СВЕТЛЕЧКИ ОТСЕЧКИ – ЛИНИСКИ ИЗВОРИ

$$\mathrm{d}E_{\mathrm{T}} = I'_{\alpha\gamma}\,\frac{\cos\beta}{\overline{\mathrm{DT}}^2}\,\mathrm{d}x = I'_{\alpha\gamma}\,\frac{\cos\beta}{r^2}\,\mathrm{d}x$$

$$E_{\mathrm{T}} = \int_0^d \frac{I'_{\alpha\gamma}\cdot\cos\beta}{r^2}\cdot\mathrm{d}x$$

$$\cos\gamma = \frac{\overline{\mathrm{A_1T}}}{r} \Rightarrow r = \frac{h}{\cos\alpha\cdot\cos\gamma}$$

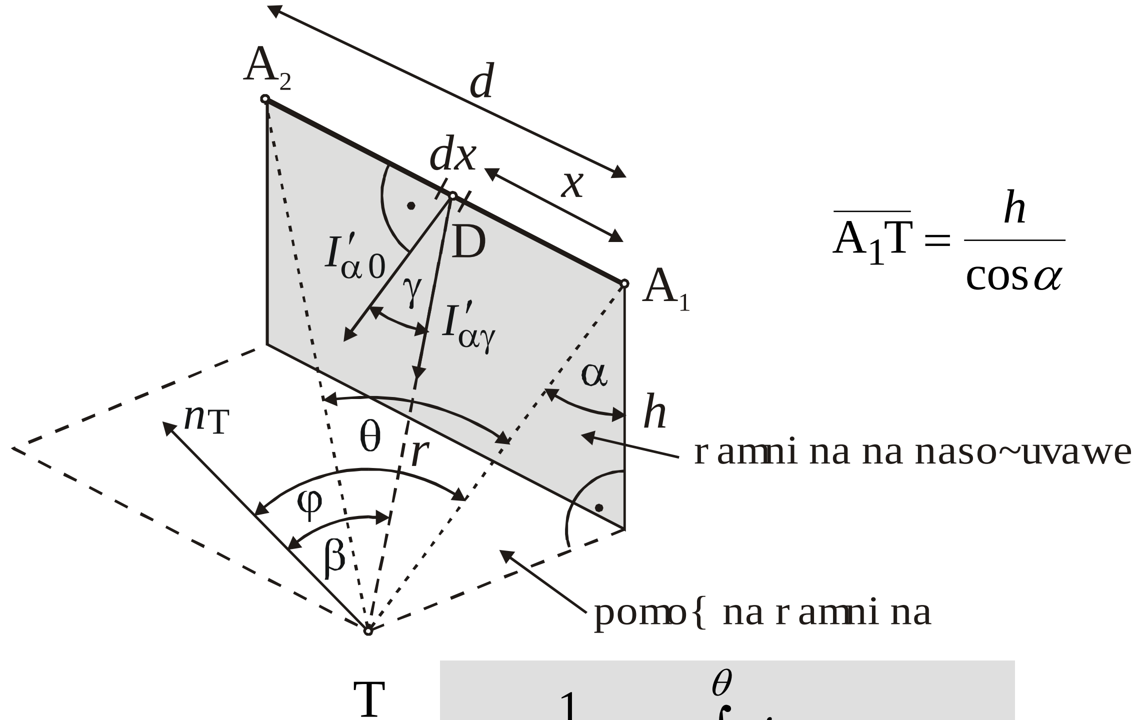
$$\tan\gamma = \frac{x}{\overline{\mathrm{A_1T}}} \Rightarrow x = \frac{h}{\cos\alpha}\cdot\tan\gamma$$

$$\mathrm{d}x = \frac{h\cdot\mathrm{d}\gamma}{\cos\alpha\cdot\cos^2\gamma}$$

$$\mathrm{d}E = \frac{I'_{\alpha\gamma}}{h}\cdot\cos\alpha\cdot\cos\beta\cdot\mathrm{d}\gamma$$

$$\theta = \arctan\left(\frac{\overline{\mathrm{A_1A_2}}}{\overline{\mathrm{A_1T}}}\right) = \arctan\left(\frac{d}{\dfrac{h}{\cos\alpha}}\right) = \arctan\left(\frac{d}{h}\cdot\cos\alpha\right)$$

$$I'_{\alpha\gamma} = I'_{\alpha 0}\cdot\cos^s\gamma$$



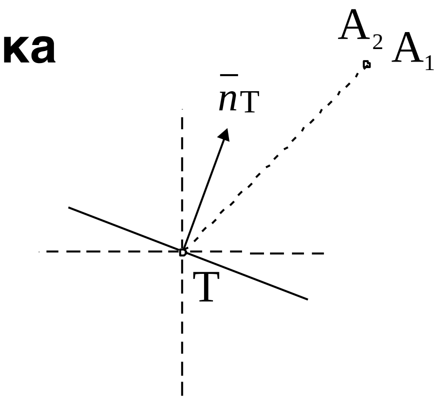
$$\overline{\mathrm{A_1T}} = \frac{h}{\cos\alpha}$$

$$E_{\mathrm{T}} = \frac{1}{h}\cdot\cos\alpha\int_0^{\theta} I'_{\alpha\gamma}\cdot\cos\beta\cdot\mathrm{d}\gamma$$

$$E = \frac{I'_{\alpha 0}}{h}\cdot\cos\alpha\cdot\int_0^{\theta}\cos\beta\cdot\cos^s\gamma\cdot\mathrm{d}\gamma$$

