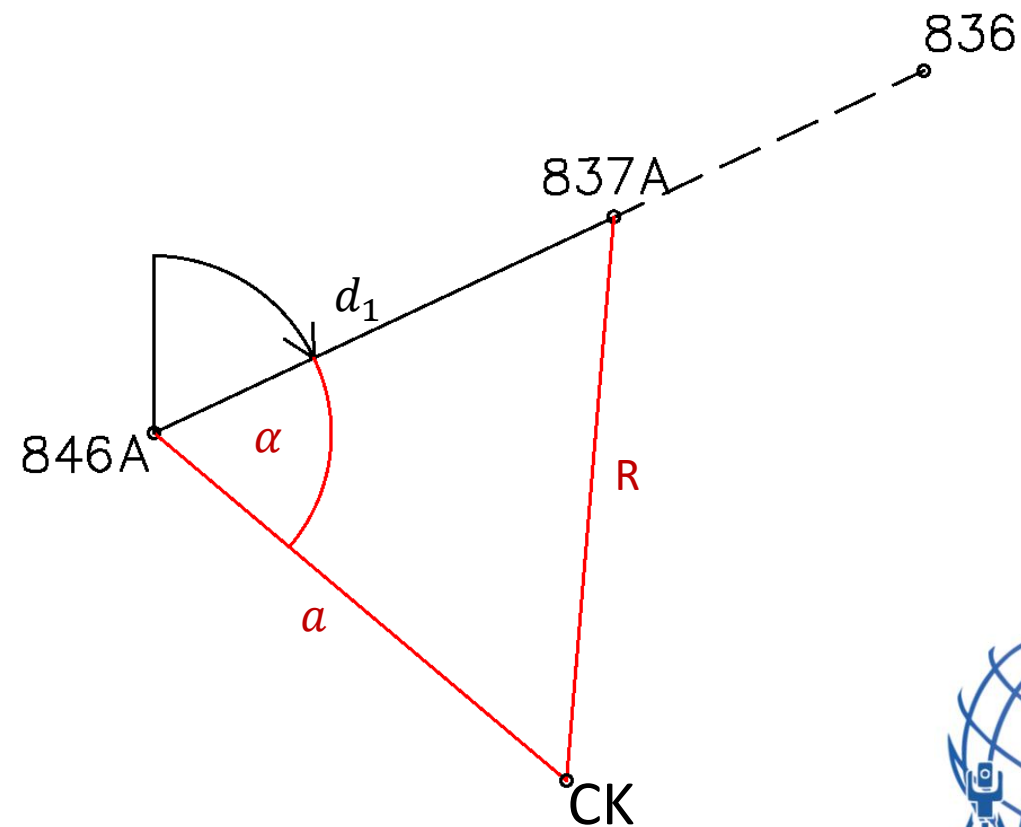
$$\frac{\Delta x}{D} = \frac{\Delta x_2}{d_2} \quad \Delta x_2 = d_2 * \frac{\Delta x}{D}$$



Vežba 1

- Računanje koordinata **TAČKE 837A**

- D se računa iz koordinata 846A i 836
- Nepoznate: d_1 , d_2
- Potrebno je rešiti trougao, ali su nepoznate α , a (R je dato u zadatku)
 - Da bismo njih dobili potrebno je odrediti koordinate tačke CK

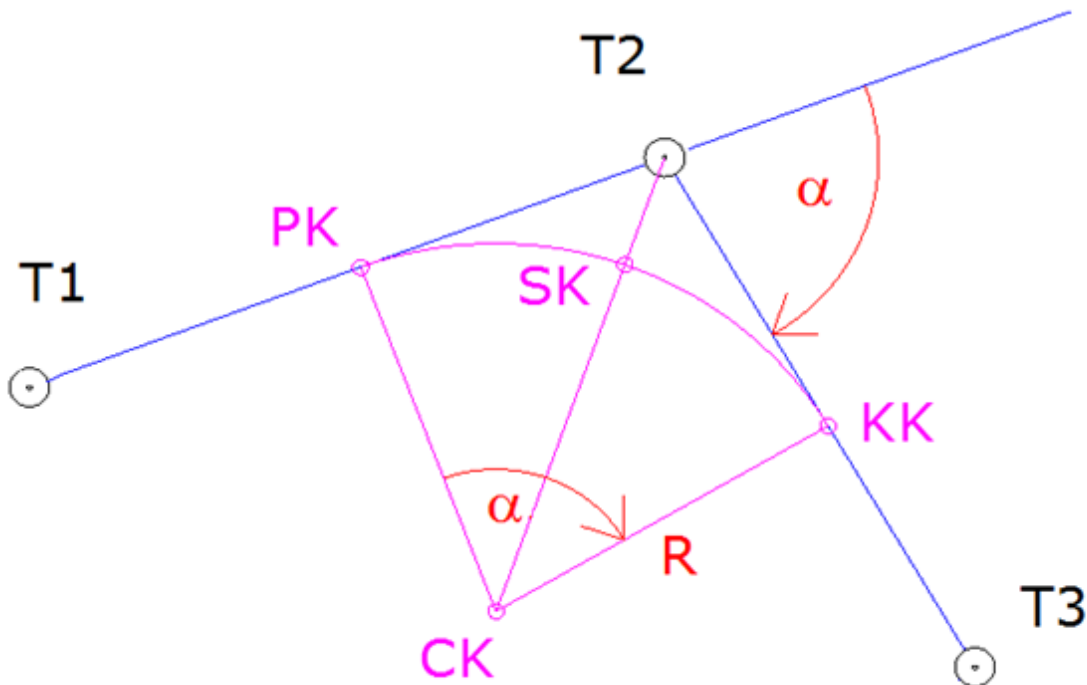


Vežba 1

- Kružna krivina

- Kružna krivina je deo kruga tj. kružni luk sa poluprečnikom R i sa centrom u tački CK

$$\alpha = \nu_{T2}^{T3} - \nu_{T1}^{T2}$$

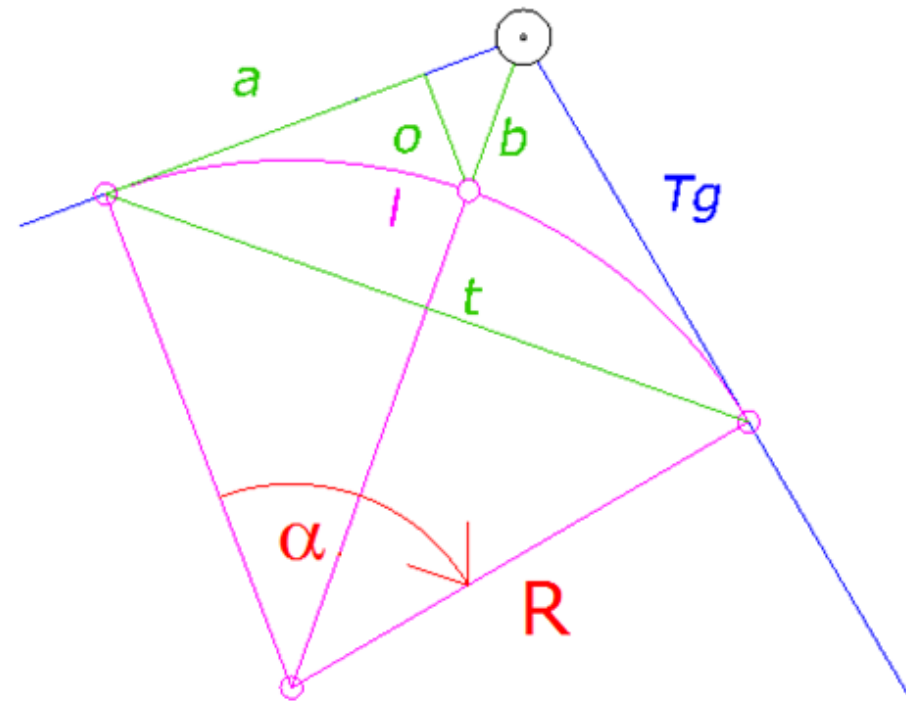


- α – Skretni ugao
- PK – Početak krivine
- SK – Sredina krivine
- KK – Kraj krivine
- CK – Centar krivine



