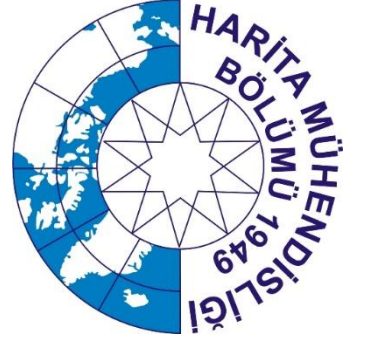


ÖLÇME BİLGİSİ 2 (HRT 2331)



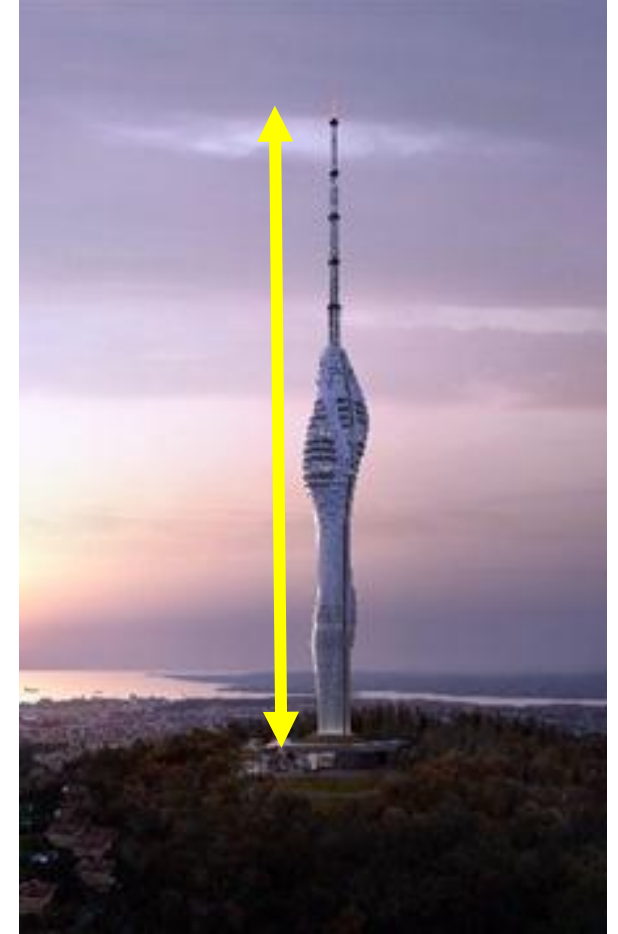
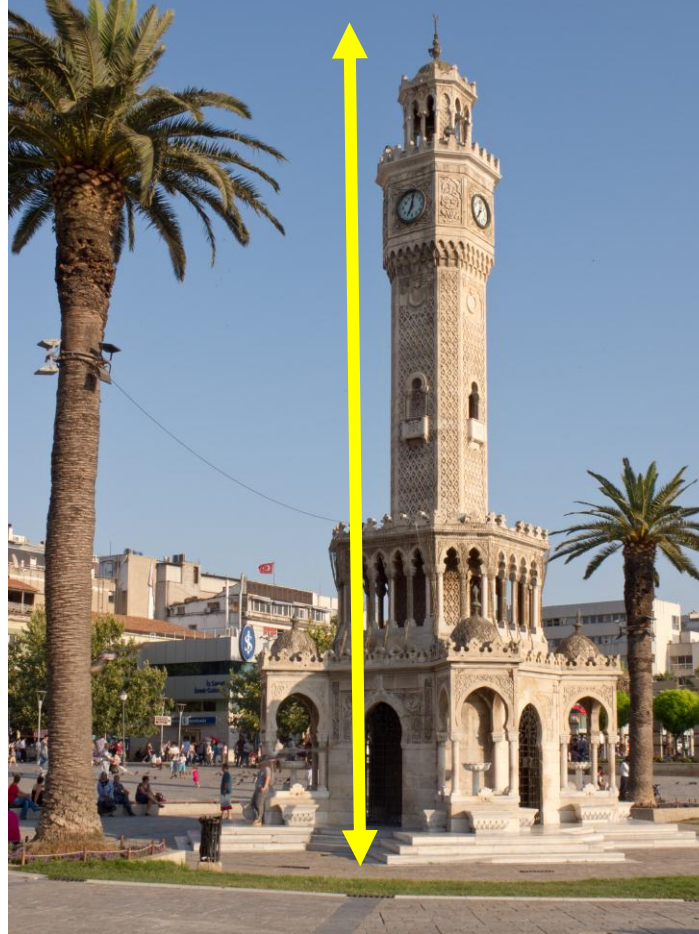
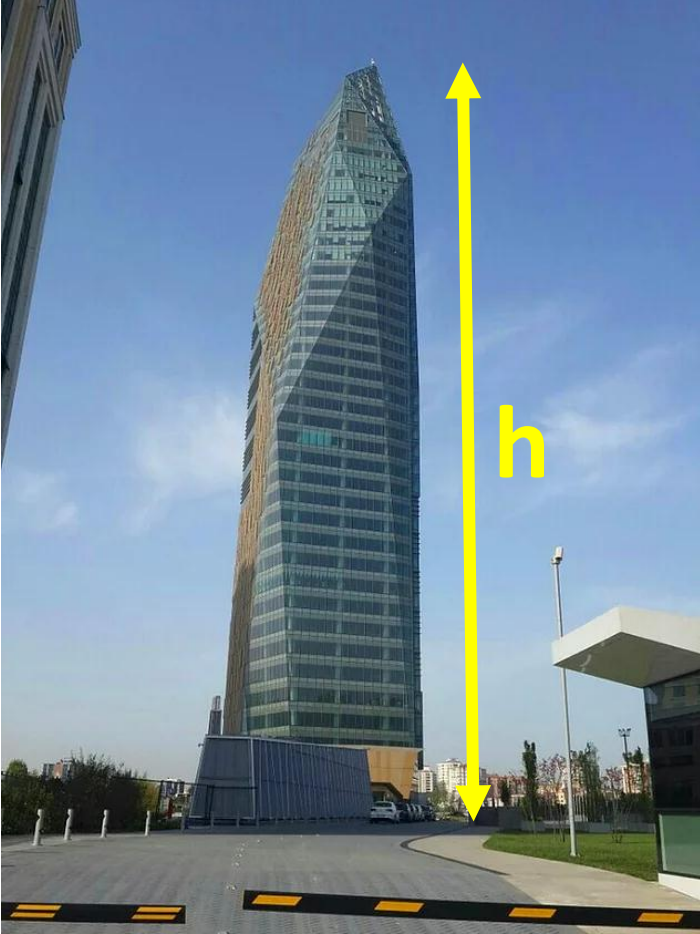
DERS NOTLARI