Vežba 1

- Kružna krivina



Tangenta $Tg = R \cdot \tan\left(\frac{\alpha}{2}\right)$

Bisektrisa $b = R \left(\frac{1}{\cos\left(\frac{\alpha}{2}\right)} - 1 \right)$

Tetiva $t = 2 \cdot R \cdot \sin\left(\frac{\alpha}{2}\right)$

Luk $l = \frac{R \cdot \pi \cdot \alpha}{180}$

Apscisa $a = R \cdot \sin\left(\frac{\alpha}{2}\right)$

Ordinata $o = R \left(1 - \cos\left(\frac{\alpha}{2}\right) \right)$



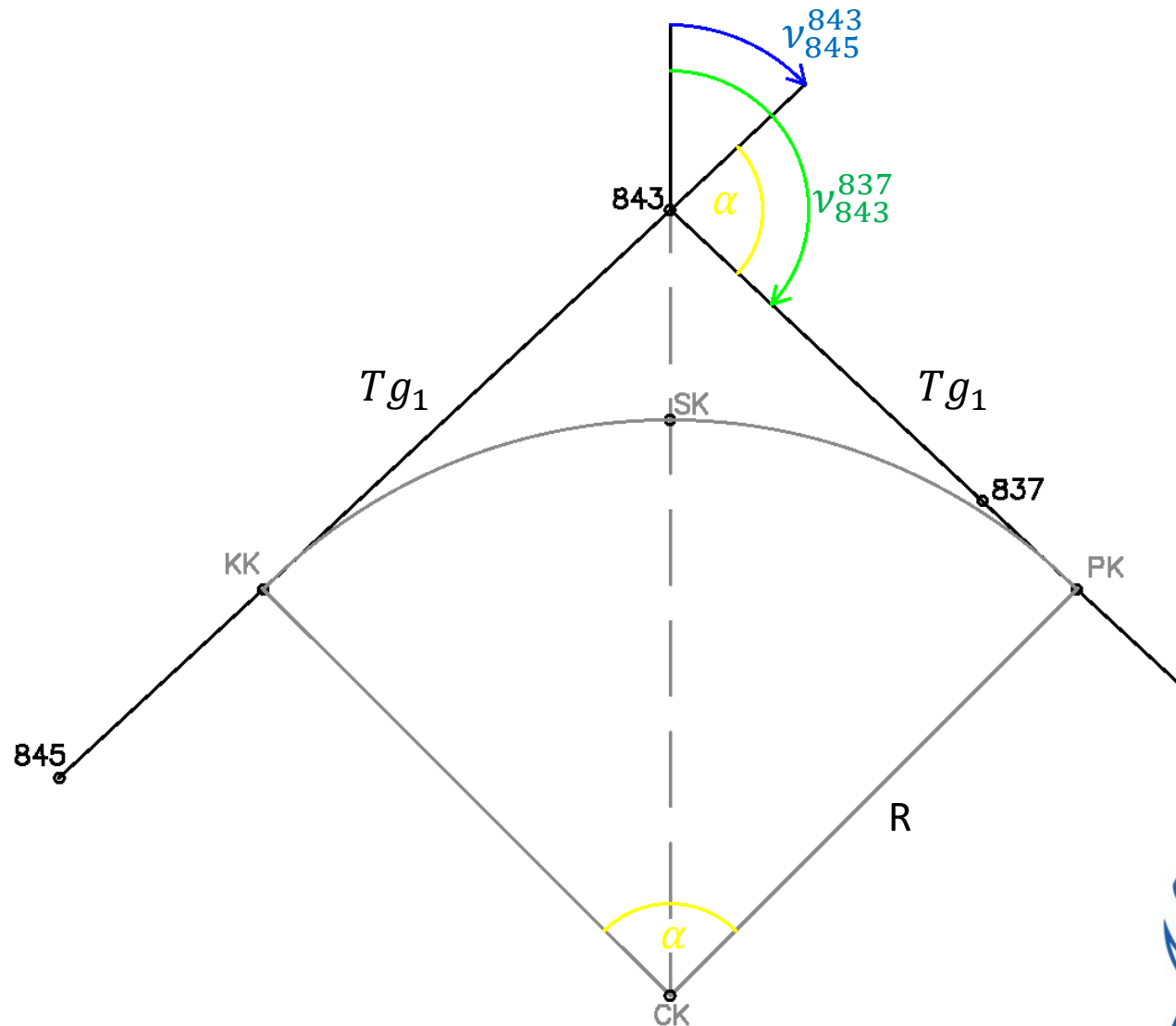
Vežba 1

- Kružna krivina
 - Elementi krivine

$$\alpha = \nu_{843}^{837} - \nu_{845}^{843}$$

$$\alpha =$$

$$Tg =$$



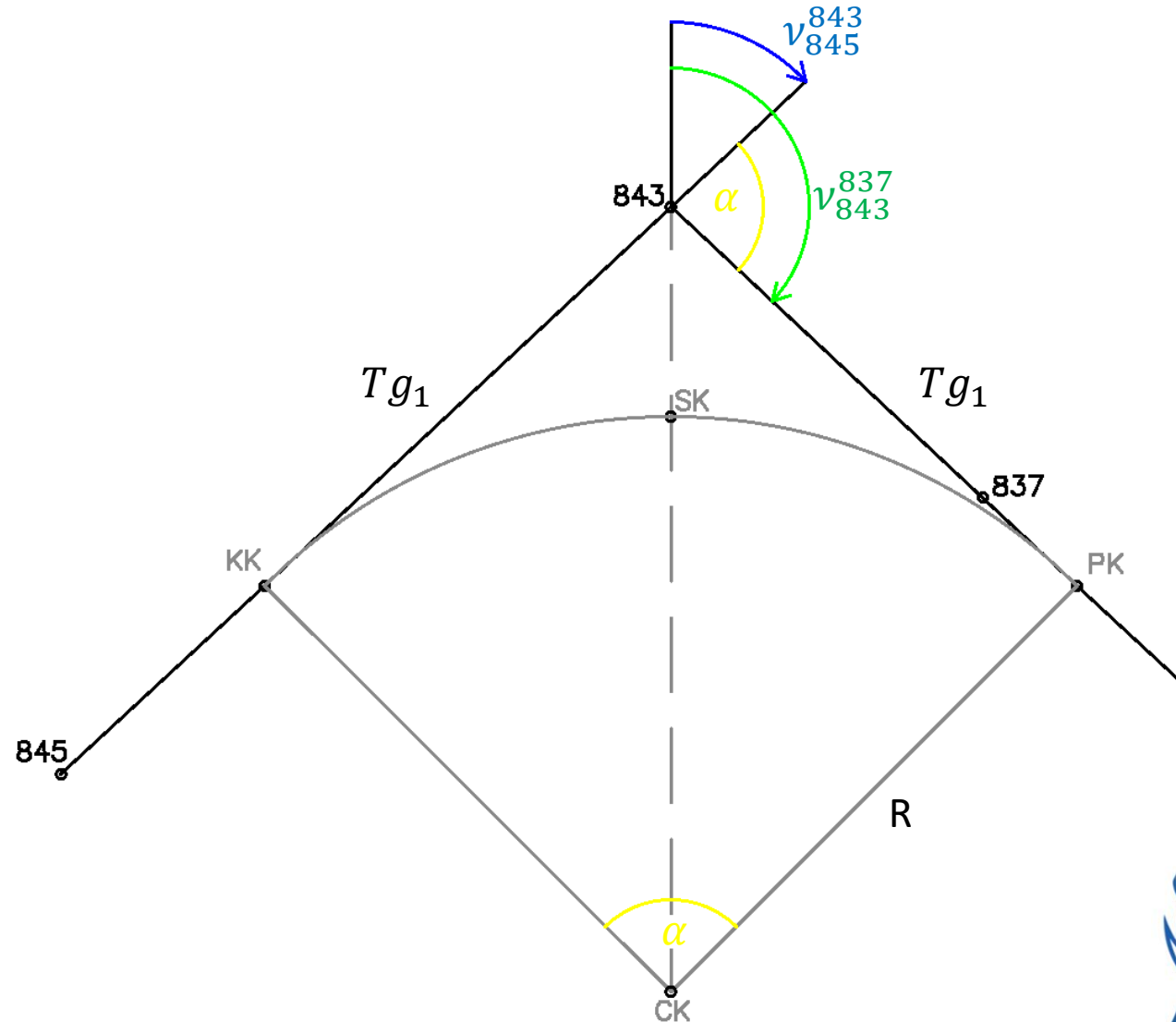
Vežba 1

- Kružna krivina
 - Elementi krivine

$$\alpha = \nu_{843}^{837} - \nu_{845}^{843}$$

$$\alpha = 73^{\circ} 52' 32''$$

$$Tg = 127.81\text{m}$$



Vežba 1

- Kružna krivina
 - Elementi krivine

$$\alpha = \nu_{843}^{837} - \nu_{845}^{843}$$

$$\alpha = 73^{\circ} 52' 32''$$

$$Tg = 127.81\text{m}$$

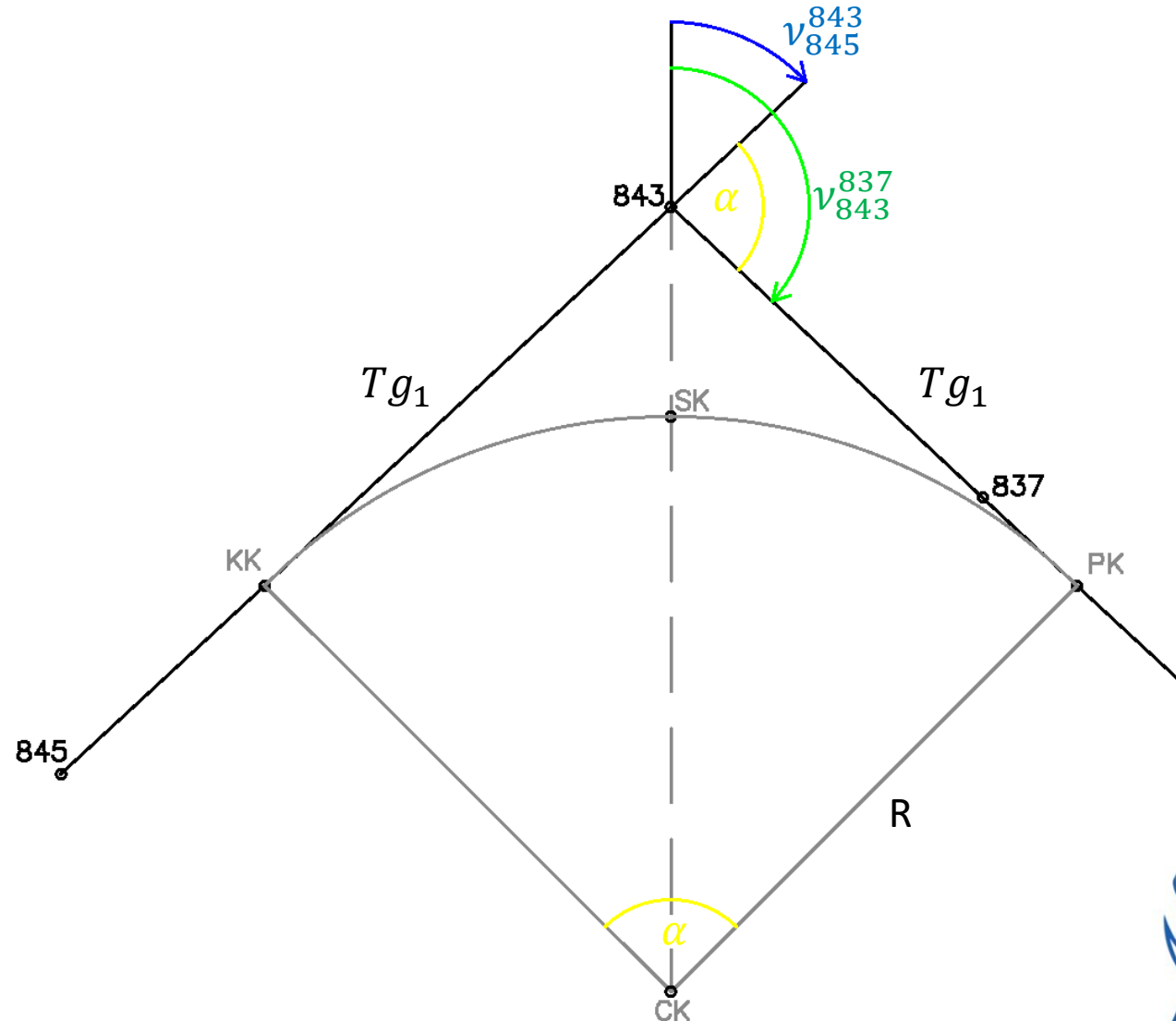
$$\nu_{843}^{KK} = \nu_{843}^{845}$$

$$\Delta y = Tg \cdot \sin \nu_{843}^{KK}$$

$$\Delta x = Tg \cdot \cos \nu_{843}^{KK}$$

$$Y_{KK} = Y_{843} + \Delta y$$

$$X_{KK} = X_{843} + \Delta x$$



Vežba 1

- Kružna krivina
 - Elementi krivine

$$\alpha = \nu_{843}^{837} - \nu_{845}^{843}$$

$$\alpha = 73^\circ 52' 32''$$

$$Tg = 127.81m$$

$$\nu_{843}^{KK} = \nu_{843}^{845}$$

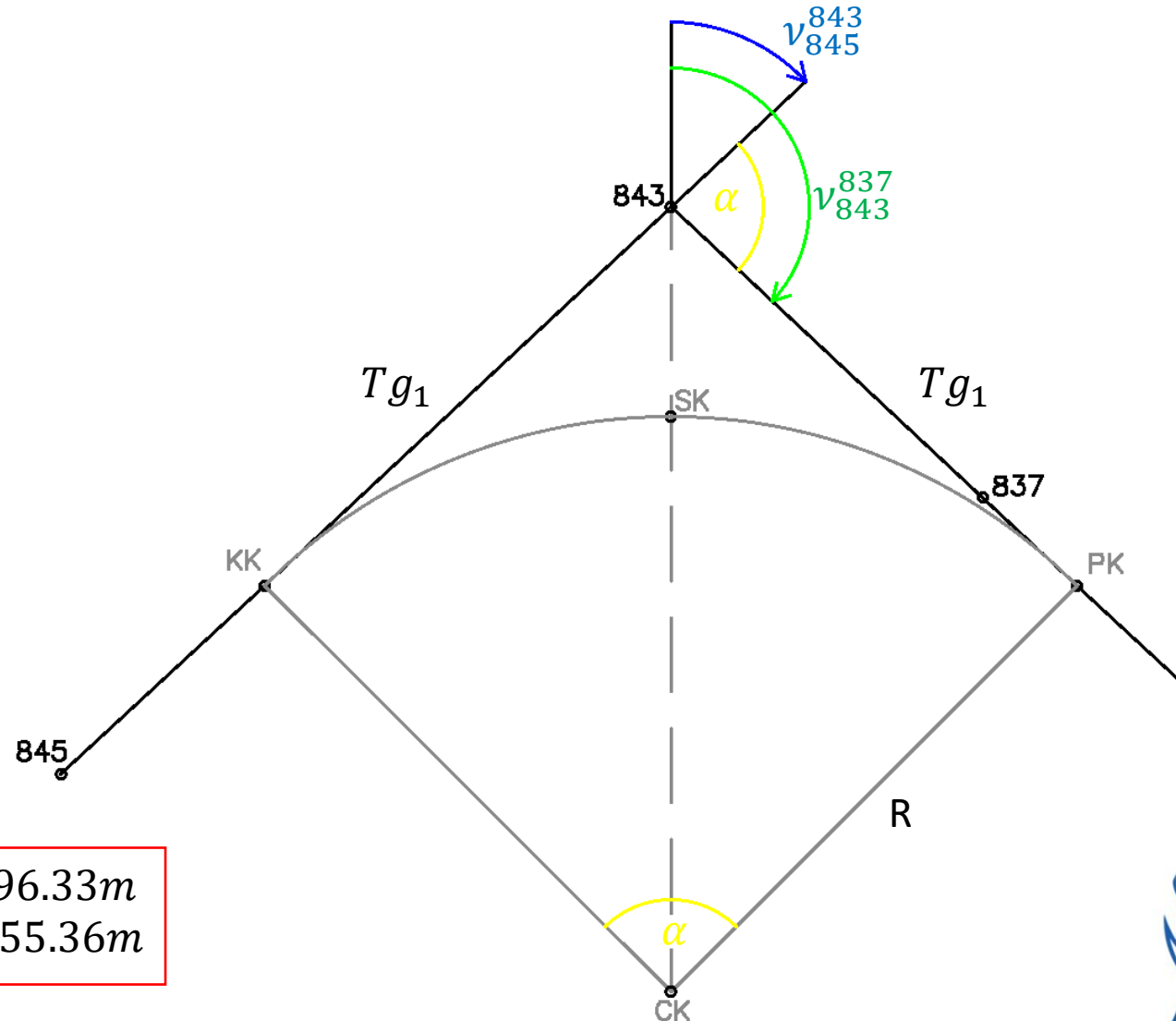
$$\Delta y = Tg \cdot \sin \nu_{843}^{KK}$$

$$\Delta x = Tg \cdot \cos \nu_{843}^{KK}$$

$$Y_{KK} = Y_{843} + \Delta y$$

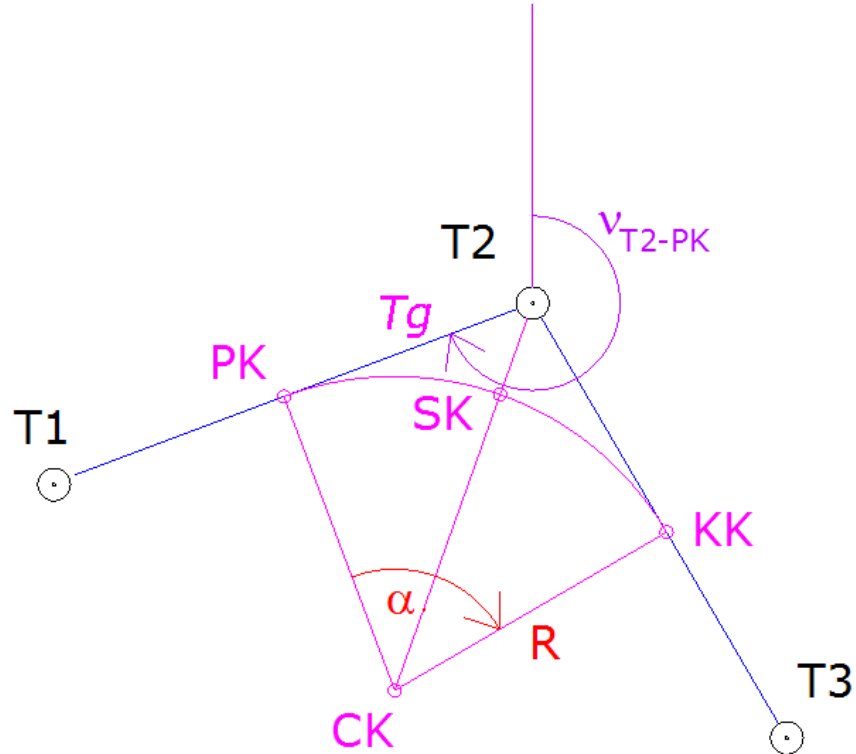
$$X_{KK} = X_{843} + \Delta x$$

$$Y_{KK} = 3296.33m$$
$$X_{KK} = 8955.36m$$



Vežba 1

- Koordinate glavnih elemenata kružne krivine PK i KK



$$v_{T2}^{PK} = v_{T2}^{T1}$$

$$\Delta y = Tg \cdot \sin v_{T2}^{PK}$$
$$\Delta x = Tg \cdot \cos v_{T2}^{PK}$$

$$Y_{PK} = Y_{T2} + \Delta y$$
$$X_{PK} = X_{T2} + \Delta x$$

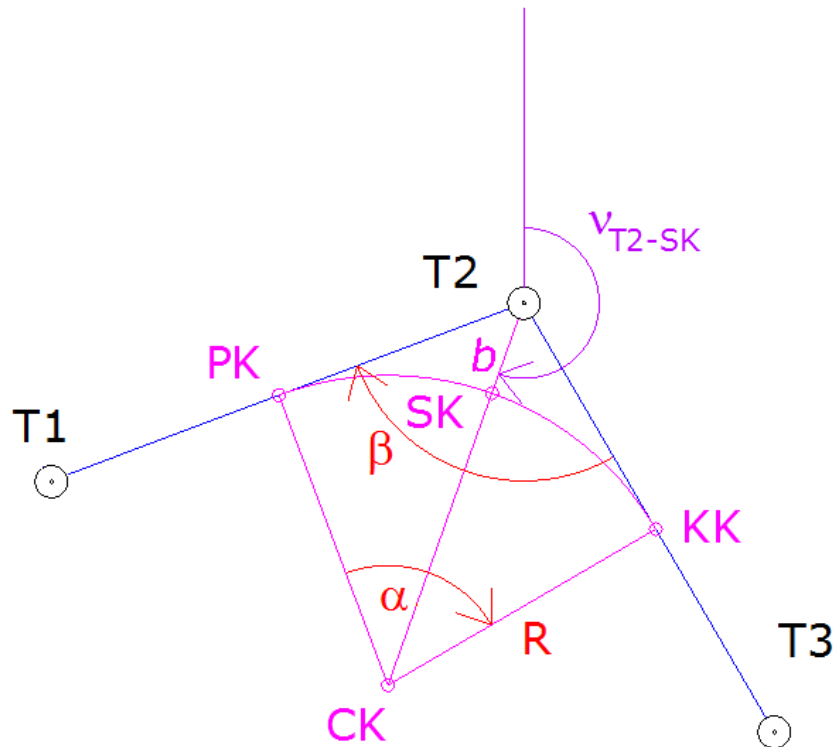
$$v_{T2}^{KK} = v_{T2}^{T3}$$

$$\Delta y = Tg \cdot \sin v_{T2}^{KK}$$
$$\Delta x = Tg \cdot \cos v_{T2}^{KK}$$

$$Y_{KK} = Y_{T2} + \Delta y$$
$$X_{KK} = X_{T2} + \Delta x$$

Vežba 1

- Koordinate glavnih elemenata kružne krivine SK i CK



$$v_{T2}^{SK} = v_{T2}^{CK} = v_{T2}^{T1} - \frac{\beta}{2} = v_{T2}^{T3} + \frac{\beta}{2}$$

$$\Delta y = b \cdot \sin v_{T2}^{SK}$$
$$\Delta x = b \cdot \cos v_{T2}^{SK}$$

$$Y_{SK} = Y_{T2} + \Delta y$$
$$X_{SK} = X_{T2} + \Delta x$$

$$\Delta y = (b + R) \cdot \sin v_{T2}^{CK}$$
$$\Delta x = (b + R) \cdot \cos v_{T2}^{CK}$$

$$Y_{CK} = Y_{T2} + \Delta y$$
$$X_{CK} = X_{T2} + \Delta x$$

Vežba 1

- Kružna krivina

- Računanje koordinate tačke CK

$$\alpha = \nu_{843}^{837} - \nu_{845}^{843}$$

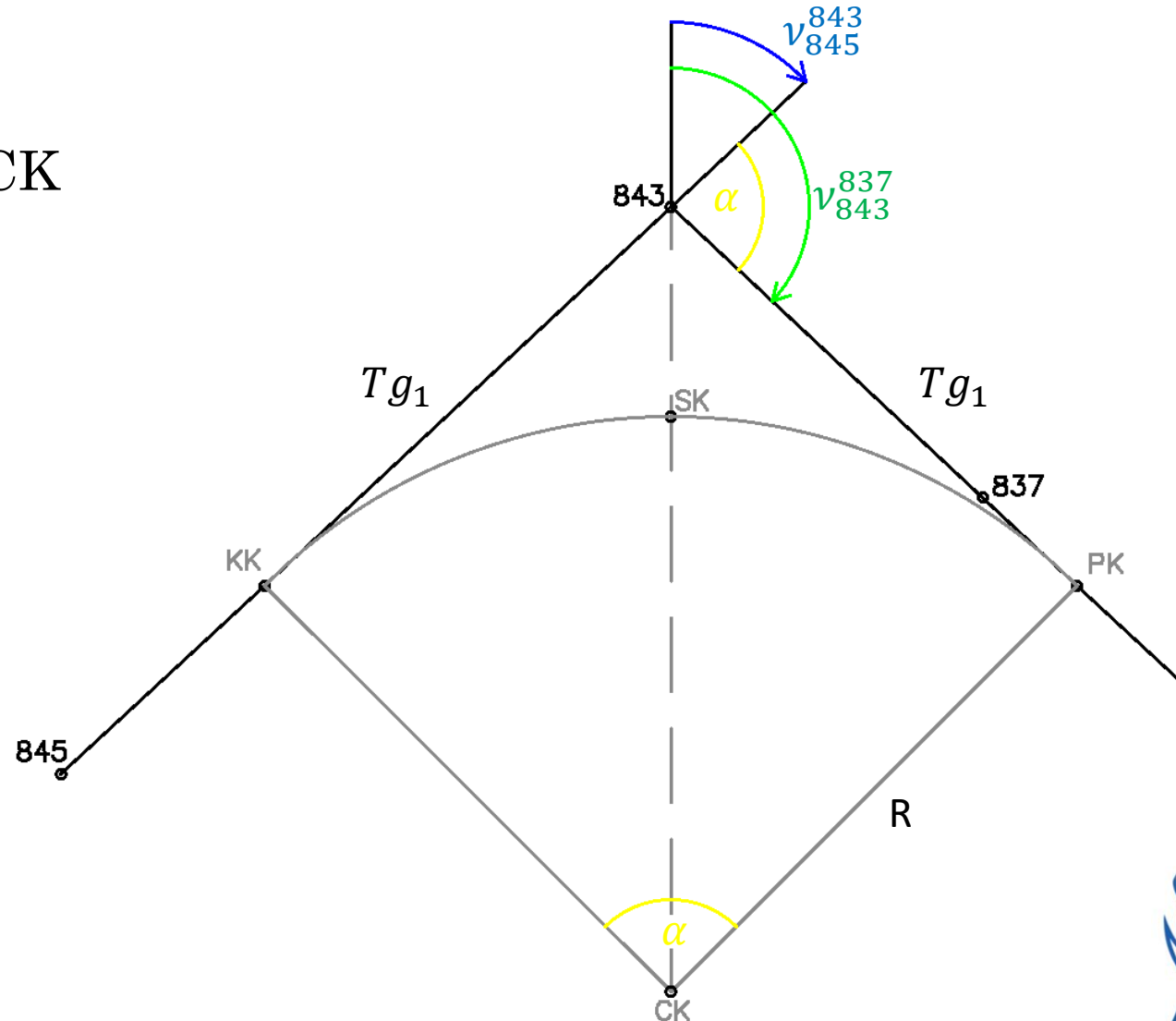
$$\alpha = 73^\circ 52' 32''$$

$$Tg = 127.81\text{m}$$

$$\nu_{KK}^{CK} = \nu_{845}^{843} + 90^\circ$$

$$\Delta y = R \cdot \sin \nu_{KK}^{CK}$$
$$\Delta x = R \cdot \cos \nu_{KK}^{CK}$$

$$Y_{CK} = Y_{KK} + \Delta y$$
$$X_{CK} = X_{KK} + \Delta x$$



Vežba 1

- Kružna krivina

- Računanje koordinate tačke CK

$$\alpha = \nu_{843}^{837} - \nu_{845}^{843}$$

$$\alpha = 73^{\circ} 52' 32''$$

$$Tg = 127.81m$$

$$\nu_{KK}^{CK} = \nu_{845}^{843} + 90^{\circ}$$

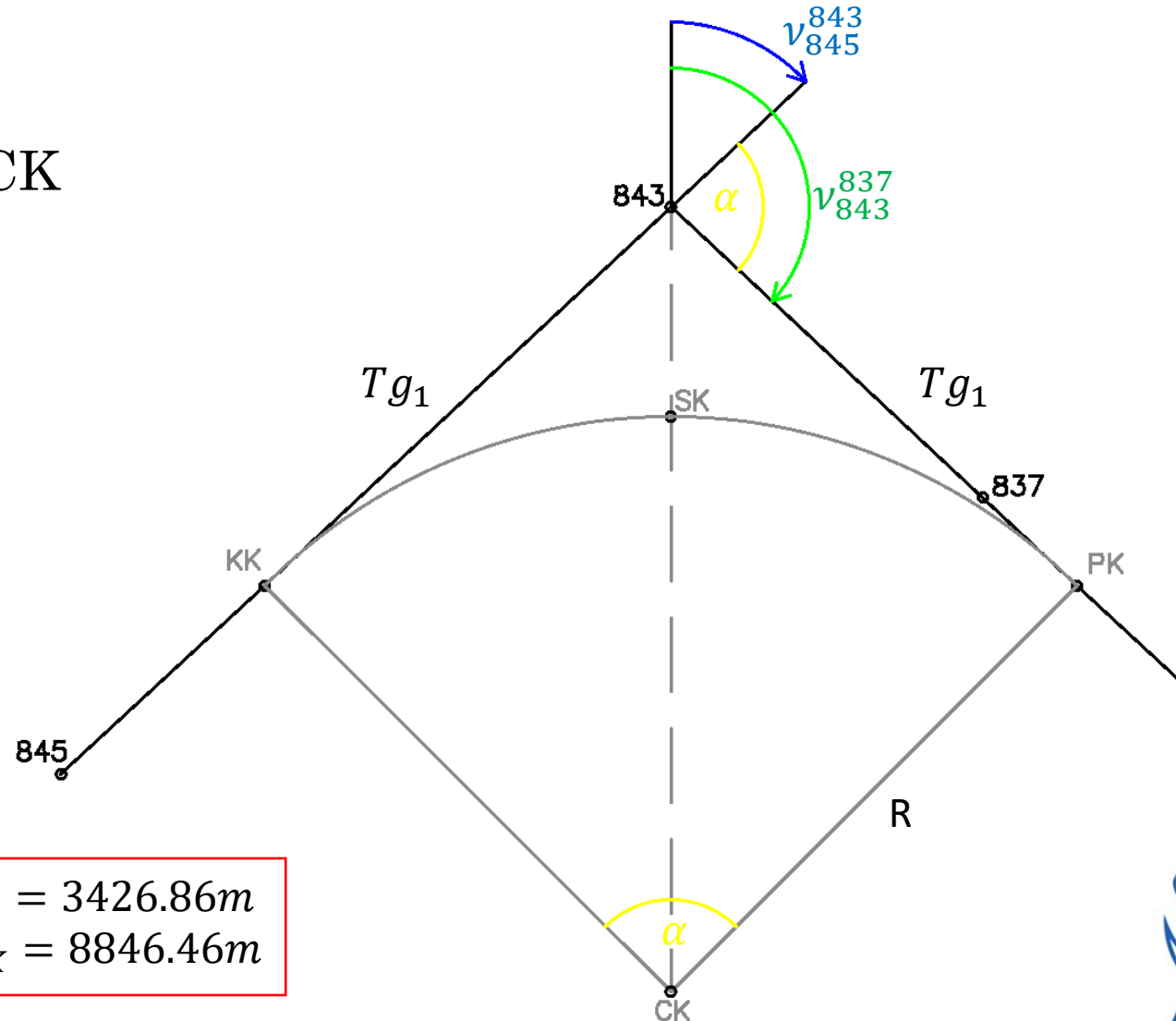
$$\Delta y = R \cdot \sin \nu_{KK}^{CK}$$