ÖZEL NİVELMAN TÜRLERİ

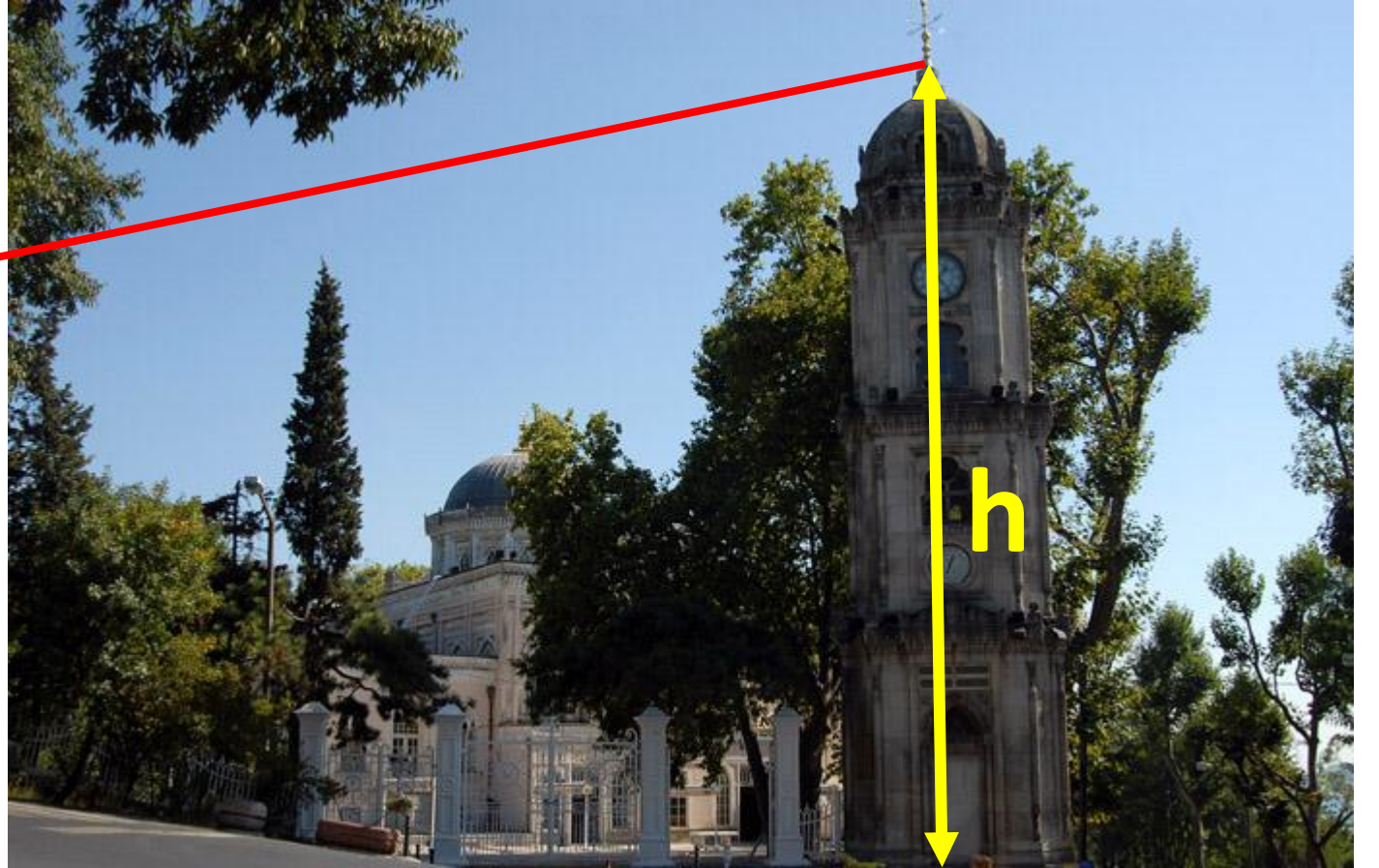
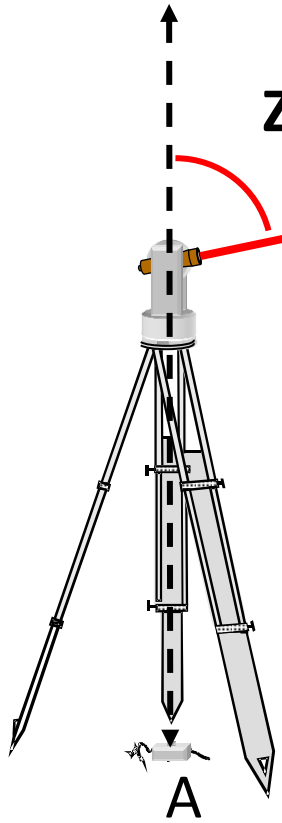
6.BÖLÜM

2-KULE YÜKSEKLİĞİ ÖLÇÜMÜ VE HESABI

Kule Yüksekliği



Kule Yüksekliği



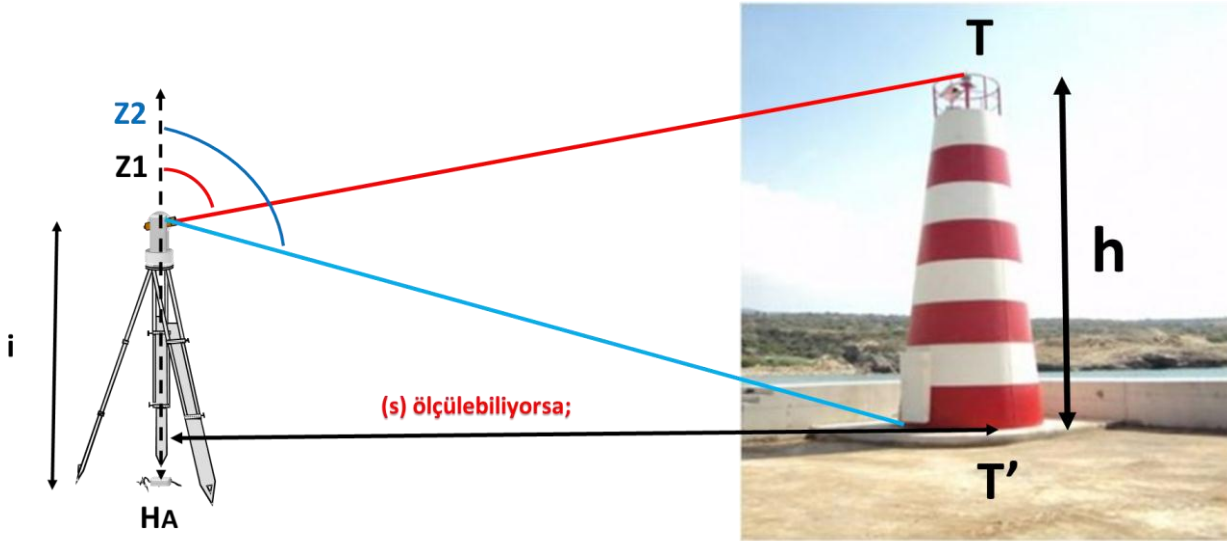
Kule Yüksekliği

Yatay uzunluk (s) ölçülebiliyorsa;



Kule Yüksekliği

Yatay uzunluk (s) ölçülebiliyorsa;



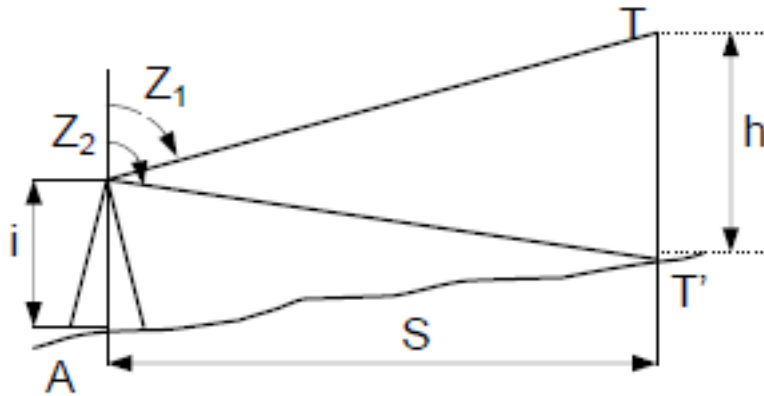
$$HT = HA + i + S \cdot \cot Z1$$

$$HT' = HA + i + S \cdot \cot Z2$$

$$h = HT - HT' = S (\cot Z1 - \cot Z2)$$

Kule Yüksekliği

ÖRNEK-1



$$Z_1 = 95^{\circ}.3674$$

$$Z_2 = 102^{\circ}.1826$$

$$S = 75.14 \text{ m}$$

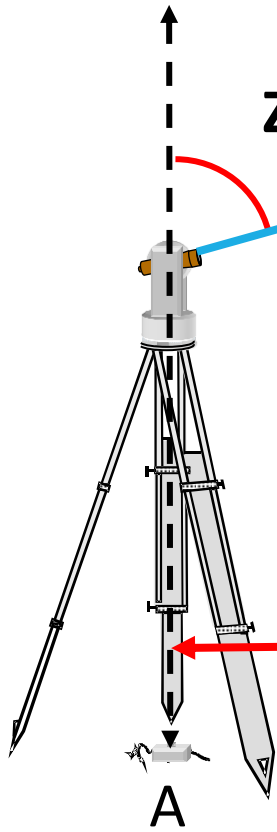
$$h = ?$$

$$h = S (\cot Z_1 - \cot Z_2) = 75.14 \cdot (\cot 95.3674 - \cot 102.1826) = 8.0546 \text{ m}$$

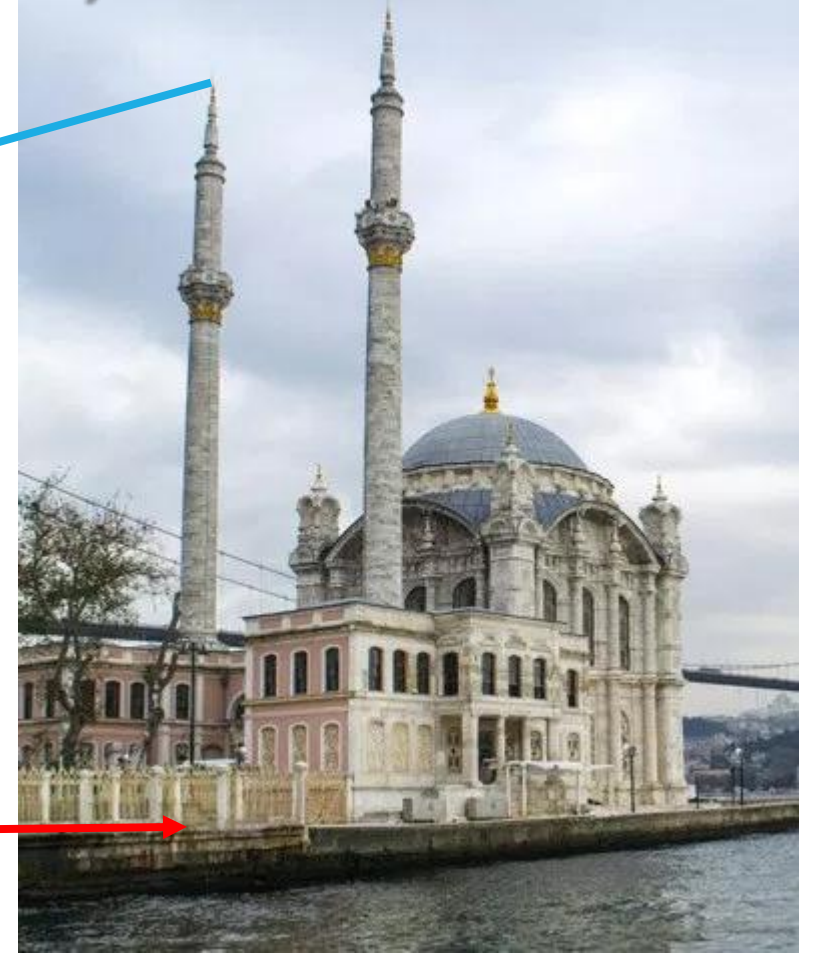
$$h = 8.05 \text{ m}$$

Kule Yüksekliği

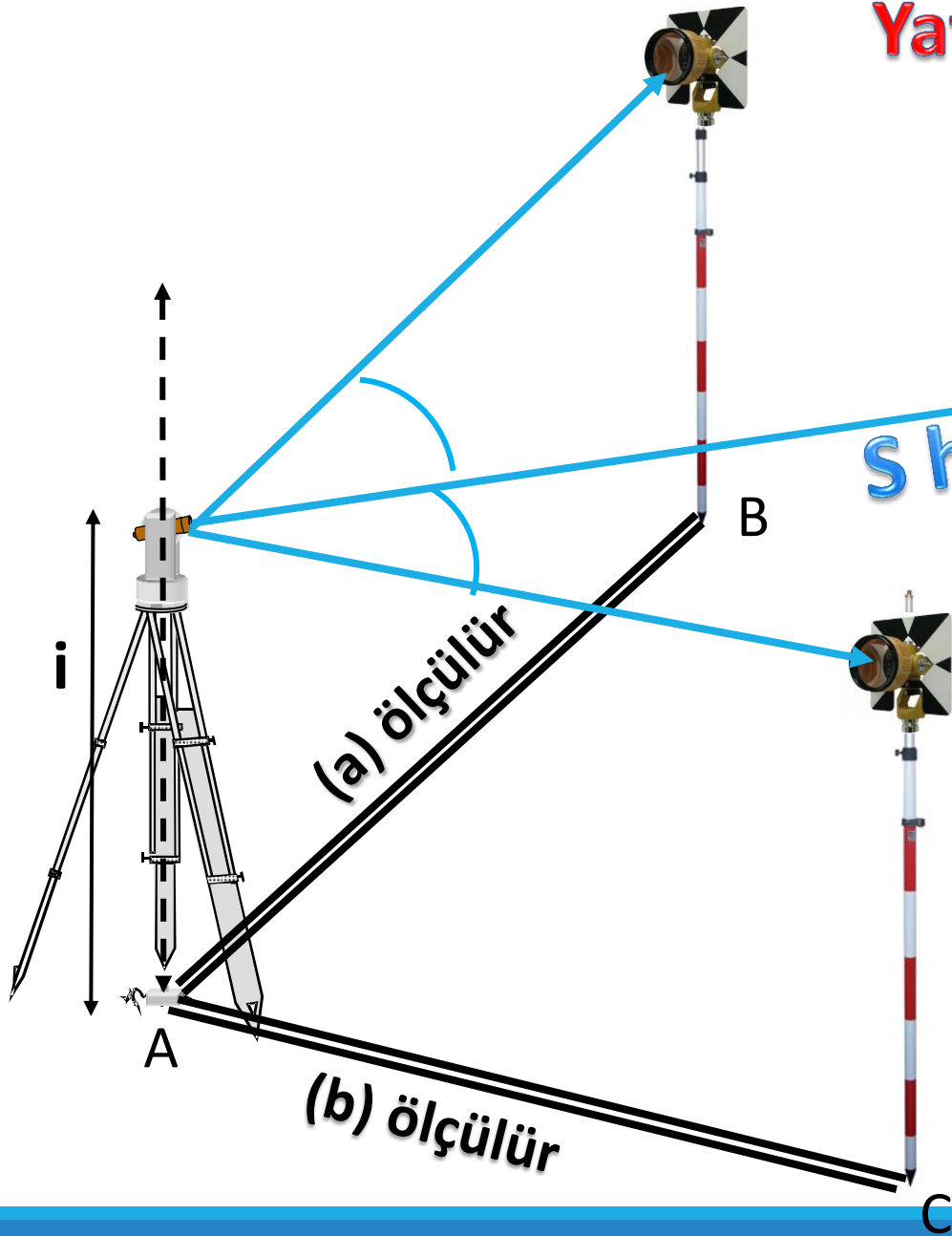
Yatay uzunluk (s) ölçülemiyorsa;