$$\Delta x = R \cdot \cos \nu_{KK}^{CK}$$

$$Y_{CK} = Y_{KK} + \Delta y$$

$$X_{CK} = X_{KK} + \Delta x$$

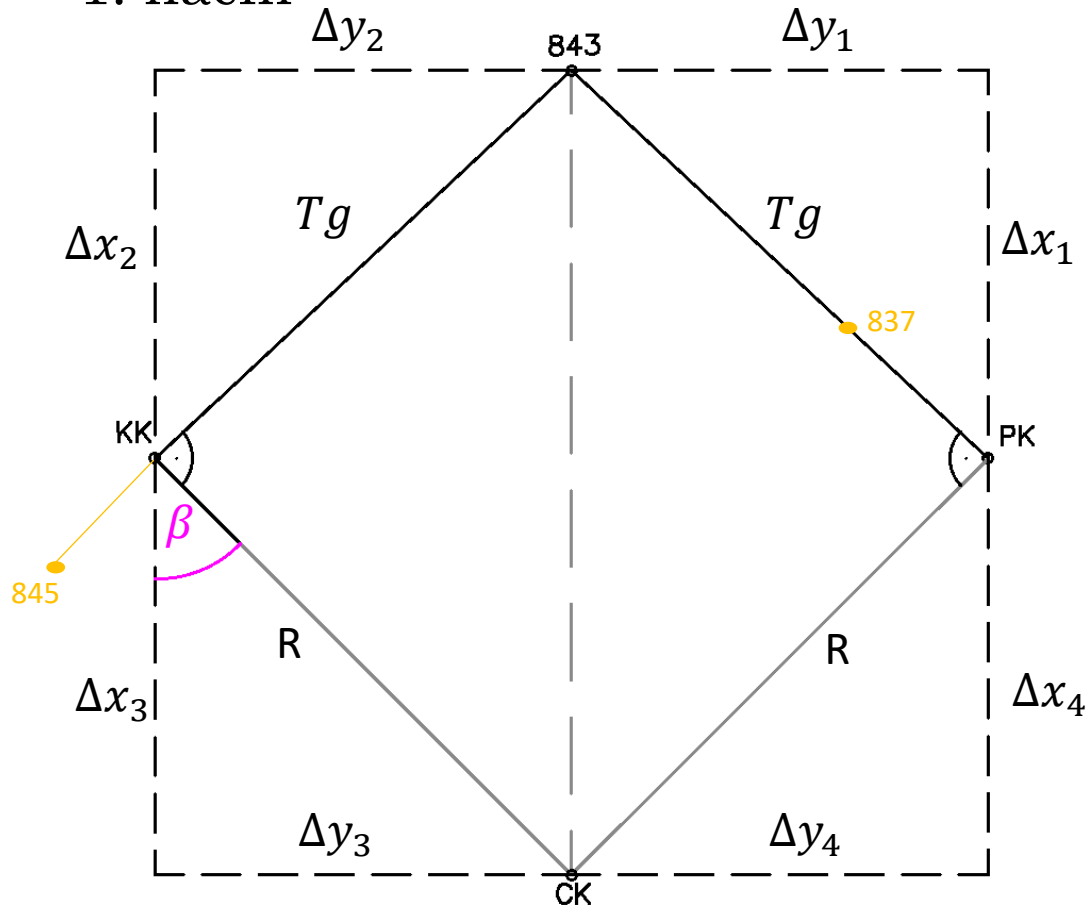
$$Y_{CK} = 3426.86m$$
$$X_{CK} = 8846.46m$$



Vežba 1

• Računanje koordinate CK

• 1. način



$$\sin(v_{843}^{837} - 90^\circ) = \frac{\Delta x_1}{Tg}$$

$$\Delta x_1 =$$

$$\cos(v_{843}^{837} - 90^\circ) = \frac{\Delta y_1}{Tg}$$

$$\Delta y_1 =$$

$$\sin(v_{845}^{843}) = \frac{\Delta y_2}{Tg}$$

$$\Delta y_2 =$$

$$\cos(v_{845}^{843}) = \frac{\Delta x_2}{Tg}$$

$$\Delta x_2 =$$

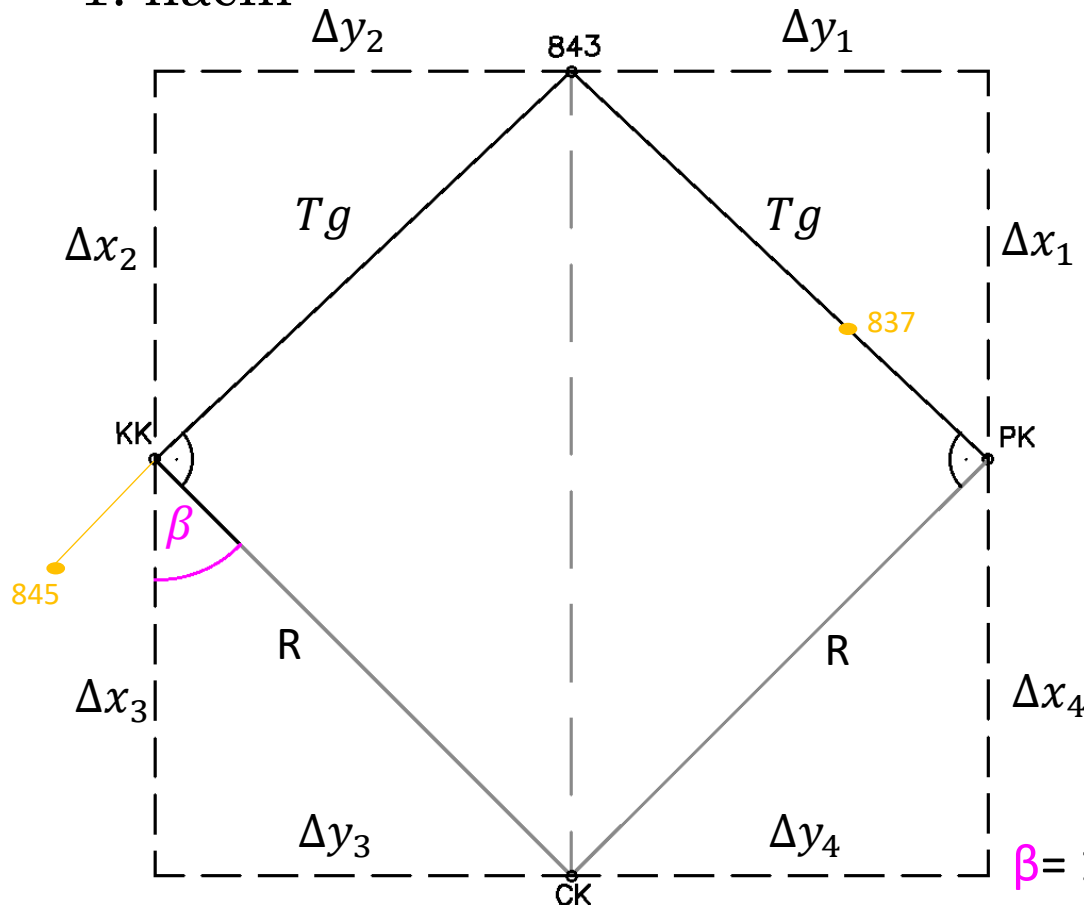
$$\beta = 180^\circ - (v_{845}^{843} + 90^\circ)$$



Vežba 1

• Računanje koordinate CK

• 1. način



$$\sin(v_{843}^{837} - 90^\circ) = \frac{\Delta x_1}{Tg}$$

$$\Delta x_1 = 51.40\text{m}$$

$$\cos(v_{843}^{837} - 90^\circ) = \frac{\Delta y_1}{Tg}$$

$$\Delta y_1 = 117.02\text{m}$$

$$\sin\beta = \frac{\Delta y_3}{R} \rightarrow \Delta y_3 = R \sin\beta$$

$$y_c = y_{kk} + \Delta y_3$$

$$y_c = 3426.86\text{m}$$

$$\beta = 180^\circ - (v_{845}^{843} + 90^\circ)$$

$$\sin(v_{845}^{843}) = \frac{\Delta y_2}{Tg}$$

$$\Delta y_2 = 81.88\text{m}$$

$$\cos(v_{845}^{843}) = \frac{\Delta x_2}{Tg}$$

$$\Delta x_2 = 98.14\text{m}$$

$$\cos\beta = \frac{\Delta x_3}{R} \rightarrow \Delta x_3 = R \cos\beta$$

$$x_c = x_{kk} - \Delta y_3$$

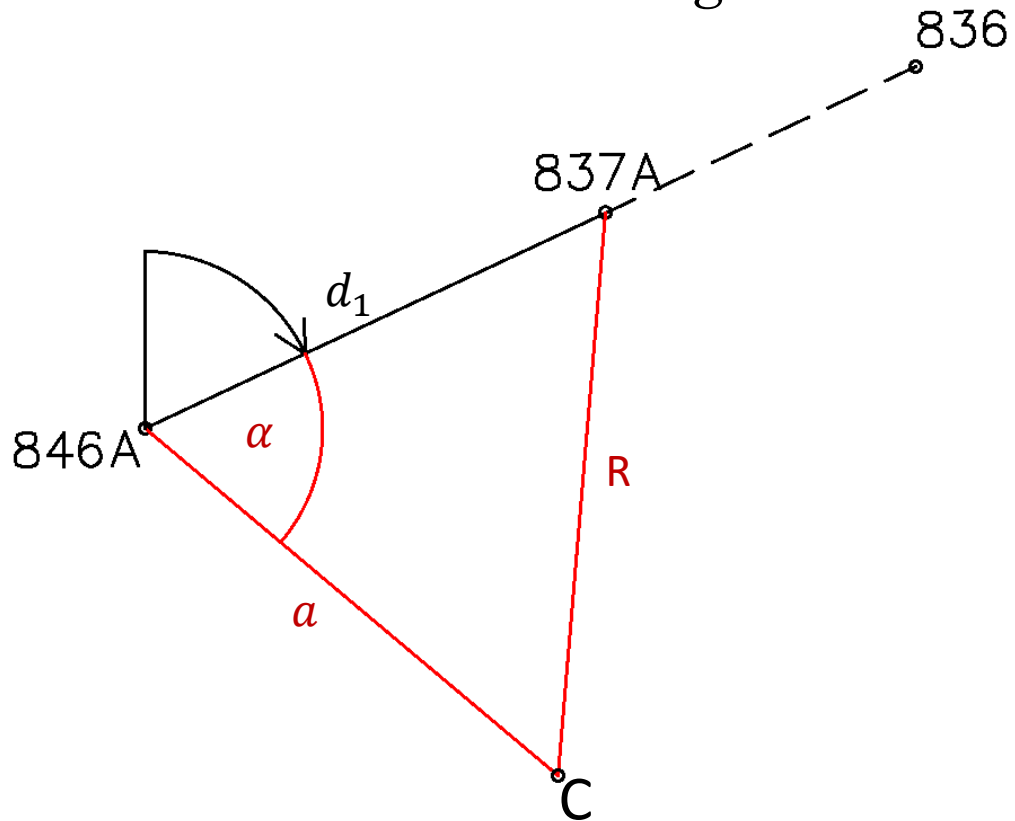
$$x_c = 8846.46\text{m}$$



Vežba 1

- Računanje koordinata TAČKE 837A

- Kad je poznata koordinata tačke C vraćamo se na trougao



$$\alpha = \nu_{846A}^C - \nu_{846A}^{836} \rightarrow \alpha =$$

$$a = 90.49m \quad \leftarrow \text{iz koordinata}$$

$$R = 170m$$

$$\frac{R}{\sin\alpha} = \frac{a}{\sin\gamma} = \frac{d_1}{\sin\beta} = m$$

$$\sin\gamma = \frac{a}{m} = \frac{a}{R} * \sin\alpha \rightarrow \gamma =$$

$$\sin\beta = \frac{d_1}{m} = \frac{d_1}{R} * \sin\alpha \rightarrow \beta =$$

$$d_1 = m * \sin\beta \rightarrow d_1 =$$

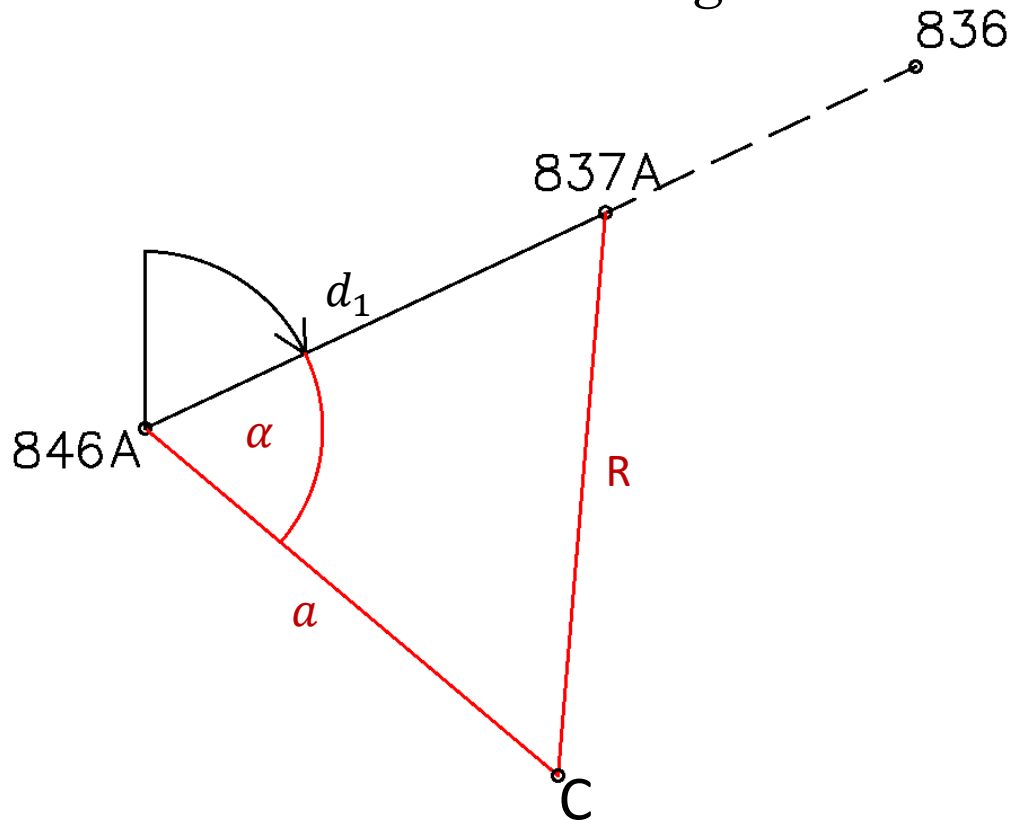
$$d_2 = D - d_1 \rightarrow d_2 =$$



Vežba 1

- Računanje koordinata TAČKE 837A

- Kad je poznata koordinata tačke C vraćamo se na trougao



$$\alpha = \nu_{846A}^C - \nu_{846A}^{836} \rightarrow \alpha = 25^\circ 39' 38''$$
$$a = 90.49m$$
$$R = 170m$$

$$\frac{R}{\sin\alpha} = \frac{a}{\sin\gamma} = \frac{d_1}{\sin\beta} = m$$

$$\sin\gamma = \frac{a}{m} = \frac{a}{R} * \sin\alpha \rightarrow \gamma = 13^\circ 19' 36''$$

$$\sin\beta = \frac{d_1}{m} = \frac{d_1}{R} * \sin\alpha \rightarrow \beta = 141^\circ 00' 46''$$

$$d_1 = m * \sin\beta \rightarrow d_1 = 246.98m$$

$$d_2 = D - d_1 \rightarrow d_2 = 125.37m$$



Vežba 1

- Računanje koordinata TAČKE 837A

- Sa poznatom dužinom d_1 možemo da sračunamo koordinatu kao tačku na liniji

$$\Delta y_1 = d_1 * \sin v_{846A}^{836}$$

$$\Delta x_1 = d_1 * \cos v_{846A}^{836}$$

$$\Delta y_2 = d_2 * \sin v_{836}^{846A}$$

$$\Delta x_2 = d_2 * \cos v_{836}^{846A}$$

$$y'_{837A} = y_{846A} + \Delta y_1$$

$$y'_{837A} =$$

$$x'_{837A} = x_{846A} + \Delta x_1$$

$$x'_{837A} =$$

$$y''_{837A} = y_{836} + \Delta y_2$$

$$y''_{837A} =$$

$$x''_{837A} = x_{836} + \Delta x_2$$

$$x''_{837A} =$$

- Ne može kao presek pravaca u programu, jer je tačka na liniji



Vežba 1

- Računanje koordinata TAČKE 837A

- Sa poznatom dužinom d_1 možemo da sračunamo koordinatu kao tačku na liniji

$$\Delta y_1 = d_1 * \sin v_{846A}^{836}$$

$$\Delta x_1 = d_1 * \cos v_{846A}^{836}$$

$$\Delta y_2 = d_2 * \sin v_{836}^{846A}$$

$$\Delta x_2 = d_2 * \cos v_{836}^{846A}$$

$$y'_{837A} = y_{846A} + \Delta y_1$$

$$x'_{837A} = x_{846A} + \Delta x_1$$

$$y''_{837A} = y_{836} + \Delta y_2$$

$$x''_{837A} = x_{836} + \Delta x_2$$

$$y'_{837A} = 3478.17m$$

$$x'_{837A} = 9008.52m$$

$$y''_{837A} = 3478.17m$$

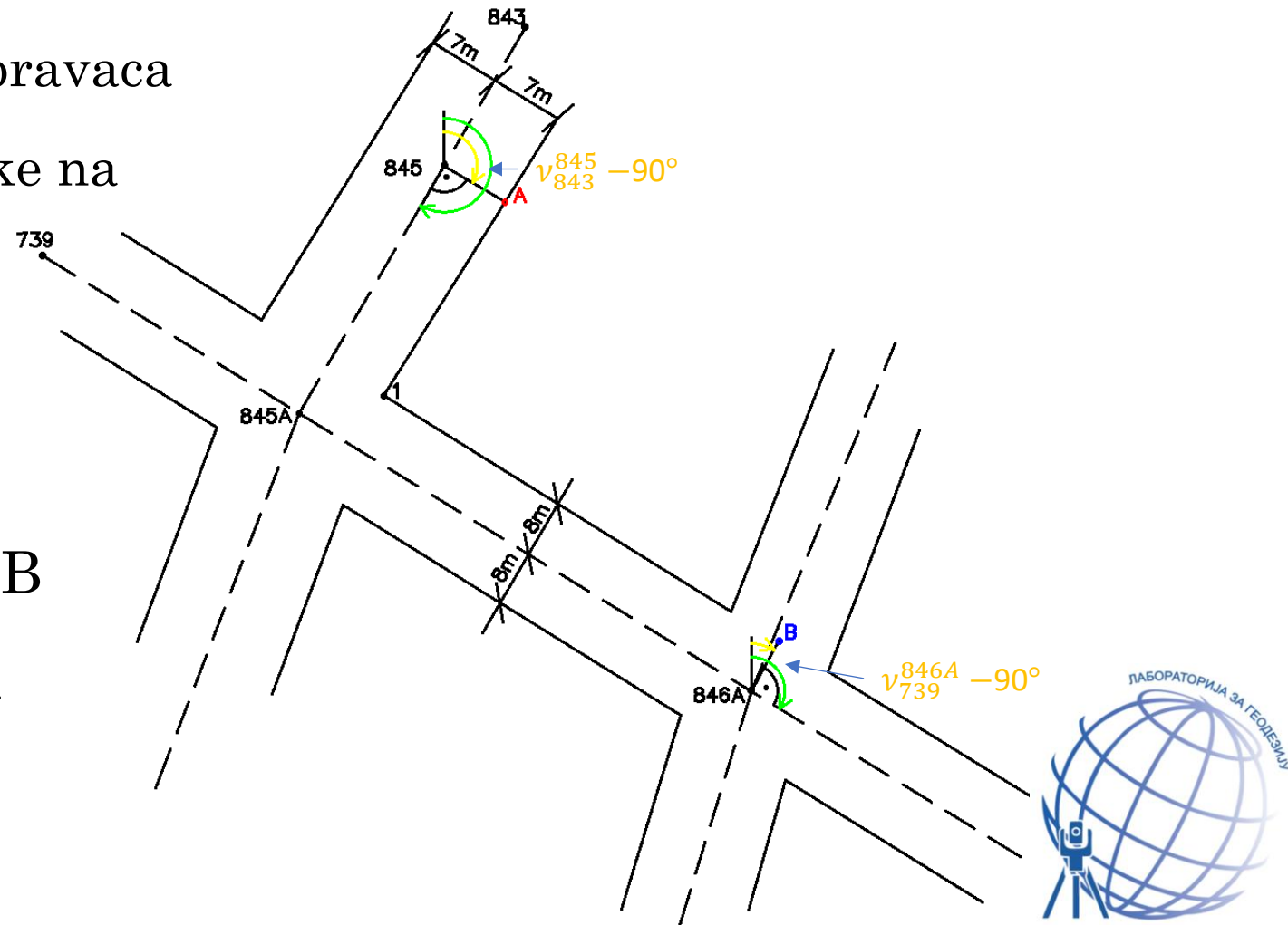
$$x''_{837A} = 9008.52m$$



Vežba 1

- Računanje koordinata TAČKA 1,2,3,4,5,6

- Koordinate računamo presekom pravaca
- Pomoćne A i B računamo kao tačke na upravnoj
- Paralelne strane pa su isti direkc
- Tačka 1 – izračunaju se koordinate pomoćnih tačaka A i B pomoću 845 i 846A na upravnim i poznatih širina ulice