(s) ölçülemiyorsa;



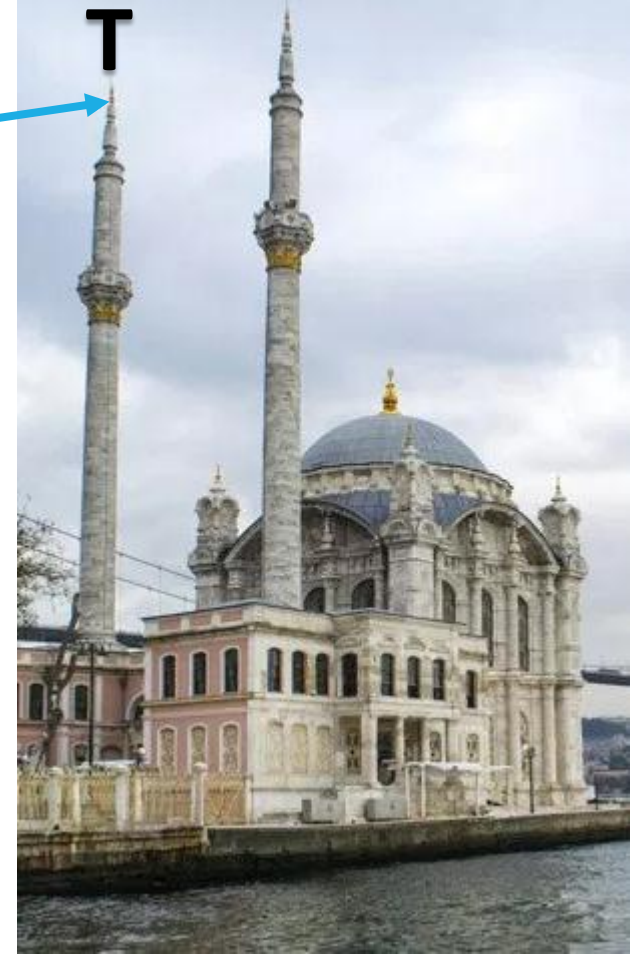
Yatay uzunluk (s) hesabı



s hesaplanır.

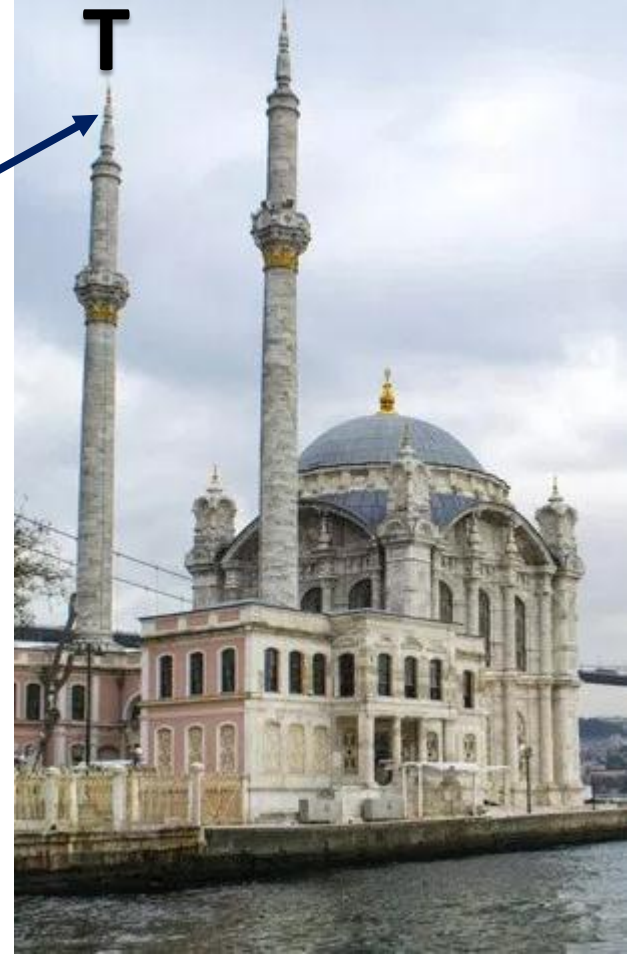
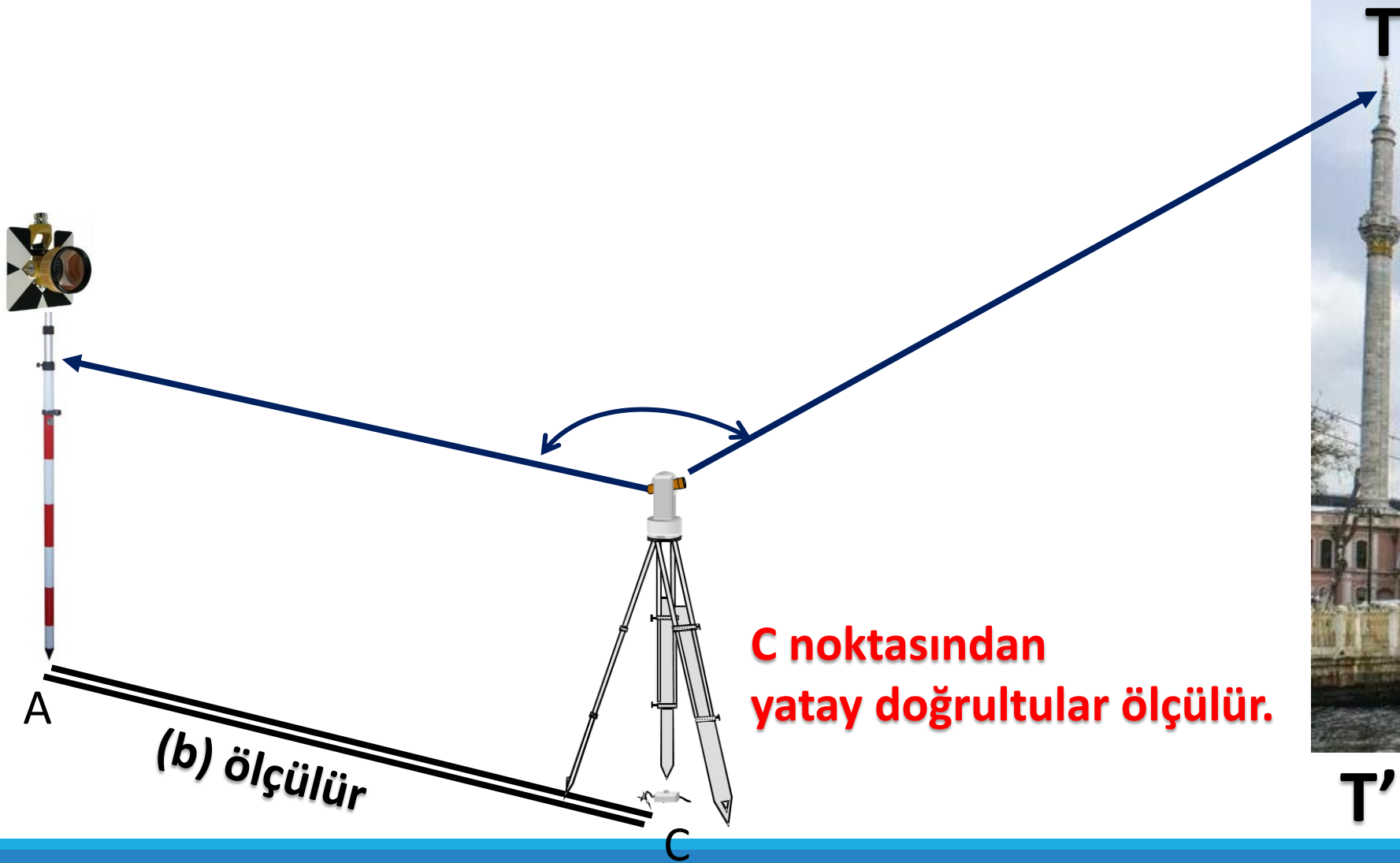
A noktasından
yatay doğrultular ölçülür.

a ve b kenarları ölçülür.

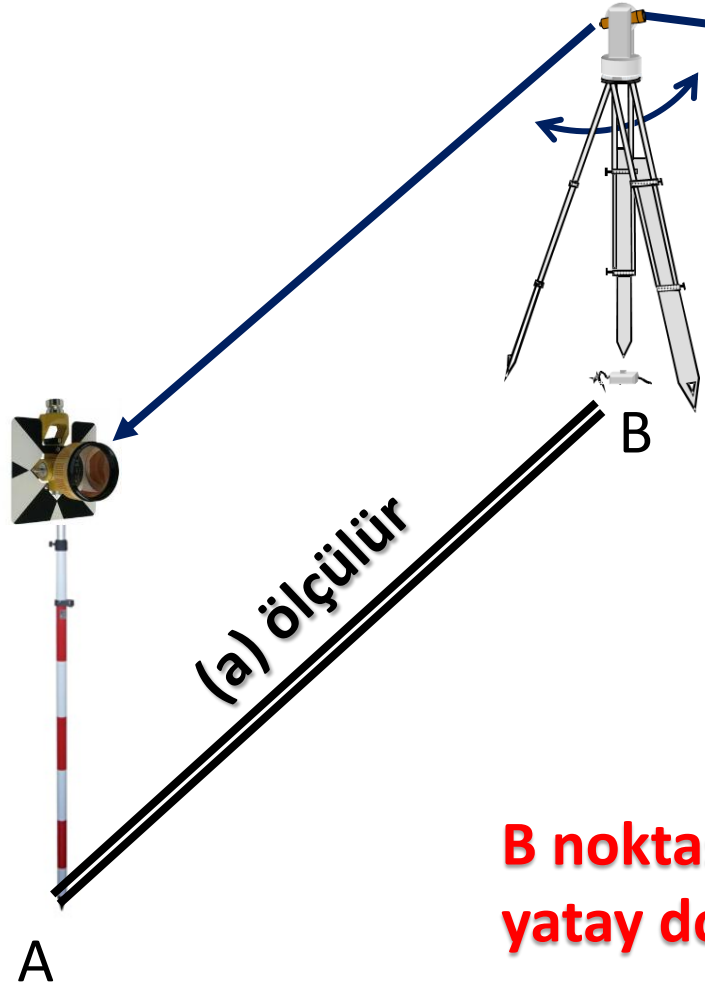


T'