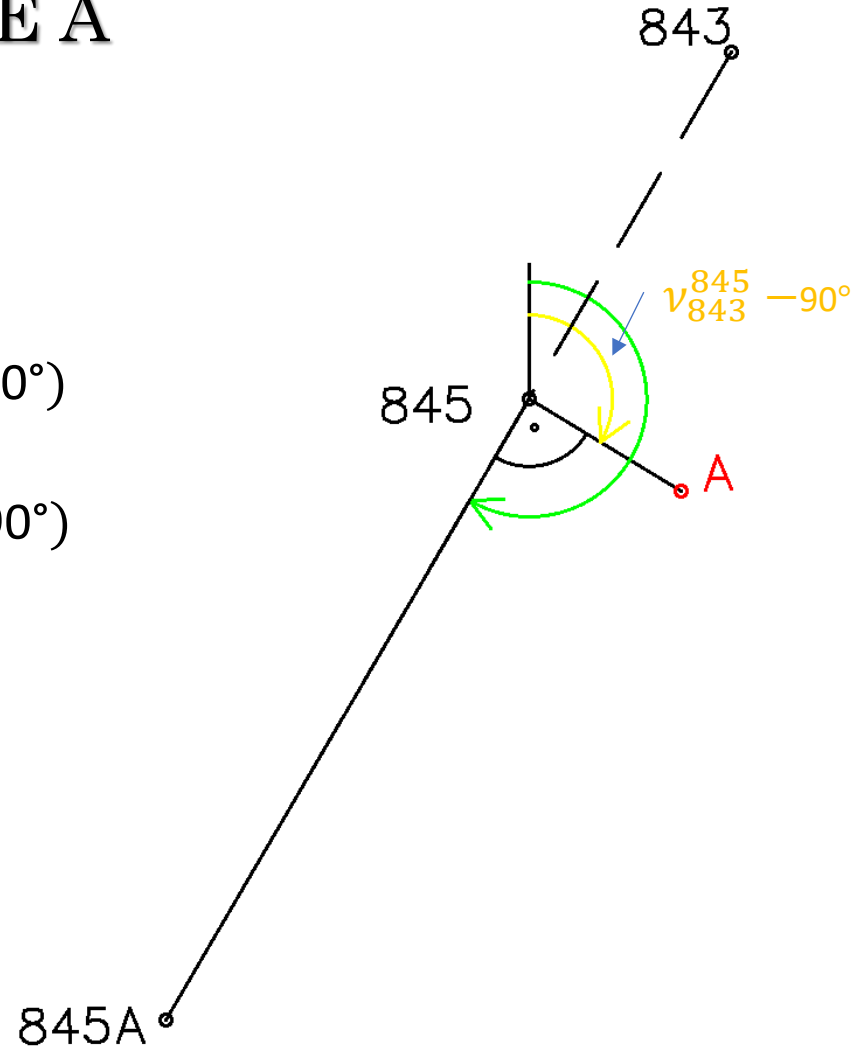


Vežba 1

- Računanje koordinata **TAČKE A**
 - lakši način

$$y_A = y_{845} + D * \sin(v_{845}^{845A} - 90^\circ)$$
$$x_A = x_{845} + D * \cos(v_{845}^{845A} - 90^\circ)$$

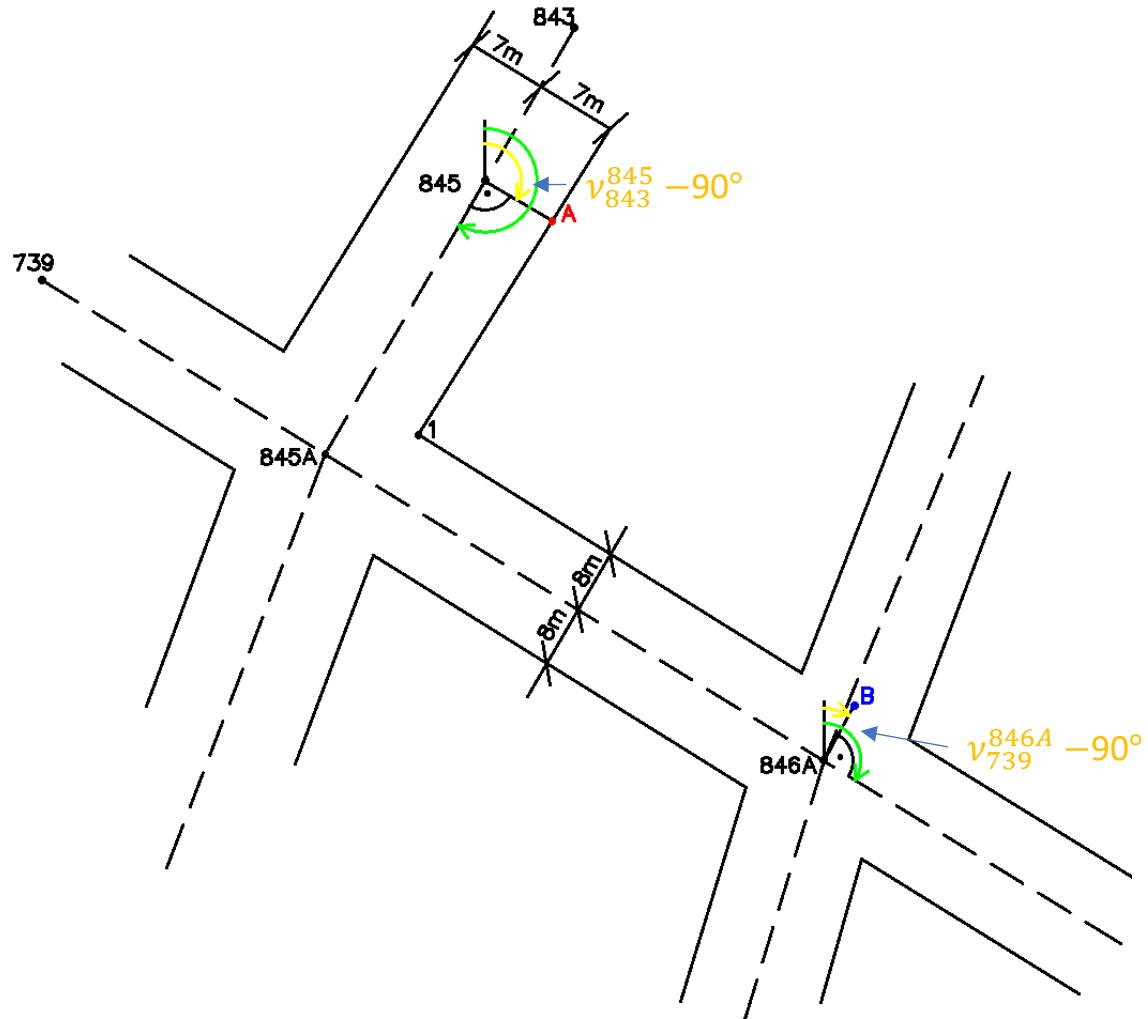
*isto i za B



Vežba 1

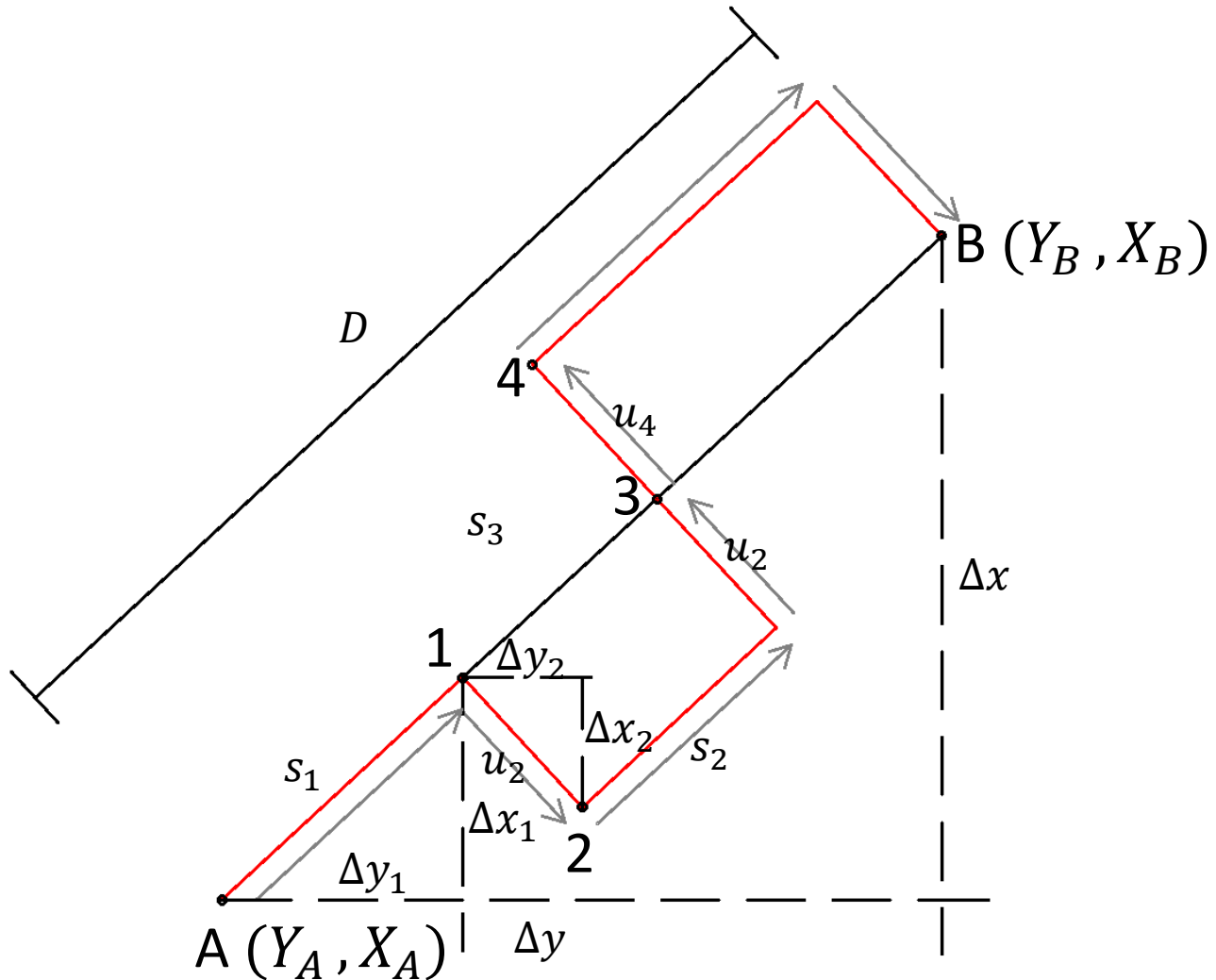
- Računanje koordinata TAČKA 1,2,3,4,5,6

$$Y_A = Y_{845} + 7 \sin(\nu_{843}^{845} - 90^\circ)$$
$$X_A = X_{845} + 7 \cos(\nu_{843}^{845} - 90^\circ)$$
$$Y_B = Y_{846A} + 8 \sin(\nu_{739}^{846A} - 90^\circ)$$
$$X_B = X_{846A} + 8 \cos(\nu_{739}^{846A} - 90^\circ)$$



Vežba 1

- Računanje koordinata na liniji



- 1 (tačka na liniji)

$$\frac{\Delta y_1}{s_1} = \frac{\Delta y}{D} \sim 0 \quad \Delta y_1 = \frac{\Delta y}{D} * S_1$$

$$\Delta y_1 = 0 * S_1$$

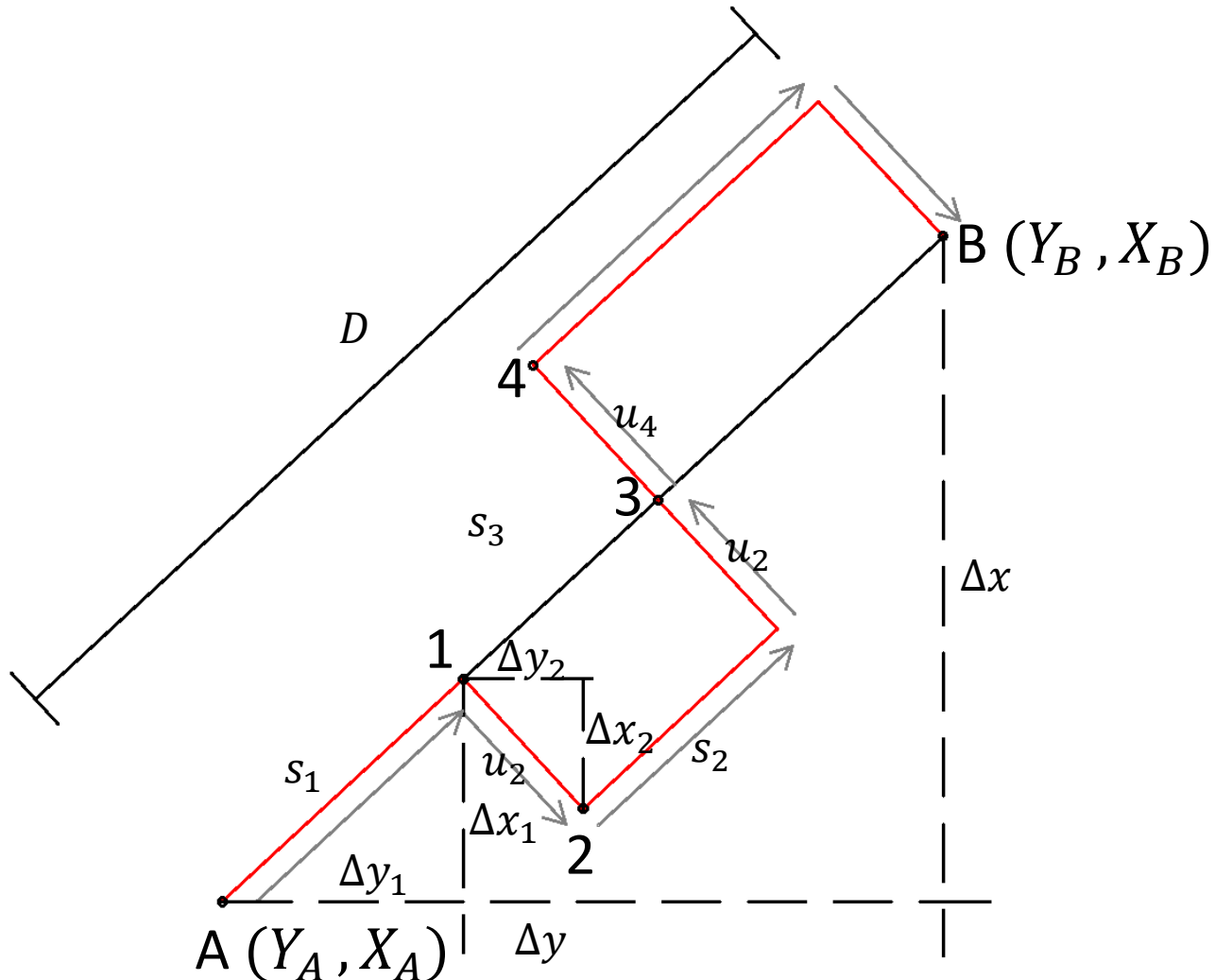
$$\frac{\Delta x_1}{s_1} = \frac{\Delta x}{D} \sim a \quad \Delta x_1 = \frac{\Delta x}{D} * S_1$$

$$\Delta x_1 = a * S_1$$



Vežba 1

- Računanje koordinata na upravnoj



- 2 (tačka na upravnoj)

$$\frac{\Delta y_2}{u_2} = \frac{\Delta x}{D} \sim a, \quad \Delta y_2 = \frac{\Delta x}{D} * u_2,$$

$$\Delta y_2 = a * u_2$$

$$\frac{\Delta x_2}{u_2} = \frac{\Delta y}{D} \sim o, \quad \Delta x_2 = \frac{\Delta y}{D} * u_2,$$

$$\Delta x_2 = o * u_2$$

$$y_2 = y_A + \Delta y_1 + \Delta y_2$$

$$x_2 = x_A + \Delta x_1 - \Delta x_2$$



Vežba 1

- Računanje koordinata **TAČKE A**

$$y_A = y_{845A} + o * D_{(845-845A)} + a * 7m$$

$$x_A = x_{845A} + a * D_{(845-845A)} - o * 7m$$

$$D_{(845-845A)} =$$

$$a = \frac{\Delta x}{D} =$$

$$o = \frac{\Delta y}{D} =$$

$$y_A =$$

$$x_A =$$



Vežba 1

- Računanje koordinata **TAČKE A**

$$y_A = y_{845A} + o * D_{(845-845A)} + a * 7m$$

$$x_A = x_{845A} + a * D_{(845-845A)} - o * 7m$$

$$D_{(845-845A)} = 53.48m$$

$$a = \frac{\Delta x}{D} = +0.76776365$$

$$o = \frac{\Delta y}{D} = +0.640613313$$

$$y_A = 3286.84m$$

$$x_A = 8933.05m$$



Vežba 1

- Računanje koordinata **TAČKE B**

$$y_B = y_{845A} + o * D_{(845A-846A)} + a * 8m$$

$$x_B = x_{845A} + a * D_{(845A-846A)} - o * 8m$$

$$D_{(845A-846A)} =$$

$$a = \frac{\Delta x}{D} \quad a =$$

$$o = \frac{\Delta y}{D} \quad o =$$

$$y_B =$$

$$x_B =$$



Vežba 1

- Računanje koordinata **TAČKE B**

$$y_B = y_{845A} + o * D_{(845A-846A)} + a * 8m$$

$$x_B = x_{845A} + a * D_{(845A-846A)} - o * 8m$$

$$D_{(845A-846A)} = 144.31m$$

$$a = \frac{\Delta x}{D} \quad a = -0.692169634$$

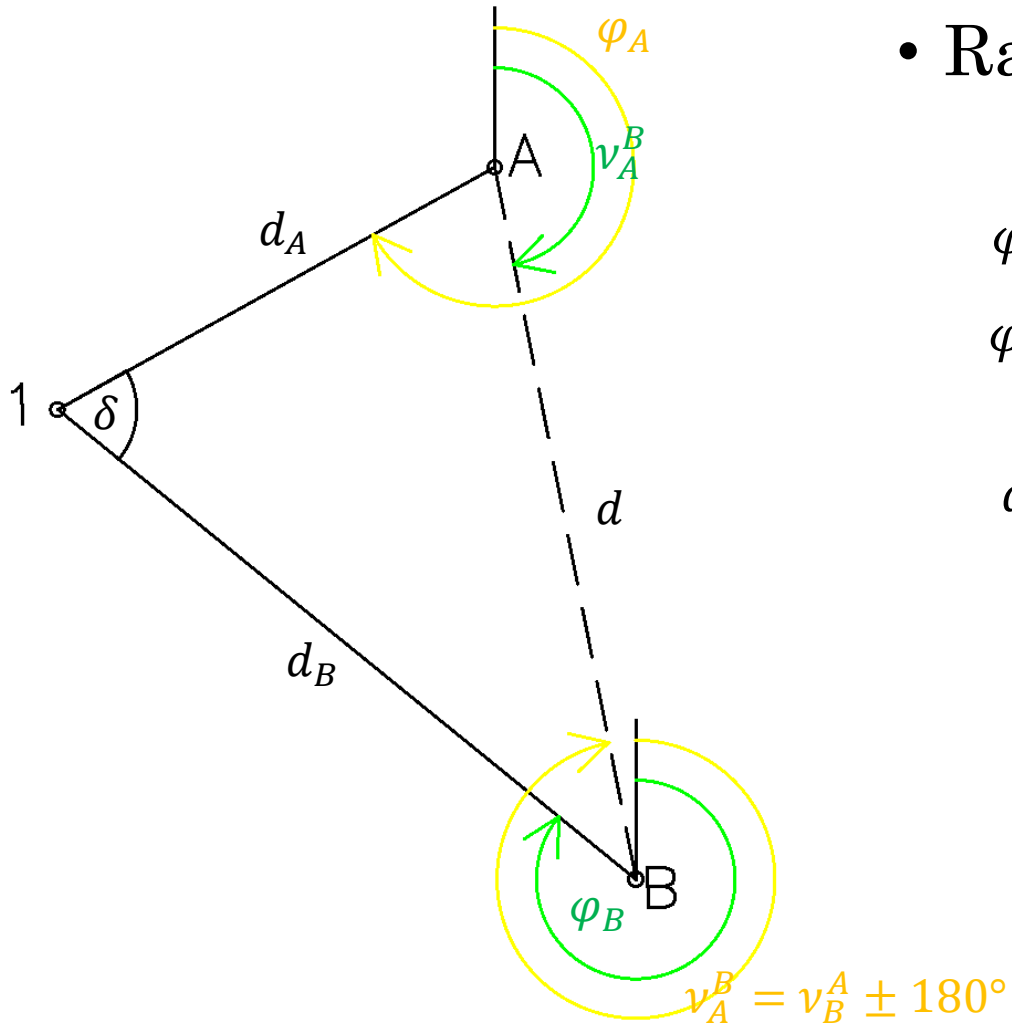
$$o = \frac{\Delta y}{D} \quad o = +0.721689418$$

$$y_B = 3356.88m$$

$$x_B = 8802.37m$$



Vežba 1



- Računanje koordinate **TAČKE 1**

$$\varphi_A = v_{845}^{845A} =$$

$$v_A^B =$$

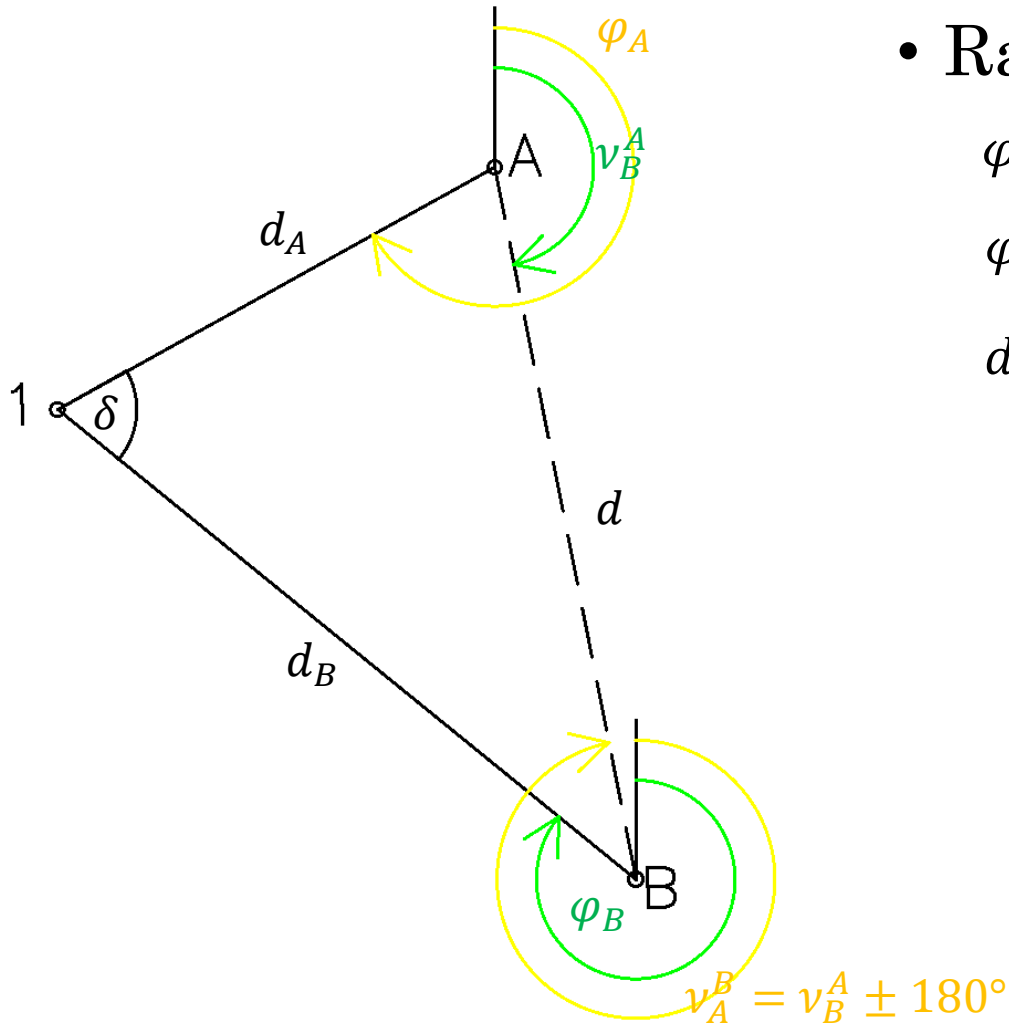
$$\varphi_B = v_{846A}^{845A} =$$

$$v_B^A =$$

$$d_{A-B} =$$

$$v_A^B = v_B^A \pm 180^\circ$$

Vežba 1



• Računanje koordinate TAČKE 1

$$\varphi_A = v_{845}^{845A} = 219^\circ 50' 12'' \quad v_A^B = 151^\circ 48' 29''$$

$$\varphi_B = v_{846A}^{845A} = 313^\circ 48' 14'' \quad v_B^A = 331^\circ 48' 29''$$

$$d_{A-B} = 148.28\text{m}$$

$$\delta_A = \varphi_A - v_A^B \rightarrow \delta_A =$$

$$\delta_B = v_B^A - \varphi_B \rightarrow \delta_B =$$

$$\delta =$$

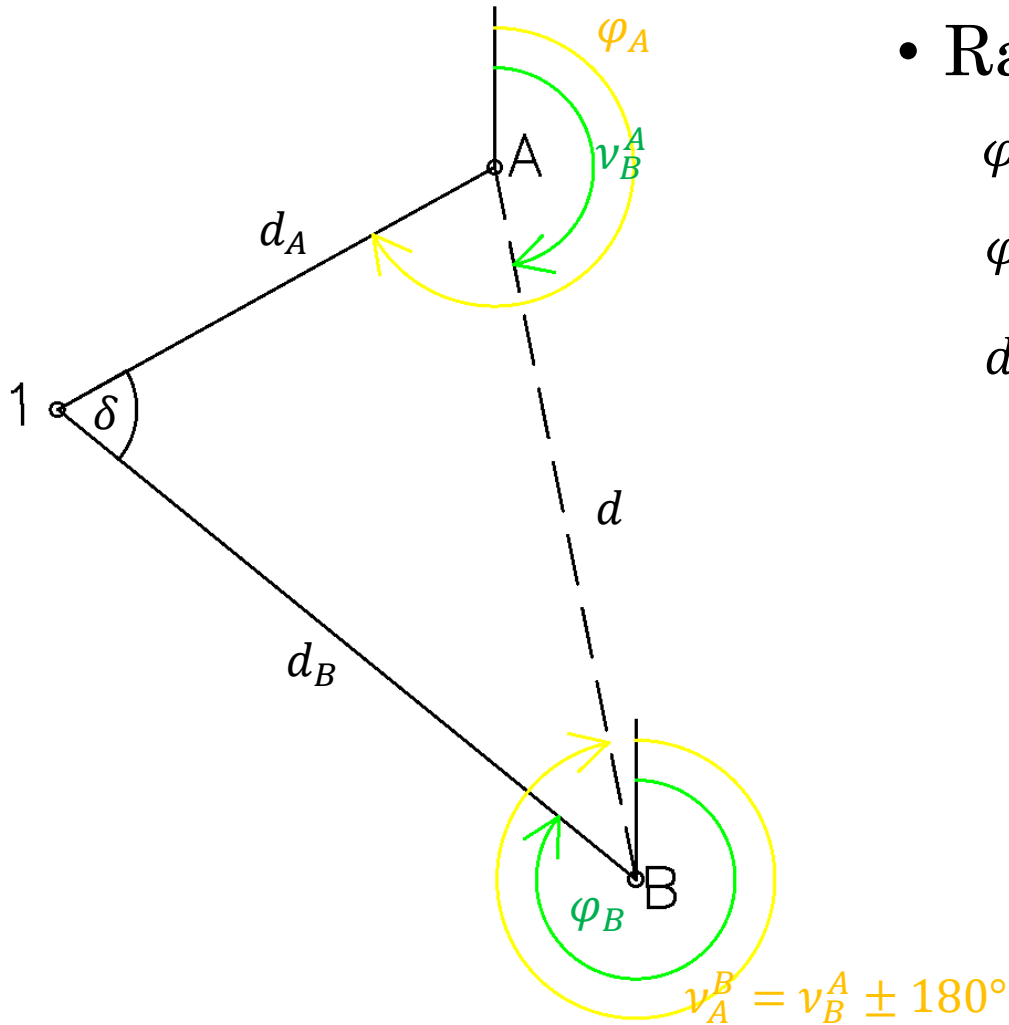
$$\frac{d}{\sin \delta} = \frac{d_A}{\sin \gamma_B} = \frac{d_B}{\sin \gamma_A} = m$$

$$d_A =$$

$$d_B =$$



Vežba 1



• Računanje koordinate **TAČKE 1**

$$\varphi_A = v_{845}^{845A} = 219^\circ 50' 12'' \quad v_A^B = 151^\circ 48' 29''$$

$$\varphi_B = v_{846A}^{845A} = 313^\circ 48' 14'' \quad v_B^A = 331^\circ 48' 29''$$

$$d_{A-B} = 148.28\text{m}$$

$$\delta_A = \varphi_A - v_A^B \rightarrow \delta_A = 68^\circ 01' 43''$$

$$\delta_B = v_B^A - \varphi_B \rightarrow \delta_B = 18^\circ 00' 15''$$

$$\delta = 93^\circ 58' 02''$$

$$\frac{d}{\sin\delta} = \frac{d_a}{\sin\gamma_B} = \frac{d_B}{\sin\gamma_A} = m$$

$$d_a = 45.94\text{m} \quad d_B = 137.84\text{m}$$



Vežba 1

$$y_1' = y_A + \Delta y_A = y_A + d_A * \sin\varphi_A$$

$$y_1' =$$

$$x_1' = x_A + \Delta x_A = x_A + d_A * \cos\varphi_A$$

$$x_1' =$$

$$y_1'' = y_B + \Delta y_B = y_B + d_B * \sin\varphi_B$$

$$y_1'' =$$

$$x_1'' = x_B + \Delta x_B = x_B + d_B * \cos\varphi_B$$

$$x_1'' =$$

$$y_1 = \frac{y_1' + y_1''}{2} =$$

$$x_1 = \frac{x_1' + x_1''}{2} =$$



Vežba 1

$$y_1' = y_A + \Delta y_A = y_A + d_A * \sin\varphi_A$$

$$y_1' = 3257.41\text{m}$$

$$x_1' = x_A + \Delta x_A = x_A + d_A * \cos\varphi_A$$

$$x_1' = 8897.78\text{m}$$

$$y_1'' = y_B + \Delta y_B = y_B + d_B * \sin\varphi_B$$

$$y_1'' = 3257.41\text{m}$$

$$x_1'' = x_B + \Delta x_B = x_B + d_B * \cos\varphi_B$$

$$x_1'' = 8897.77\text{m}$$

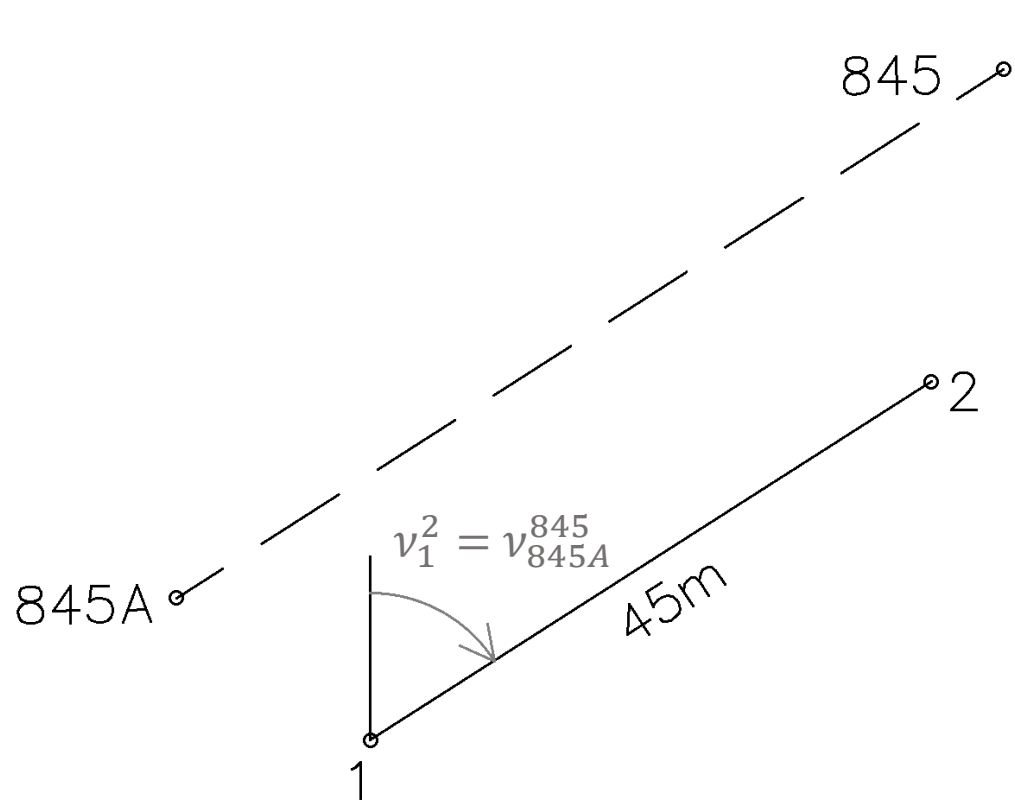
$$y_1 = \frac{y_1' + y_1''}{2} = 3257.41\text{m}$$

$$x_1 = \frac{x_1' + x_1''}{2} = 8897.78\text{m}$$



Vežba 1

- Računanje koordinata **TAČKE 2**



$$y_2 = y_1 + \Delta y_1 = y_1 + 45 * \sin v_1^2$$

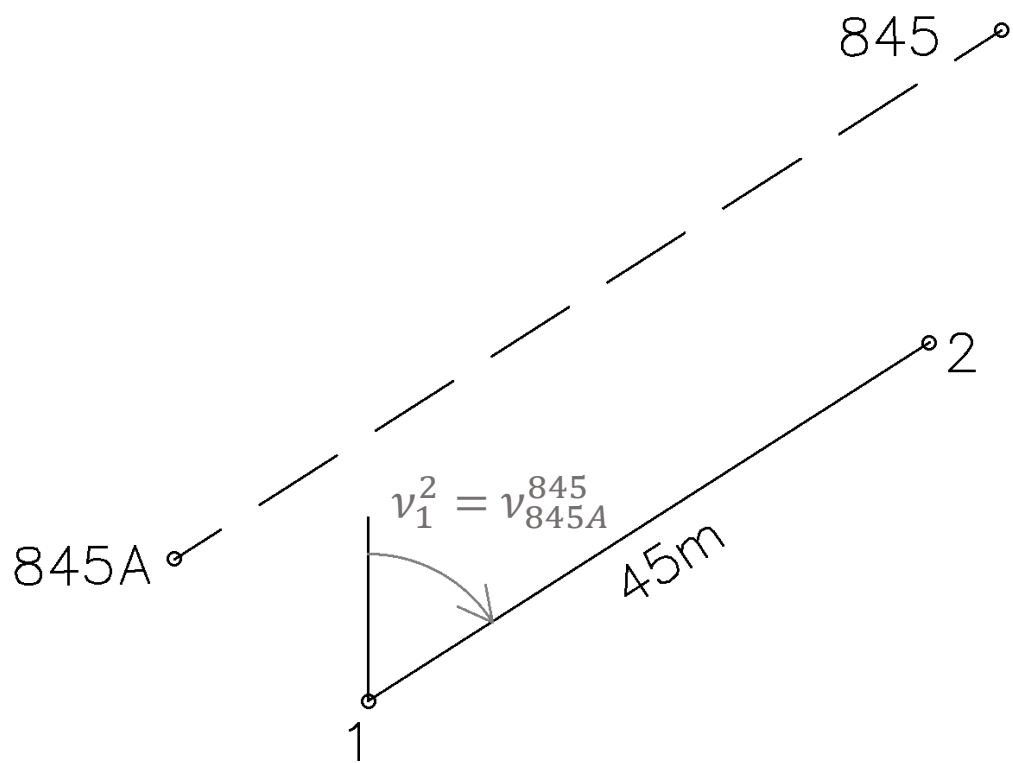
$$x_2 = x_1 + \Delta x_1 = x_1 + 45 * \cos v_1^2$$