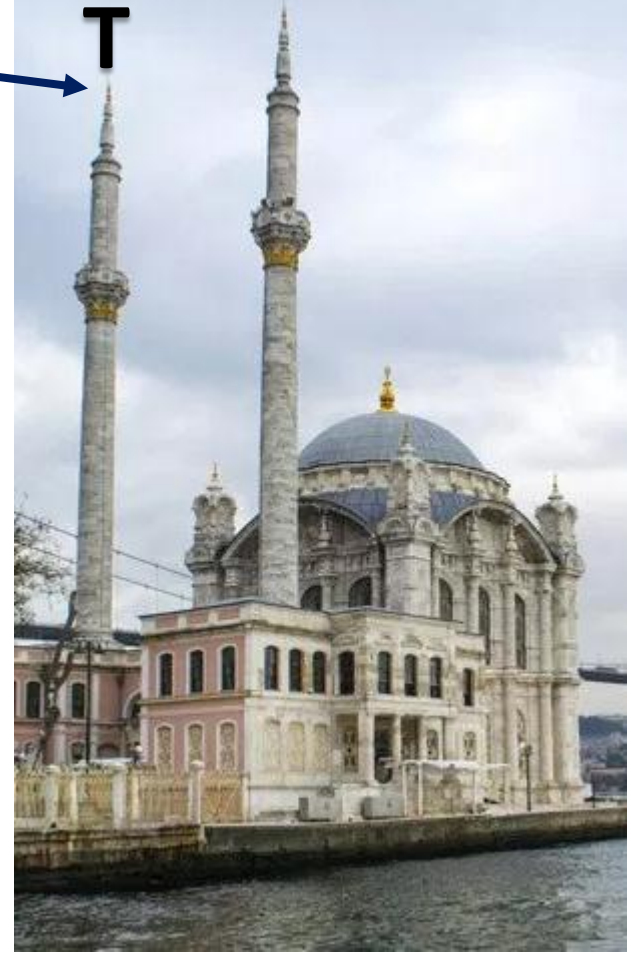
Yatay uzunluk (s) hesabı



Yatay uzunluk (s) hesabı

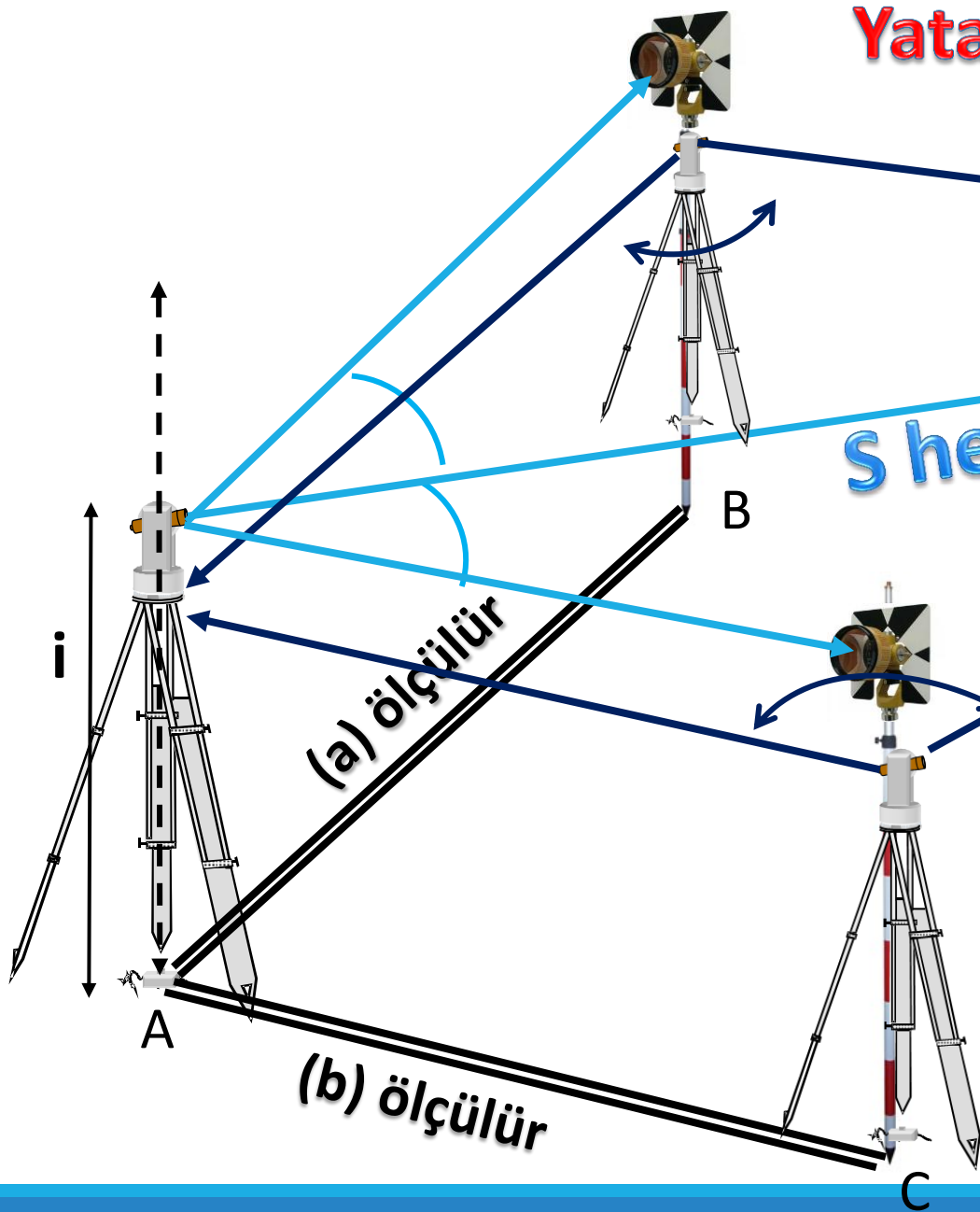


**B noktasından
yatay doğrultular ölçülür.**



T'

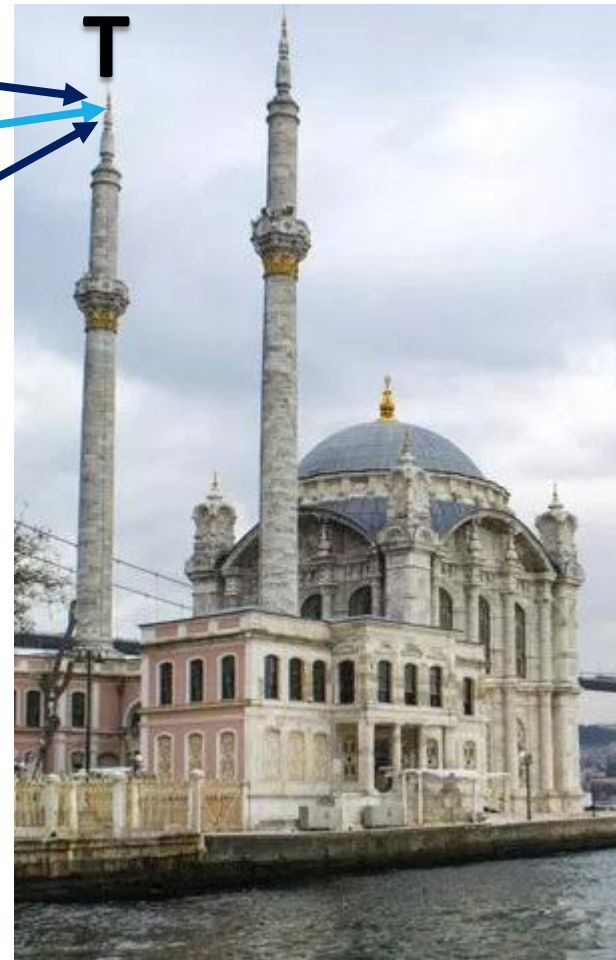
Yatay uzunluk (s) hesabı



s hesaplanır.

A, B ve C noktalarından
yatay doğrultular ölçülür.

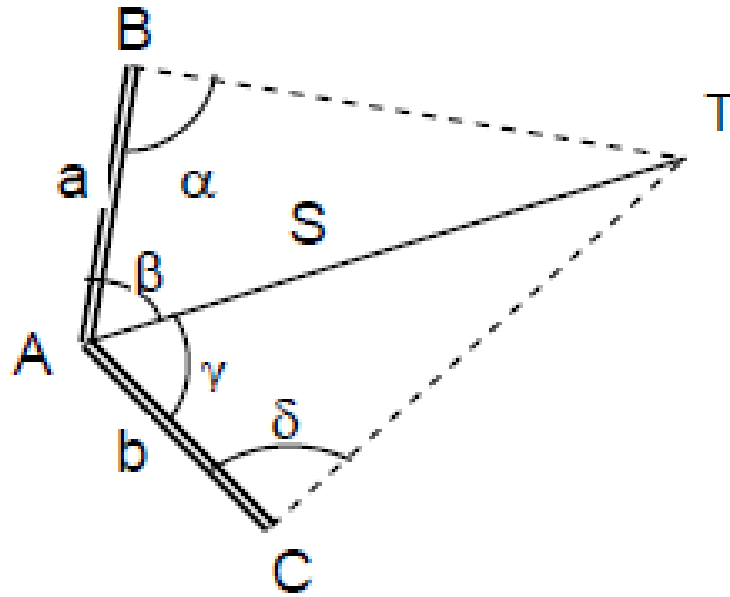
a ve b kenarları ölçülür.



T'

Kule Yüksekliği

Yatay uzunluk (s) ölçülemiyorsa;



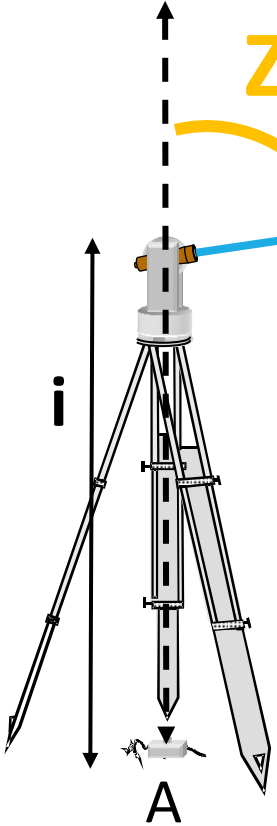
SİNÜS TEOREMİ

$$ABT \rightarrow S = a \cdot \frac{\sin \alpha}{\sin(\alpha + \beta)}$$

$$ATC \rightarrow S = b \cdot \frac{\sin \delta}{\sin(\gamma + \delta)}$$

S hesaplanır.

Kule Yüksekliği



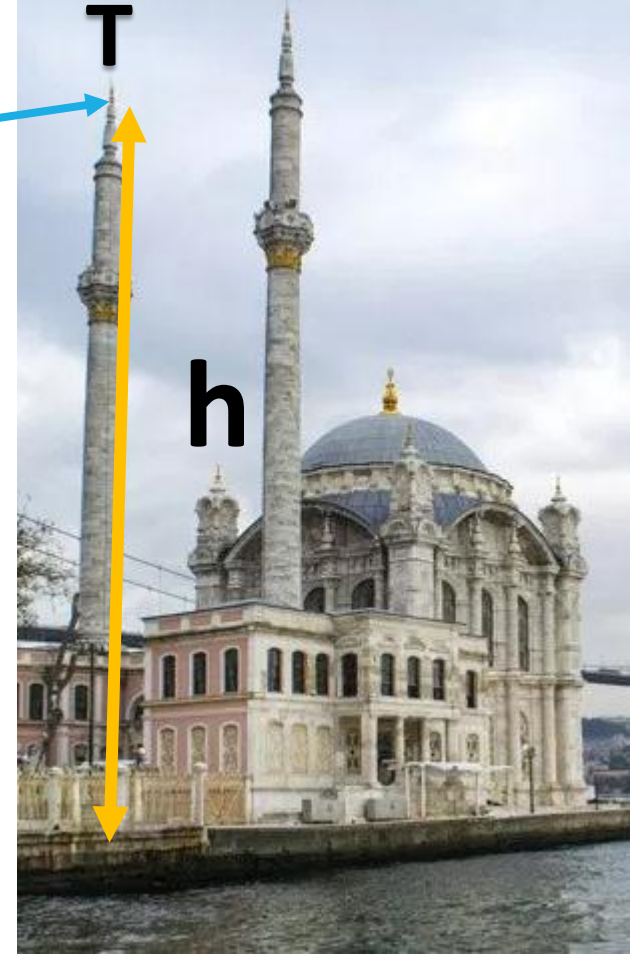
Düşey açı (Z) silsile yöntemiyle ölçülür.