$$y_2 =$$

$$x_2 =$$

Vežba 1

- Računanje koordinata **TAČKE 2**



$$y_2 = y_1 + \Delta y_1 = y_1 + 45 * \sin v_1^2$$

$$x_2 = x_1 + \Delta x_1 = x_1 + 45 * \cos v_1^2$$

$$y_2 = 3286.24\text{m}$$

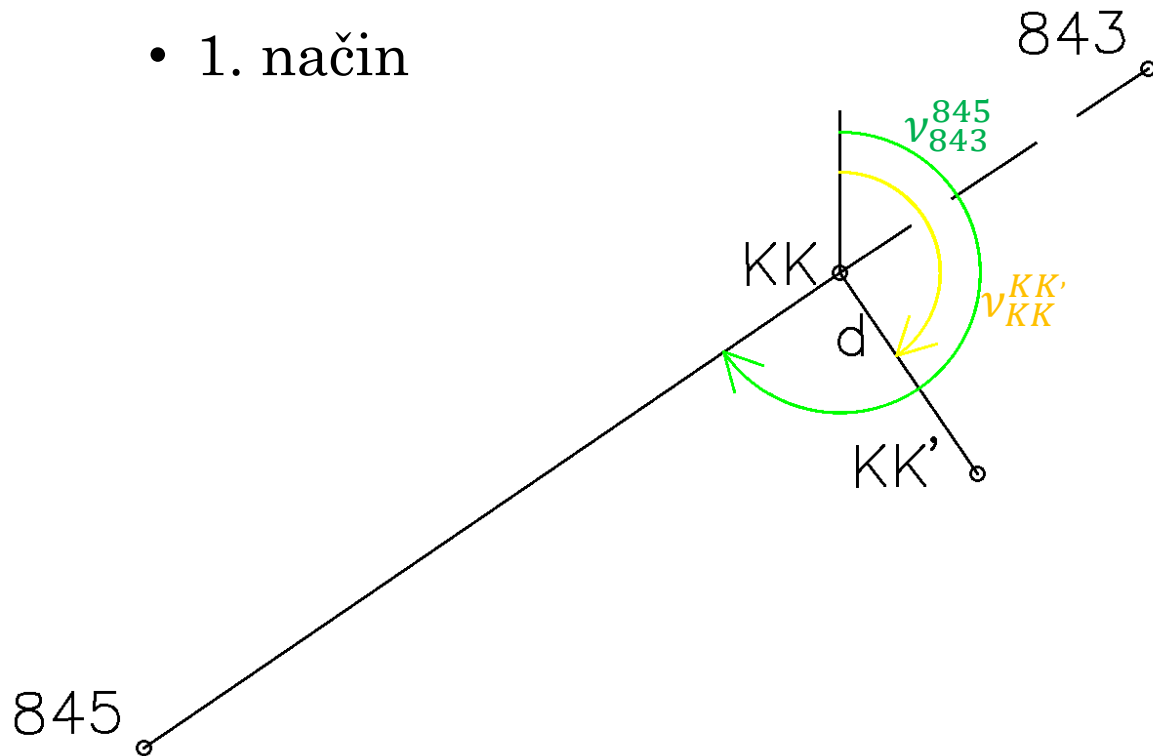
$$x_2 = 8932.33\text{m}$$



Vežba 1

- Računanje koordinata **TAČKE KK'**

- 1. način



$$v_{kk}^{kk'} = v_{kk}^{ck} = v_{843}^{845} - 90$$

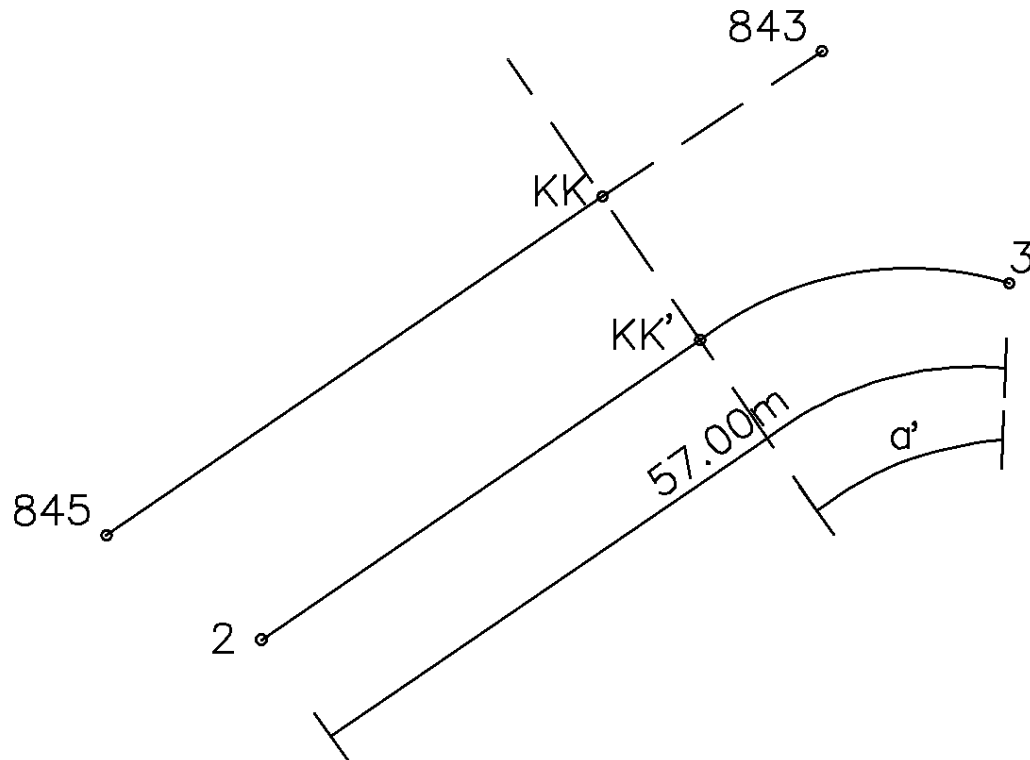
Već sračunato negde

$$y_{kk}' = y_{kk} + d * \sin v_{kk}^{kk'}$$

$$x_{kk}' = x_{kk} + d * \cos v_{kk}^{kk'}$$

Vežba 1

- Računanje koordinata **TAČKE 3**



$$D_{(2-kk')} =$$

Iz koordinata

$$a' = 57 - D_{(2-kk')}$$

$$D_{(2-3)}$$

$$a' = 57.00 - 24.15 \quad a' =$$

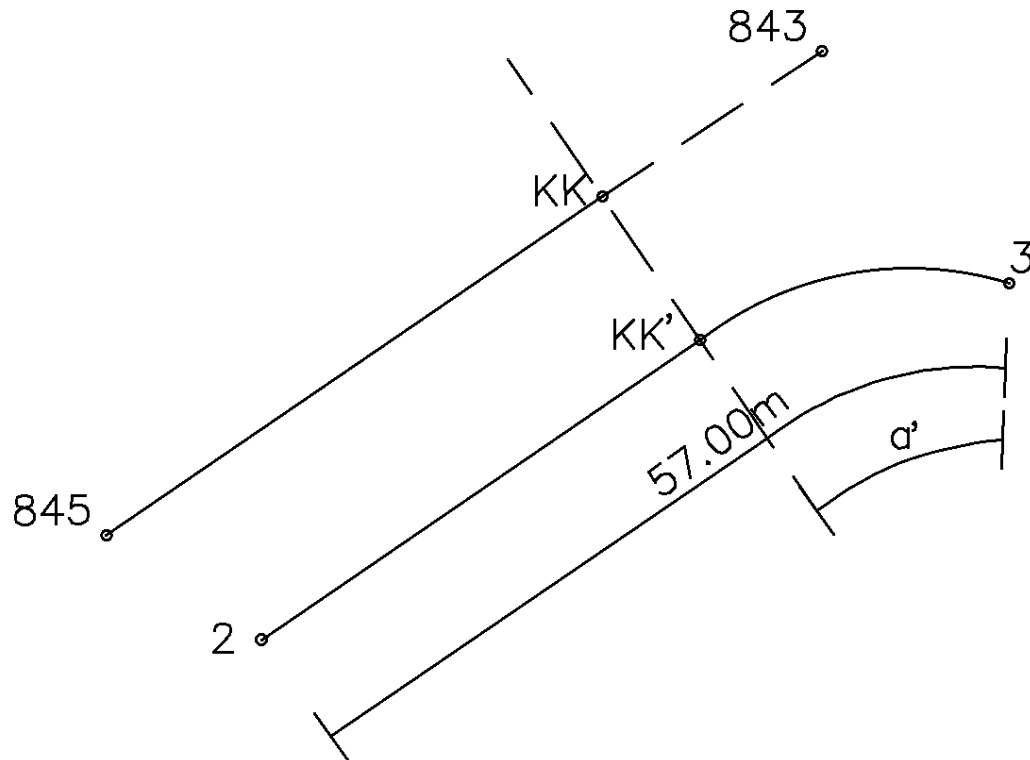
$$R = 170\text{m}$$

$$R' = 170 - 7\text{m} \quad R' =$$



Vežba 1

- Računanje koordinata TAČKE 3



$$D_{(2-kk')} = 24.15m \quad \text{Iz koordinata}$$

$$a' = 57 - D_{(2-kk')}$$

$$a' = 57.00 - 24.15$$

$$a' = 32.85m$$

$$R = 170m$$

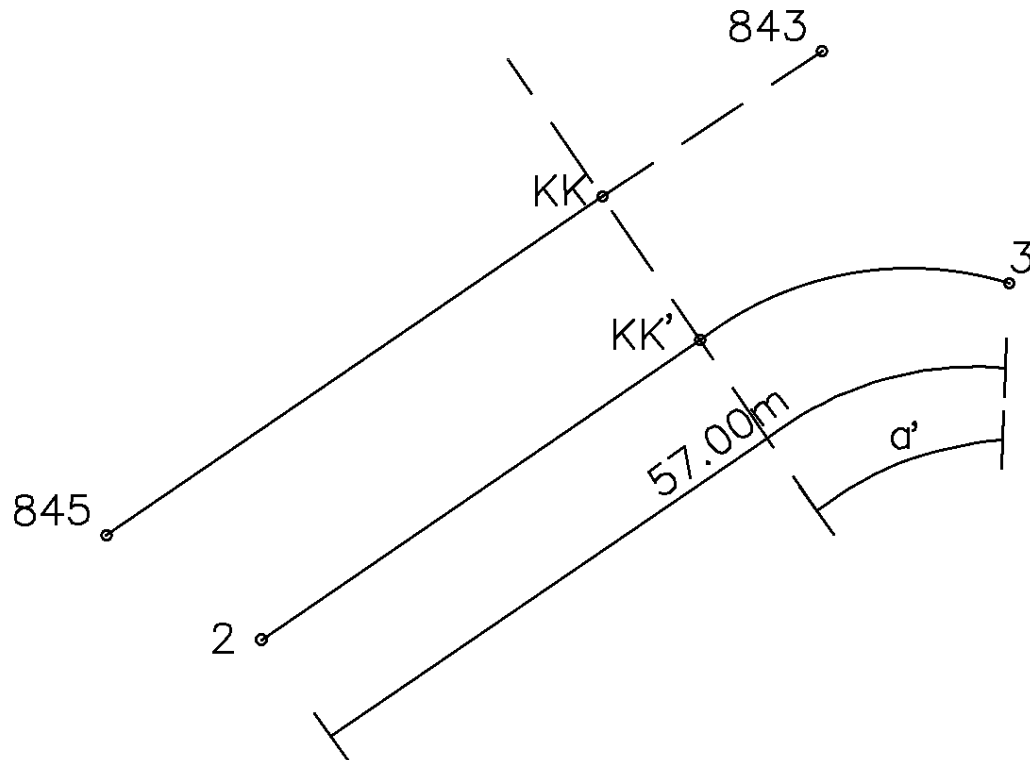
$$R' = 170 - 7m$$

$$R' = 163m$$



Vežba 1

- Računanje koordinata TAČKE 3
 - 2. način



$$y_{kk'} = y_{845} + od_1 + au$$

$$x_{kk'} = x_{845} + ad_1 - ou$$

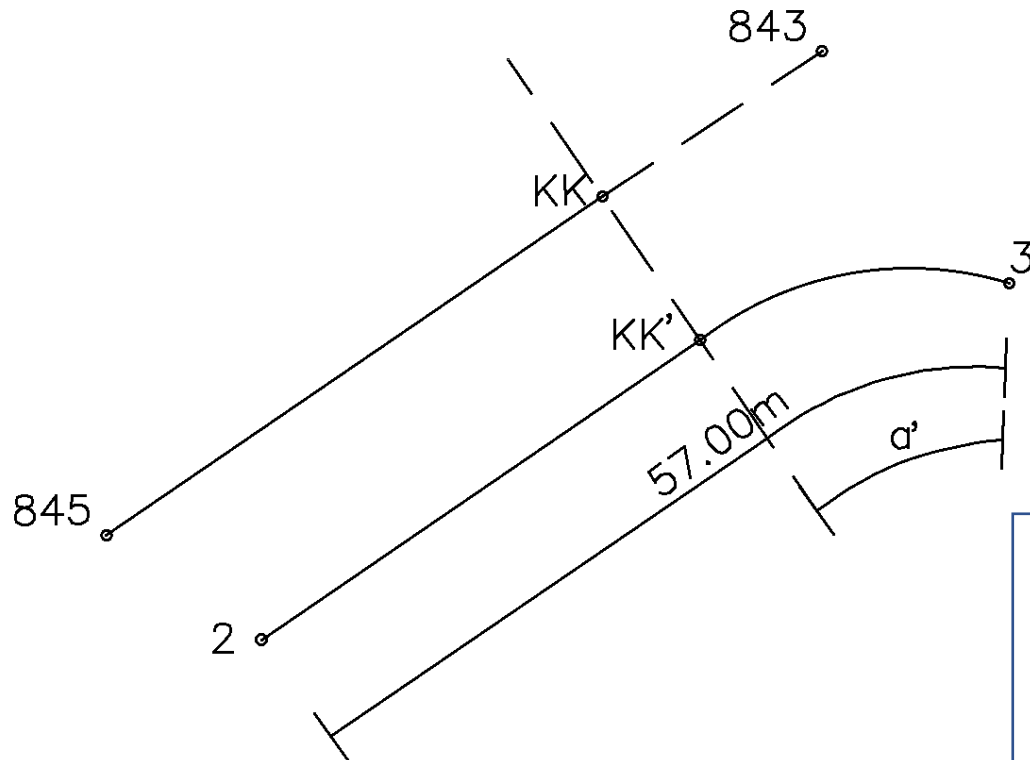
*ako Vam je lakše radite preko $\nu \pm 90$

$$y_{kk'} =$$

$$x_{kk'} =$$

Vežba 1

- Računanje koordinata TAČKE 3
 - 2. način



$$y_{kk'} = y_{845} + od_1 + au$$

$$x_{kk'} = x_{845} + ad_1 - ou$$

*ako Vam je lakše radite preko $\nu \pm 90$

$$y_{kk'} = 3301.70\text{m}$$

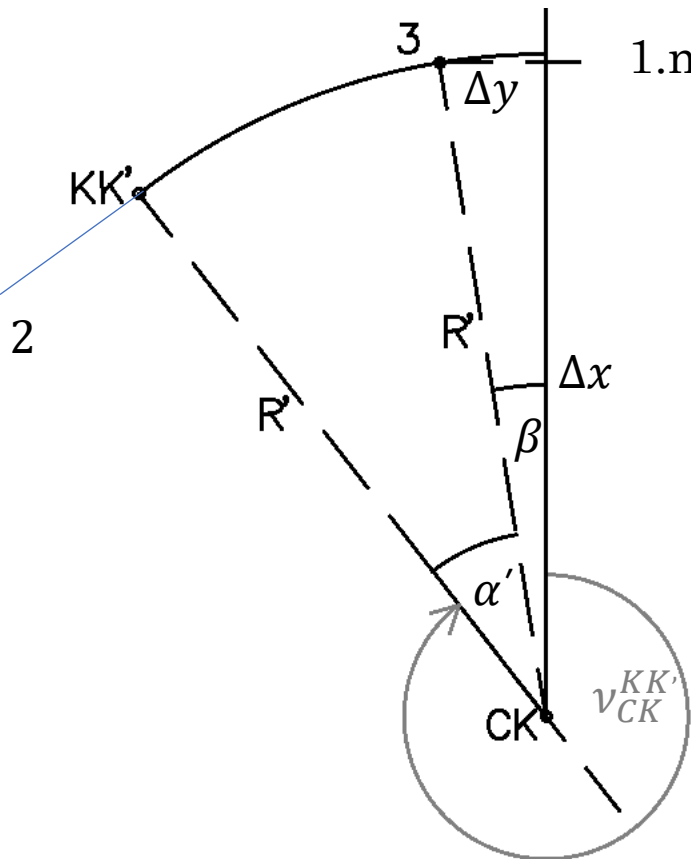
$$x_{kk'} = 8950.88\text{m}$$



Vežba 1

• Računanje koordinata TAČKE 3

• Računanje kao tačke na kružnom luku



1.način

$$\alpha' = D = \frac{R \cdot \pi \cdot \alpha'}{180}$$

$$Tg = R \cdot \tan\left(\frac{\alpha'}{2}\right)$$

$$\alpha' = \frac{180 \cdot D}{R \cdot \pi}, \alpha' =$$

$$y_3 = y_{ck} + R' * \sin(\nu_{ck}^{kk} + \alpha')$$

$$x_3 = x_{ck} + R' * \cos(\nu_{ck}^{kk} + \alpha')$$

2.način

$$\beta = 360^\circ - (a' + \nu_c^{kk'}) \quad \beta =$$

$$\Delta y = d_{C-3} * \sin \beta$$

$$\Delta x = d_{C-3} * \cos \beta$$

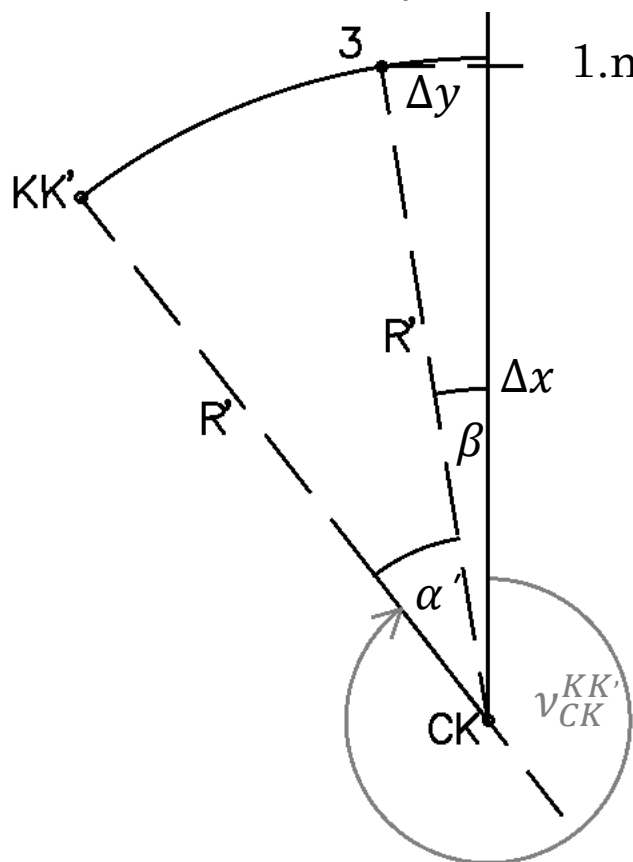
$$y_3 = y_C - \Delta y$$

$$x_3 = x_C + \Delta x$$

Vežba 1

• Računanje koordinata TAČKE 3

• Računanje kao tačke na kružnom luku



1.način

$$\alpha' = D = \frac{R \cdot \pi \cdot \alpha'}{180}$$

$$Tg = R \cdot \tan\left(\frac{\alpha'}{2}\right)$$

$$\alpha' = \frac{180 \cdot D}{R \cdot \pi}, \alpha' = 11^\circ 32' 49''$$

$$y_3 = y_{ck} + R' * (\nu_{ck}^{kk'} + \alpha')$$

$$x_3 = x_{ck} + R' * (\nu_{ck}^{kk'} + \alpha')$$

2.način

$$\beta = 360^\circ - (\alpha' + \nu_c^{kk'}) \quad \beta = 38^\circ 37' 00''$$

$$\Delta y = d_{c-3} * \sin \beta$$

$$\Delta x = d_{c-3} * \cos \beta$$

$$y_3 = y_c - \Delta y$$

$$x_3 = x_c + \Delta x$$

$$y_3 = 3325.13\text{m}$$

$$x_3 = 8973.82\text{m}$$



Vežba 1

- Računanje koordinata TAČKA 4 I 5 KK
 - Racunaju se kao tačke na kružnom luku

$$D_{3-4} = 55m$$

$$\alpha'' = \frac{180 \cdot D}{R \cdot \pi}$$

$$\alpha'' =$$

Lakši način:

$$v_C^4 = v_C^{kk'} + \alpha' + \alpha''$$

$$y_4 = y_C + R' * \sin v_C^4$$

$$x_4 = x_C + R' * \cos v_C^4$$

2.način

$$\left\{ \begin{array}{l} \beta = \\ y_4 = y_C - R * \sin \beta \\ x_4 = x_C + R * \cos \beta \end{array} \right.$$

$$y_4 =$$
$$x_4 =$$



Vežba 1

- Računanje koordinata TAČKA 4 I 5 KK
 - Racunaju se kao tačke na kružnom luku

$$D_{3-4} = 55m$$

$$\alpha'' = \frac{180 \cdot D}{R \cdot \pi}$$

$$\alpha'' = 19^\circ 19' 59''$$

Lakši način:

$$v_C^4 = v_C^{kk'} + \alpha' + \alpha''$$

$$y_4 = y_C + R' * \sin v_C^4$$

$$x_4 = x_C + R' * \cos v_C^4$$

2.način

$$\left\{ \begin{array}{l} \beta = 19^\circ 16' 52'' \\ y_4 = y_C - R * \sin \beta \\ x_4 = x_C + R * \cos \beta \end{array} \right.$$

$$y_4 = 3373.04m$$

$$x_4 = 9000.31m$$



Vežba 1

- Računanje koordinata **TAČKE 5**

$$D_{4-5} = 46m$$

$$\alpha''' =$$

$$\beta =$$

$$y_5 = y_C - R * \sin\beta$$

$$x_5 = x_C + R * \cos\beta$$

Lakši način:

$$v_C^5 = v_C^{kk'} + \alpha' + \alpha'' + \alpha'''$$

$$y_5 = y_C + R' * \sin v_C^5$$

$$x_5 = x_C + R' * \cos v_C^5$$

$$y_5 =$$

$$x_5 =$$



Vežba 1

- Računanje koordinata **TAČKE 5**

$$D_{4-5} = 46m$$

$$\alpha''' = 16^\circ 10' 10''$$

$$\beta = 3^\circ 06' 38''$$

$$y_5 = y_C - R * \sin\beta$$

$$x_5 = x_C + R * \cos\beta$$

Lakši način:

$$v_C^5 = v_C^{kk'} + \alpha' + \alpha'' + \alpha'''$$

$$y_5 = y_C + R' * \sin v_C^5$$

$$x_5 = x_C + R' * \cos v_C^5$$

$$y_5 = 3418.02m$$

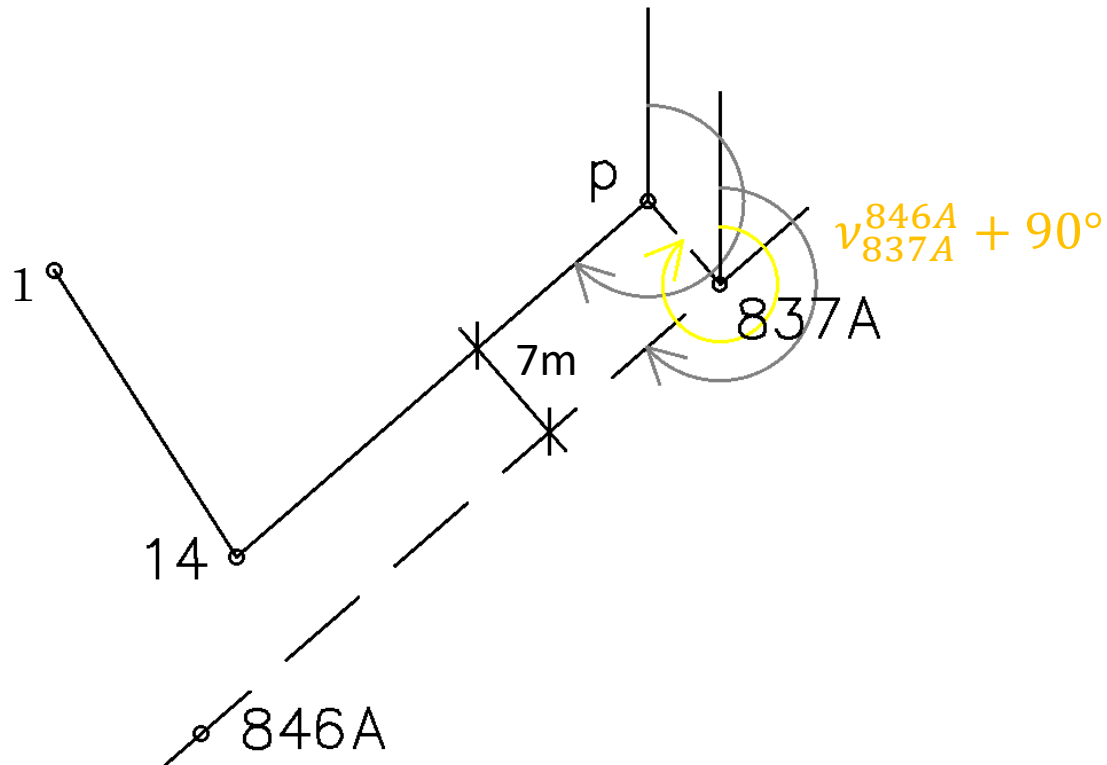
$$x_5 = 9009.21m$$



Vežba 1

- Računanje koordinata **TAČKE 6**

- Prvo se računa koordinata tačke 14 (presekom pravaca sa 1 i P)



$$v_{837A}^{846A} = v_P^{14}$$

$$y_P = y_{837A} + 7m * \sin v_{837A}^P$$

$$X_P = x_{837A} + 7m * \cos v_{837A}^P$$

$y_P =$

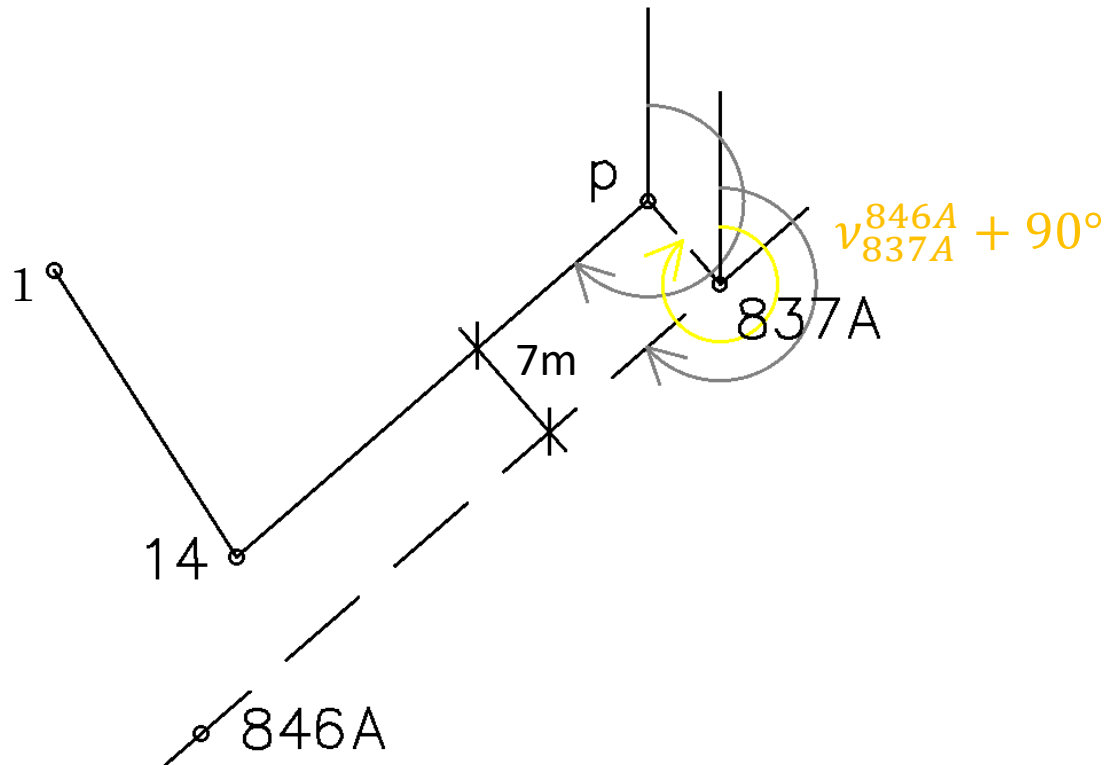
$x_P =$



Vežba 1

- Računanje koordinata **TAČKE 6**

- Prvo se računa koordinata tačke 14 (presekom pravaca sa 1 i P)



$$v_{837A}^{846A} = v_P^{14}$$

$$y_P = y_{837A} + 7m * \sin v_{837A}^P$$

$$X_P = x_{837A} + 7m * \cos v_{837A}^P$$

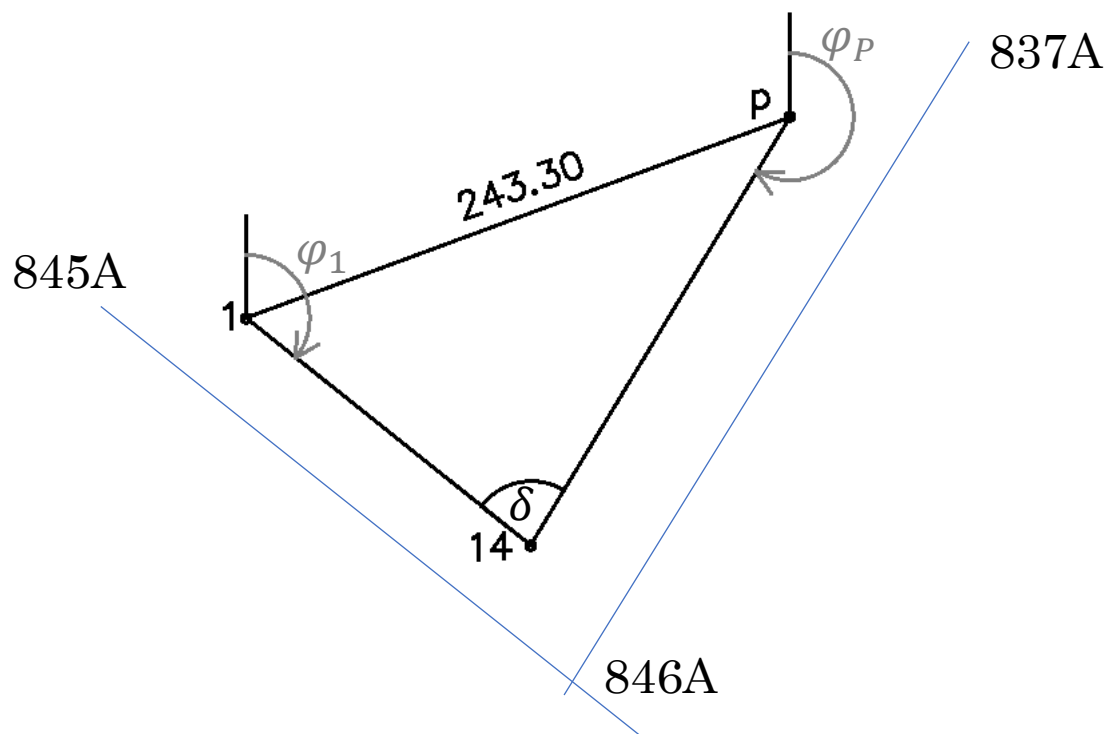
$$y_P = 3472.16m$$

$$x_P = 9012.12m$$



Vežba 1

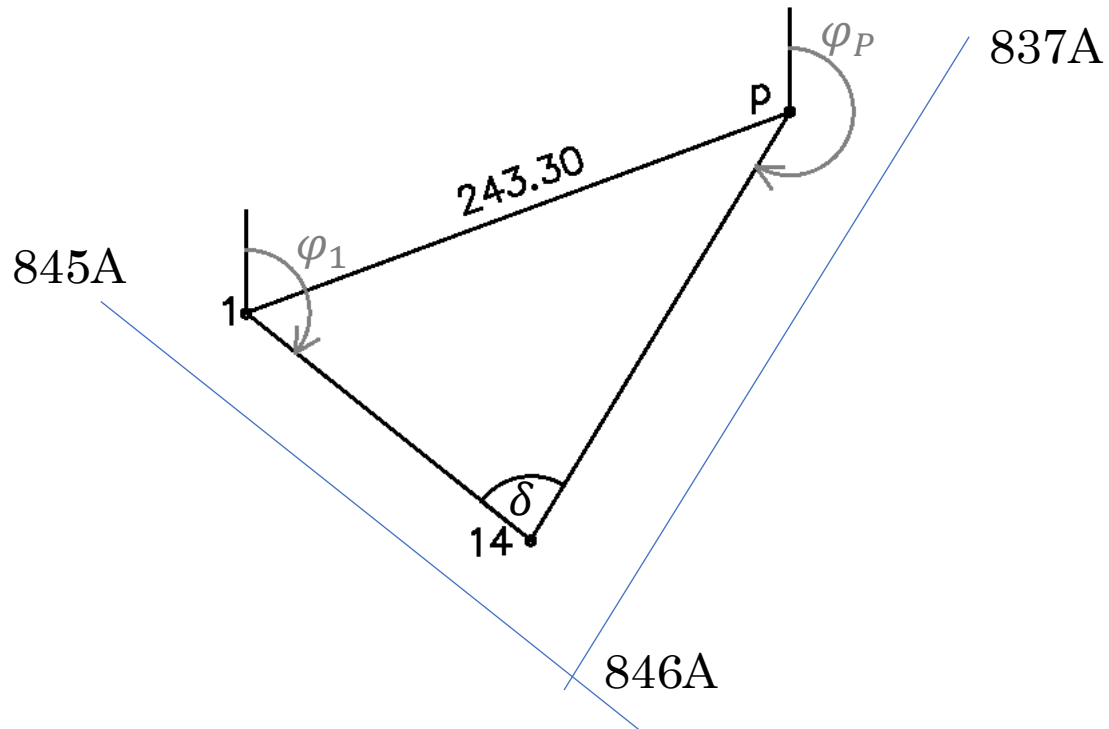
- Računanje koordinata **TAČKE 14**
 - Samostalno rešavanjem trougla ili presekom pravaca



$y_{14} =$
$x_{14} =$

Vežba 1

- Računanje koordinata **TAČKE 14**
 - Samostalno rešavanjem trougla ili presekom pravaca

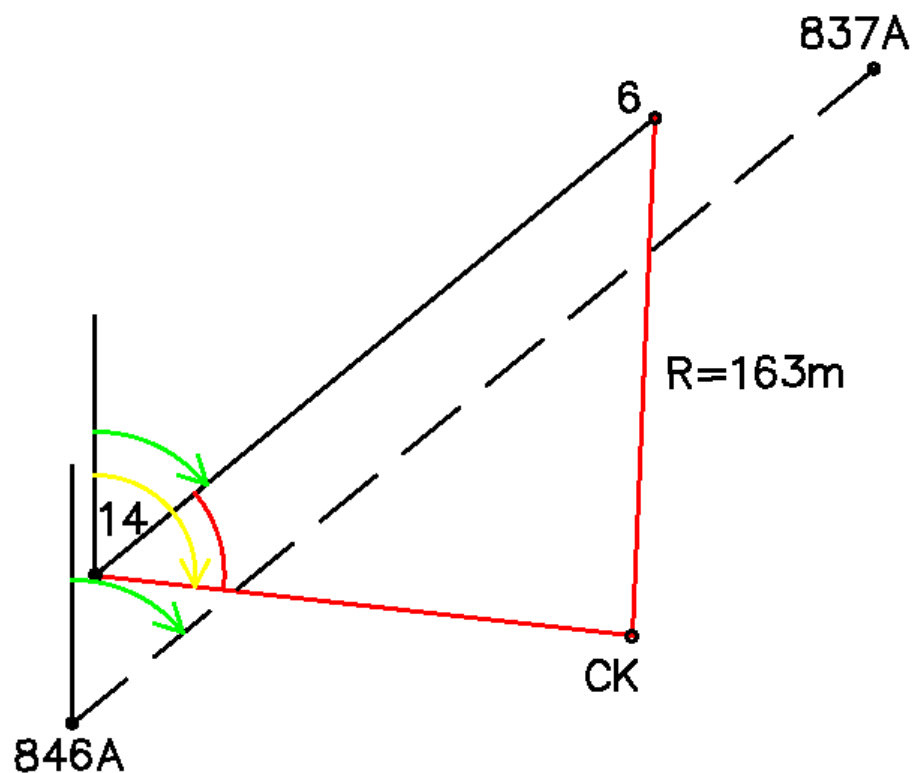


$$y_{14} = 3350.38\text{m}$$

$$x_{14} = 8808.60\text{m}$$

Vežba 1

- Računanje koordinata TAČKE 6
 - Samostalno rešiti

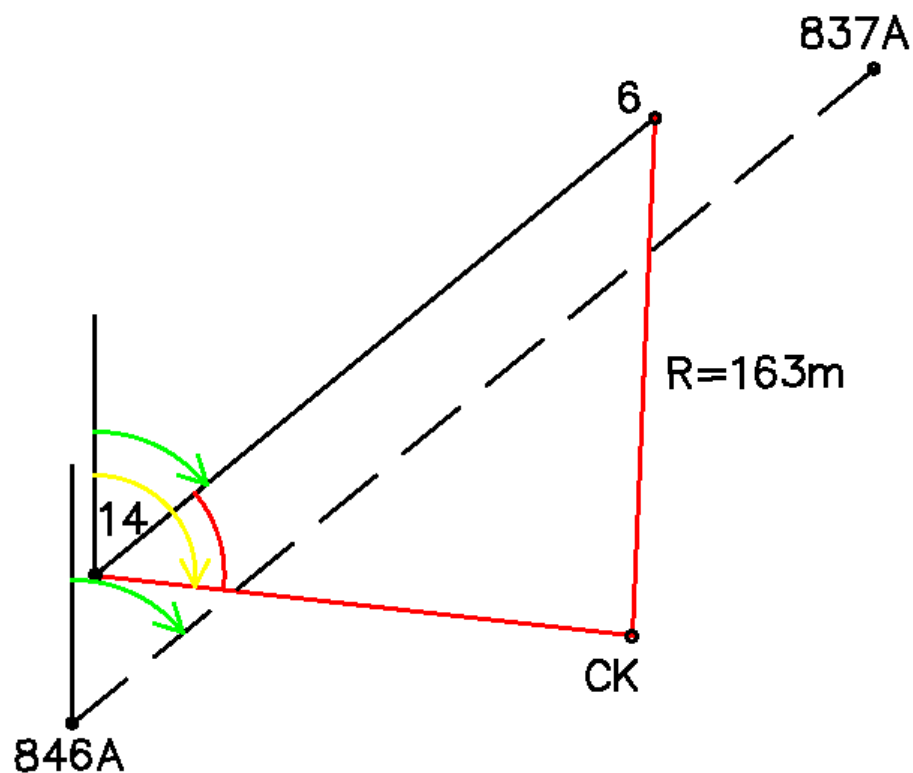


$y_6 =$

$x_6 =$

Vežba 1

- Računanje koordinata TAČKE 14
 - Samostalno rešiti

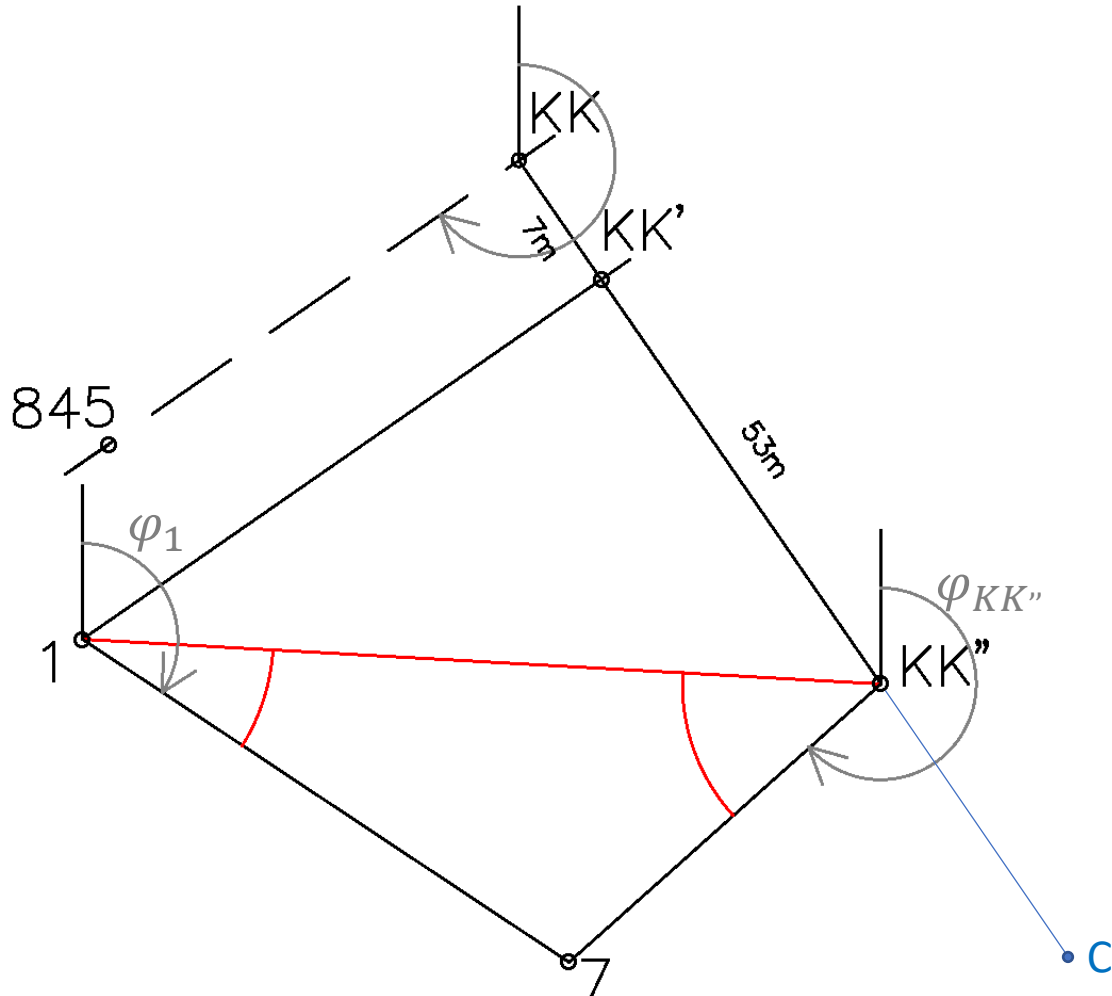


$$y_6 = 3467.49\text{m}$$

$$x_6 = 9004.31\text{m}$$

Vežba 1

- Računanje koordinata TAČKA KK' i KK''



$$y_{kk'} = 3301.70\text{m}$$

$$x_{kk'} = 8950.88\text{m}$$

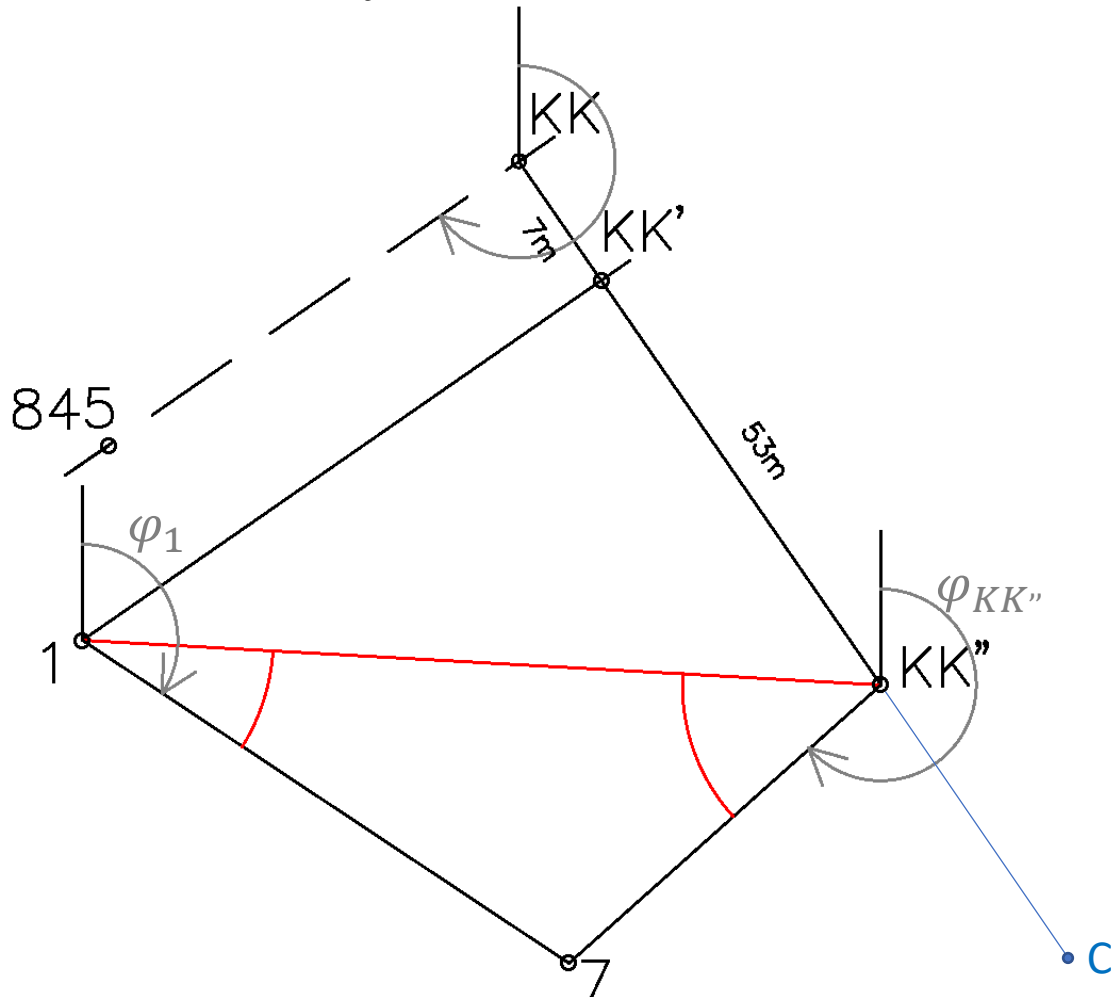
$$y''_{kk} = y'_{kk} + 53 * \sin v_{kk}^C$$

$$x''_{kk} = x'_{kk} + 53 * \cos v_{kk}^C$$

KK''

Vežba 1

- Računanje koordinata TAČKA KK' i KK''



$$y_{kk'} = 3301.70\text{m}$$

$$x_{kk'} = 8950.88\text{m}$$

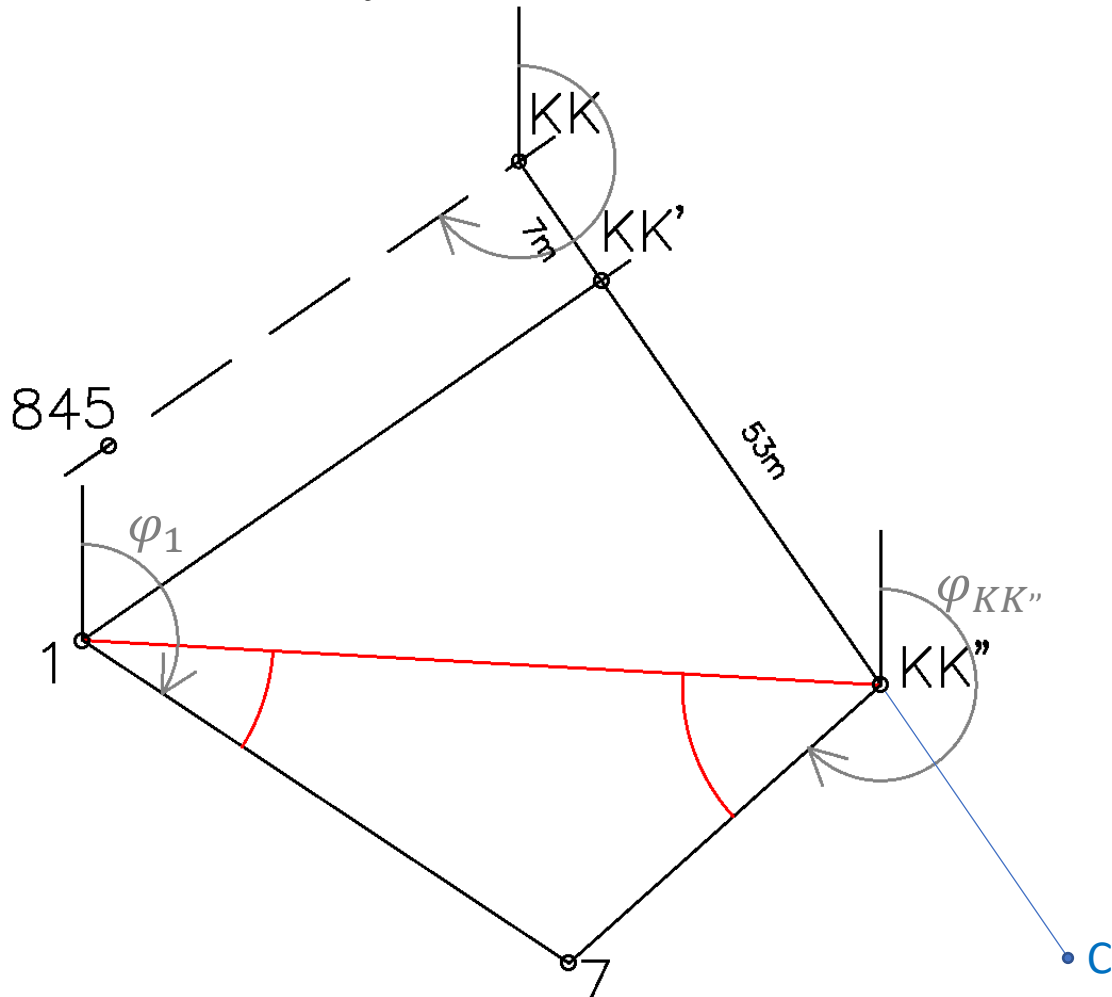
$$y''_{kk} = y'_{kk} + 53 * \sin v_{kk}^C$$

$$x''_{kk} = x'_{kk} + 53 * \cos v_{kk}^C$$

KK'' 3342.39 8916.92

Vežba 1

- Računanje koordinata TAČKA KK' i KK''



$$y_{kk'} = 3301.70\text{m}$$

$$x_{kk'} = 8950.88\text{m}$$

$$y''_{kk} = y'_{kk} + 53 * \sin v_{kk}^C$$

$$x''_{kk} = x'_{kk} + 53 * \cos v_{kk}^C$$

KK'' 3342.39 8916.92

$$\varphi_1 = v_1^7 = v_{845A}^{846A}$$

$$\varphi_{kk} = v_{kk}^7 = v_{kk}^{845}$$



Vežba 1

- Računanje koordinata TAČKA 7,8,9,10,11 na isti način
- Uraditi samostalno
 - Tačka 7 – potrebno sračunati KK” na liniji KK-C; Presek pravaca
 - ako bi računali na liniji 1-14 na rastojanju od 53 (ne znamo jel 53) dobije se razlika 8cm
 - Tačka 8 se računa kao tačka 2
 - Tačka 9 kao tačka 3
 - Tačka 10 kao tačke 4 i 5
 - Tačka 11 kao tačka 6



Vežba 1

- Računanje koordinata TAČKA 7,8,9,10,11

Тачка	Y	X
7		
8		
9		
10		
11		

Vežba 1

- Računanje koordinata TAČKA 7,8,9,10,11

Tačka	Y	X
7	3295.74	8861.01
8		
9		
10		
11		



Vežba 1

- Računanje koordinata TAČKA 7,8,9,10,11

Tačka	Y	X
7	3295.74	8861.01
8	3321.36	8891.72
9		
10		
11		



Vežba 1

- Računanje koordinata TAČKA 7,8,9,10,11

Tačka	Y	X
7	3295.74	8861.01
8	3321.36	8891.72
9	3352.15	8927.19
10		
11		



Vežba 1

- Računanje koordinata TAČKA 7,8,9,10,11

Tačka	Y	X
7	3295.74	8861.01
8	3321.36	8891.72
9	3352.15	8927.19
10	3398.07	8952.62
11		



Vežba 1

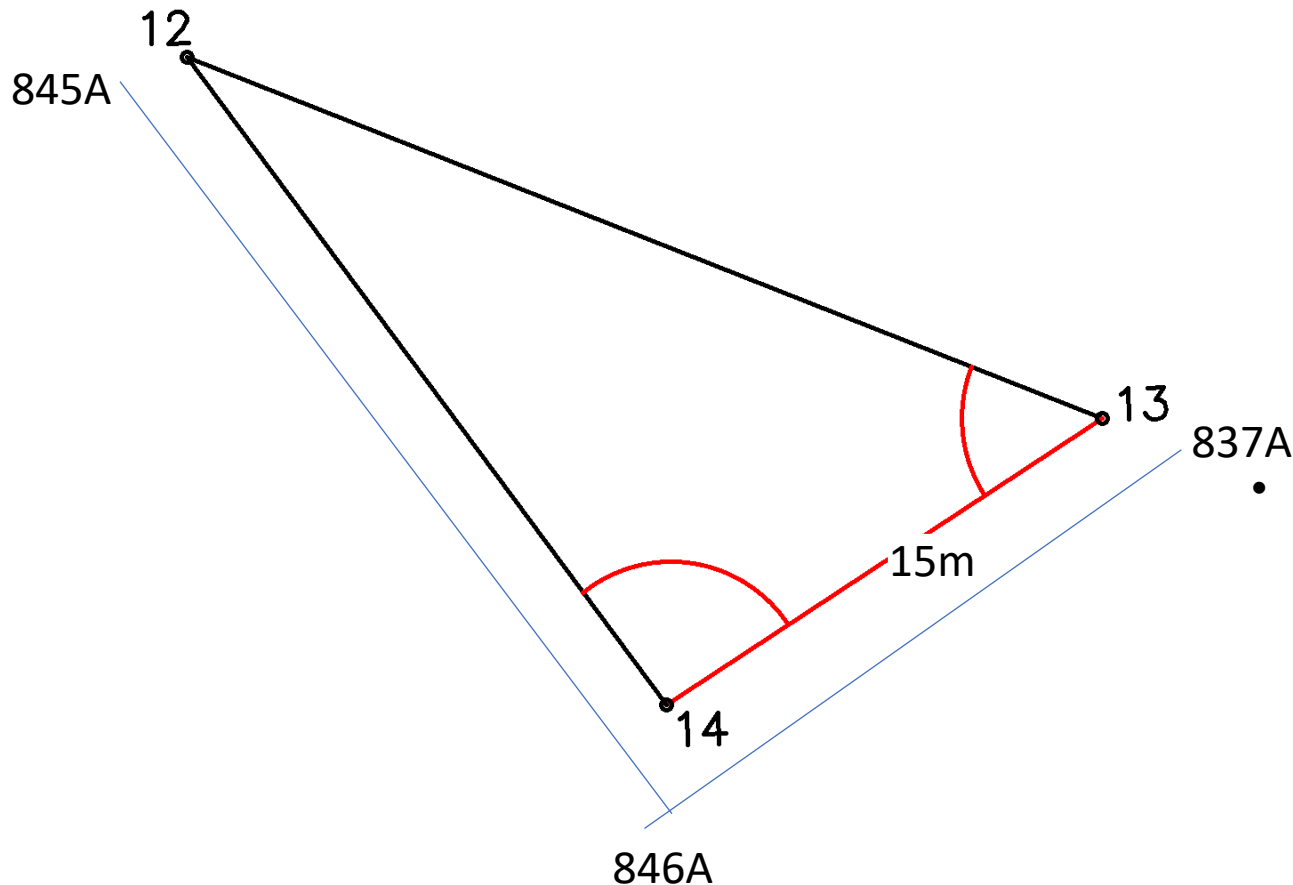
- Računanje koordinata TAČKA 7,8,9,10,11

Tačka	Y	X
7	3295.74	8861.01
8	3321.36	8891.72
9	3352.15	8927.19
10	3398.07	8952.62
11	3438.49	8955.83



Vežba 1

- Računanje koordinata TAČKA 12,13



$$v_{14}^{13} = v_{14}^6 = v_{846A}^{837A} = 30^\circ 53' 48'' \quad \text{Već računato}$$

$$v_{13}^{12} = v_{837A}^{843} \quad \text{Dato u tekstu da je paralelan pravac}$$

$$v_{14}^{12} = v_{846A}^{845A} \quad \text{Već računato}$$

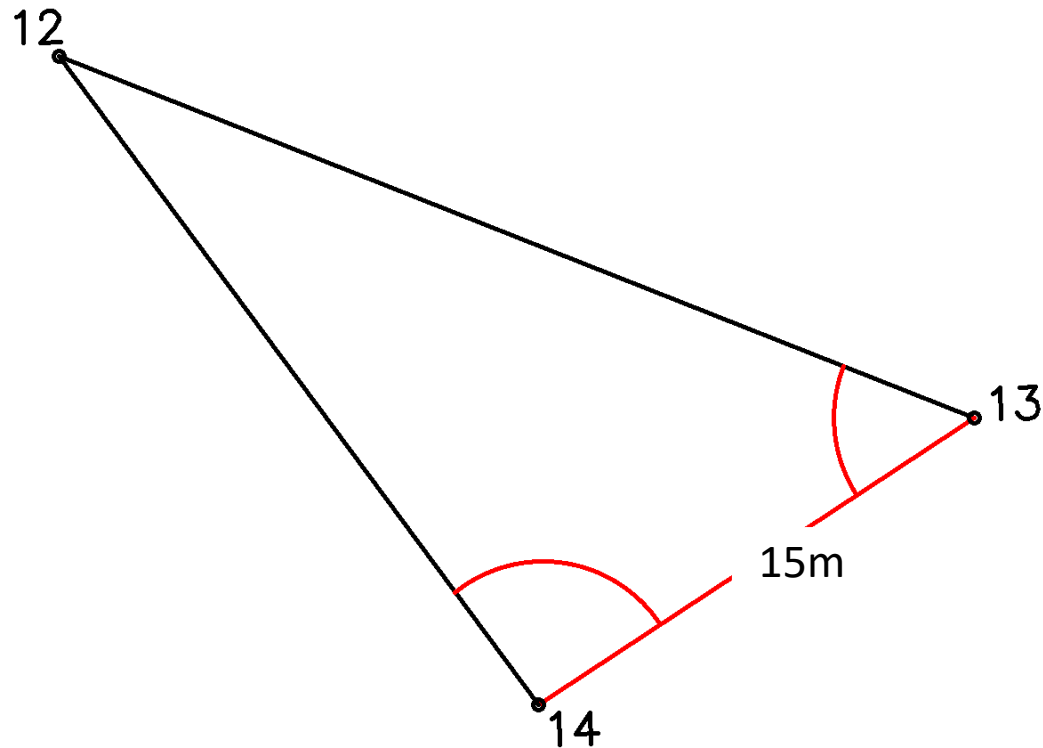
- Samostalno rešiti trougao i sračunati koordinate

12
13



Vežba 1

- Računanje koordinata TAČKA 12,13
 - Rešavamo trougao



$$v_{14}^{13} = v_{14}^6 = v_{846A}^{837A} = 30^{\circ} 53' 48''$$

$$v_{13}^{12} = v_{837A}^{843}$$

$$v_{14}^{12} = v_{846A}^{845A}$$

12	3318.30	8839.37
13	3358.08	8821.47



Vežba 1

- **POLARNO OBELEŽAVANJE**

- Problem inženjerske geodezije - suprotan od problema geodetskog premera
- U geodetskom premeru se mere veličine i nepoznate su koordinate
- U inženjerskoj geodeziji se veličine računaju na osnovu koordinata iz projekta



Vežba 1

• POLARNO OBELEŽAVANJE

• DATO: A, B, 1

• Stanica A

• Orijentacija B

• Tačku 1 treba obeležiti

$$\alpha = v_A^1 - v_A^B \quad d = \sqrt{(Y_A - Y_1)^2 + (X_A - X_1)^2}$$

d – iz koordinata

• Za obeležavanje je potrebno odrediti rastojanje d i ugao

• Od pravca stanica- orijentacija u smeru kretanja kazaljke na satu