T' noktasına kot verilir.

$$HT = HA + i + S \cdot \cot Z$$

$$h = HT - HT'$$

T'



Silsile Yöntemi İle Düşey Açı Ölçümü

(Hatırlatma Ölçme Bilgisi – 1)

DN	BN	Silsile No	Dübbün Durumu	Okunan Düşey Açı	δ (mgon)	Z 400-Z	Ortalama Z
A	B	1	I	95.7718	-3	95.7688	95.7689
			II	304.2342	-3	304.2312	
				400.0060		400.0000	
		2	I	95.7730	-4	95.7690	
			II	304.2350	-4	304.2310	
				400.0080		400.0000	
	C	1	I	107.3641	-3.5	107.3606	107.3601
			II	292.6429	-3.5	292.6394	
				400.0070		400.0000	
		2	I	107.3623	-2.7	107.3596	
			II	292.6431	-2.7	292.6404	
				400.0054	$\delta_{ort}=-3.3$	400.0000	

Düşey Açı Ölçümünde Ölçüm Belirsizliği

(Hatırlatma Ölçme Bilgisi – 1)

DN	BN	Silsile No	Dübbün Durumu	Okunan Düşey Açı	δ (mgon)	Z 400-Z	Ortalama Z	v_{δ} (mgon)	V_{δ}^2 (mgon)
A	B	1	I	95.7718	-3	95.7688	95.7689	-0.3	0.9
			II	304.2342	-3	304.2312			
				400.0060		400.0000			
		2	I	95.7730	-4	95.7690		0.7	4.9
			II	304.2350	-4	304.2310			
				400.0080		400.0000			
	C	1	I	107.3641	-3.5	107.3606	107.3601	0.2	0.4
			II	292.6429	-3.5	292.6394			
				400.0070		400.0000			
		2	I	107.3623	-2.7	107.3596		-0.6	3.6
			II	292.6431	-2.7	292.6404			
				400.0054	$\delta_{ort}=-3.3$	400.0000			

$$v_{\delta_i} = \frac{[\delta_i]}{n \cdot s} - \delta_i = \delta_{ort} - \delta_i$$

Düşey Açı Ölçümünde Ölçüm Belirsizliği

(Hatırlatma Ölçme Bilgisi – 1)

Bir silsile ölçülen düşey açının standart sapması

$$s_z = \sqrt{\frac{[v_\delta^2]}{n \cdot k - 1}} = \sqrt{\frac{9.8}{2 \cdot 2 - 1}} = 0.57 \text{ mgon}$$

n silsile ölçülen düşey açının standart sapması

$$S_z = \frac{s_z}{\sqrt{n}} = \frac{0.57}{\sqrt{2}} = 0.41 \text{ mgon}$$

u_z = Rastlantısal Hata + Sistemik Hata

$$u_z = \delta_R + \delta_S$$

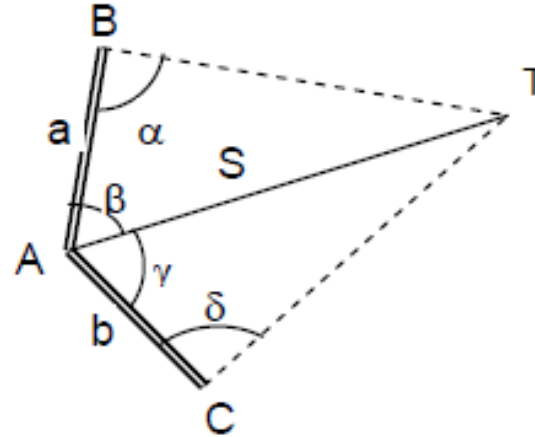
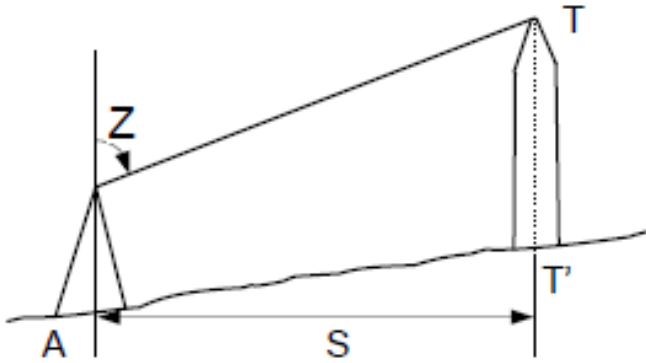
$$\delta_S = 0$$

$$u_z = \delta_R = S_z$$

$u_z = 0.41 \text{ mgon}$ %68 Güven alanı

Kule Yüksekliği

ÖRNEK-2



$$a = 28.15 \text{ m}$$

$$\alpha = 75^{\circ}.1428$$

$$b = 23.90 \text{ m}$$

$$\beta = 67.3920$$

$$Z = 95^{\circ}.1686$$

$$\gamma = 71.2675$$

$$i = 1.50 \text{ m}$$

$$\delta = 80.4750$$

$$H_A = 101.00 \text{ m}$$

$$H_T = 101.95 \text{ m}$$

$$h = ?$$

$$S = a \cdot \frac{\sin \alpha}{\sin(\alpha + \beta)} = 33.162 \text{ m}$$

$$S = b \cdot \frac{\sin \delta}{\sin(\gamma + \delta)} = 33.142 \text{ m}$$

$$S_{\text{ort}} = 33.152 \text{ m}$$

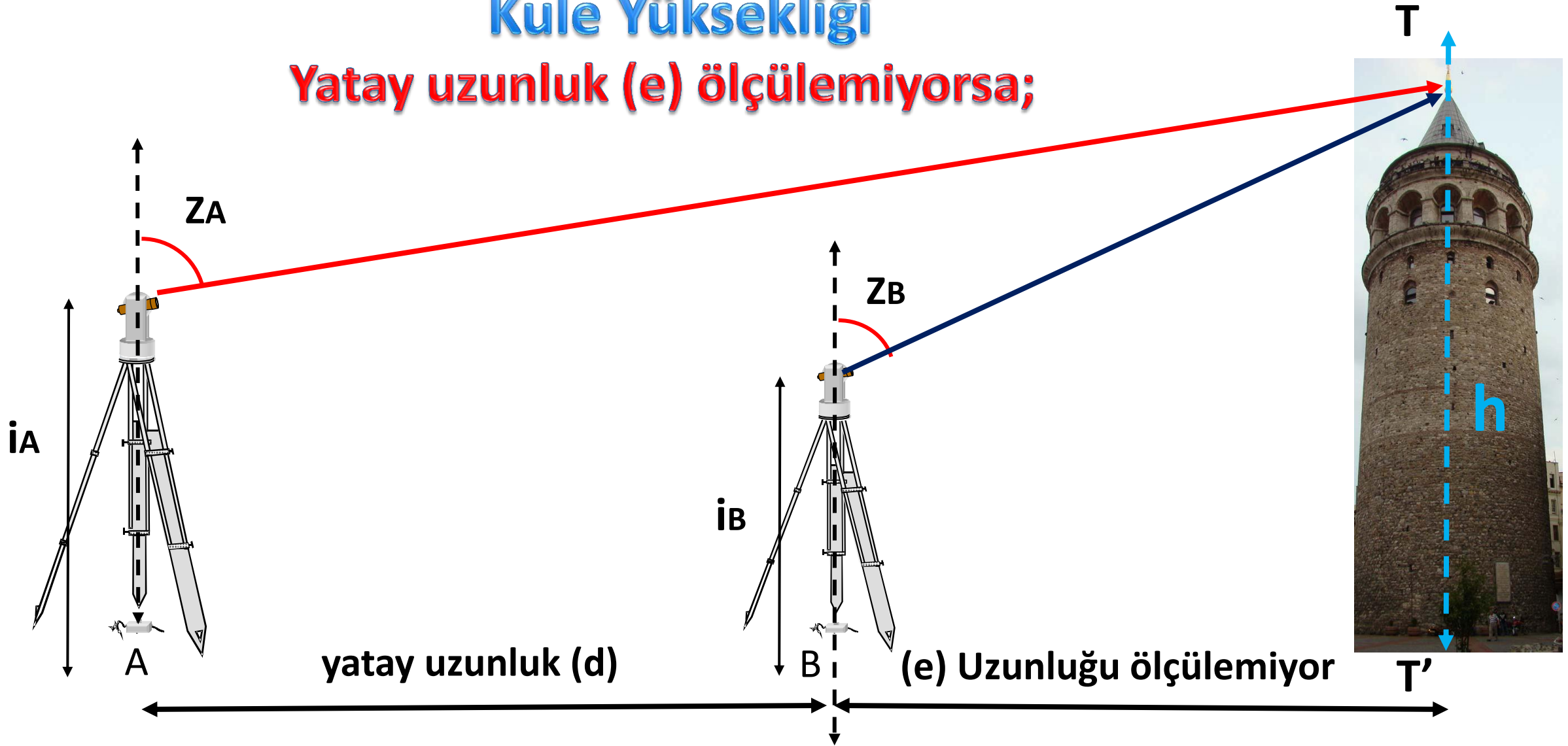
$$H_T = H_A + 1.50 + S \cdot \cot Z = 101.00 + 1.50 + 33.152 \cdot \cot 95^{\circ}.1686 =$$

$$= 101.00 + 1.50 + 2.52 = 105.02 \text{ m}$$

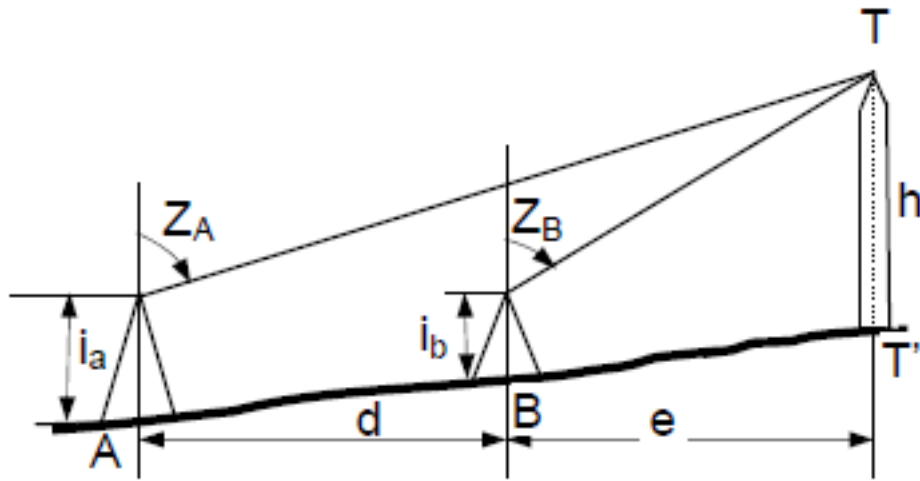
$$h = H_T - H_T = 105.02 - 101.95 = 3.07 \text{ m}$$

Kule Yüksekliği

Yatay uzunluk (e) ölçülemiyorsa;



Kule Yüksekliği



$$H_T = H_A + i_a + (d + e) \cot Z_A$$

$$H_T = H_B + i_b + e \cot Z_B$$

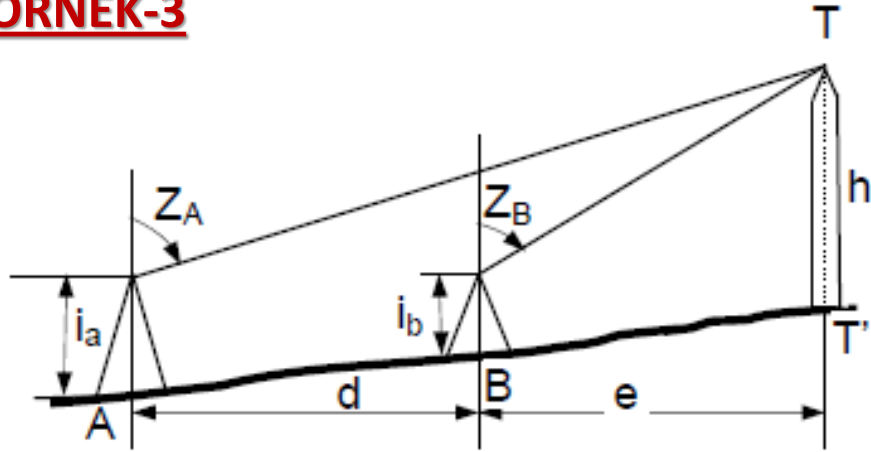
$$H_A + i_a + (d + e) \cot Z_A = H_B + i_b + e \cot Z_B$$

$$e \cot Z_A - e \cot Z_B = H_B + i_b - H_A - i_a - d \cot Z_A$$

$$e = \frac{H_B - H_A + i_b - i_a - d \cdot \cot Z_A}{\cot Z_A - \cot Z_B}$$

Kule Yüksekliği

ÖRNEK-3



$$Z_A = 82^{\circ}.1694$$

$$i_a = 1.55 \text{ m}$$

$$Z_B = 53^{\circ}.4961$$

$$i_b = 1.42 \text{ m}$$

$$H_A = 100.00 \text{ m}$$

$$d = 42.76 \text{ m}$$

$$H_B = 102.15 \text{ m}$$

$$h = ?$$

$$H_{T'} = 105.24 \text{ m}$$

$$e = \frac{H_B - H_A + i_b - i_a - d \cdot \cot Z_A}{\cot Z_A - \cot Z_B} = \frac{102.15 - 100.00 + 1.42 - 1.55 - 42.76 \cdot \cot 82.1694}{\cot 82.1694 - \cot 53.4961}$$

$$e = \frac{-10.27963822}{-0.6081415692} = 16.903 \text{ m}$$

$$H_T = H_A + i_a + (d + e) \cdot \cot Z_A$$

$$H_T = H_B + i_b + e \cdot \cot Z_B$$

$$H_A + i_a + (d + e) \cdot \cot Z_A = H_B + i_b + e \cdot \cot Z_B$$

$$\text{Hesap} \rightarrow H_T = 100.00 + 1.55 + (42.76 + 16.90) \cdot \cot 82.1694 = 118.712 \text{ m}$$

$$\text{Kontrol} \rightarrow H_T = 102.15 + 1.42 + 16.90 \cdot \cot 53.4961 = 118.709 \text{ m}$$

$$h = H_T - H_{T'} = 118.71 - 105.24 = 13.47 \text{ m}$$

3-KARŞILIKLİ TRİGONOMETRİK NİVELMAN