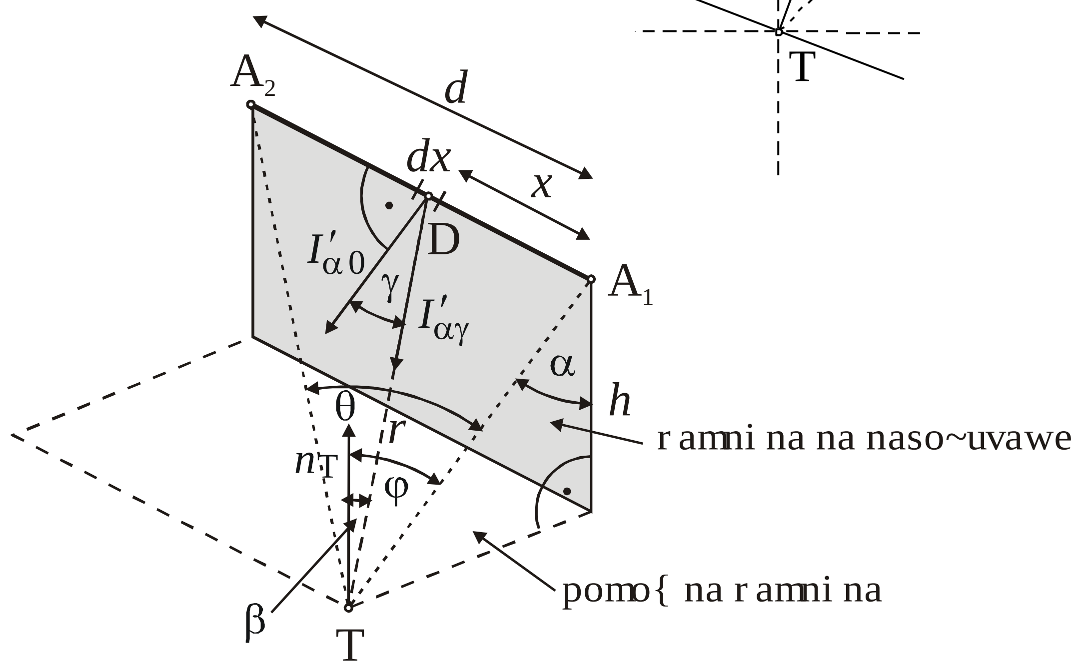
- **Најчести меѓусебни положби на осветлуваната рамнина и светлечката отсечка:**
  - осветлуваната рамнина е паралелна на светлечката отсечка
  - осветлуваната рамнина е нормална на светлечката отсечка

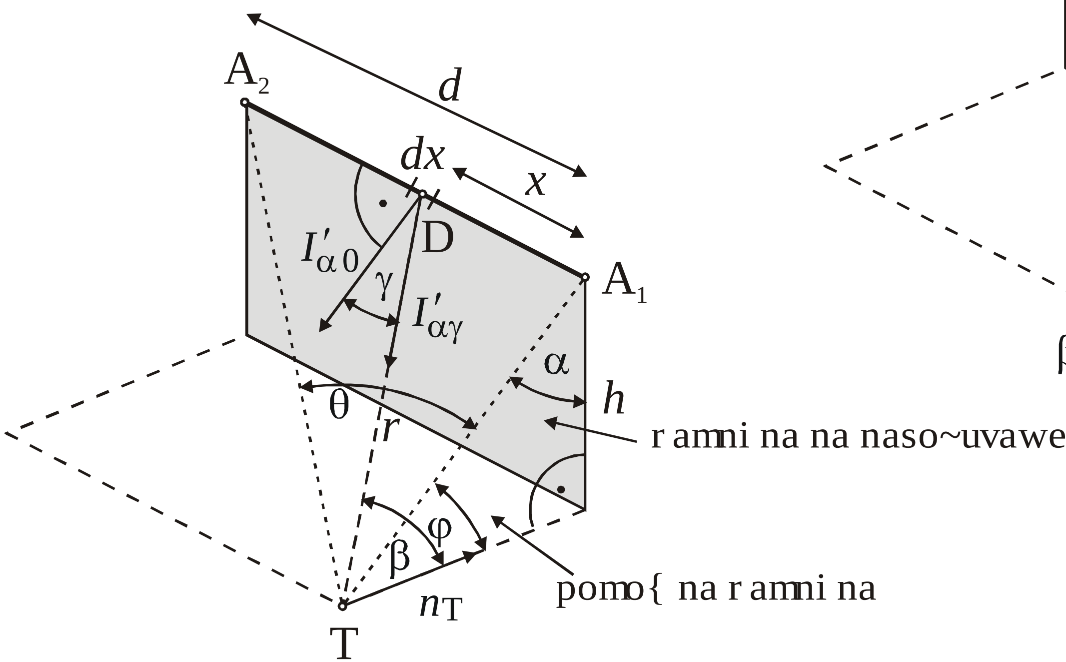
Осветлуваната рамнина е паралелна на светлечката отсечка



$$\cos\beta = \cos\gamma \cdot \cos\varphi.$$

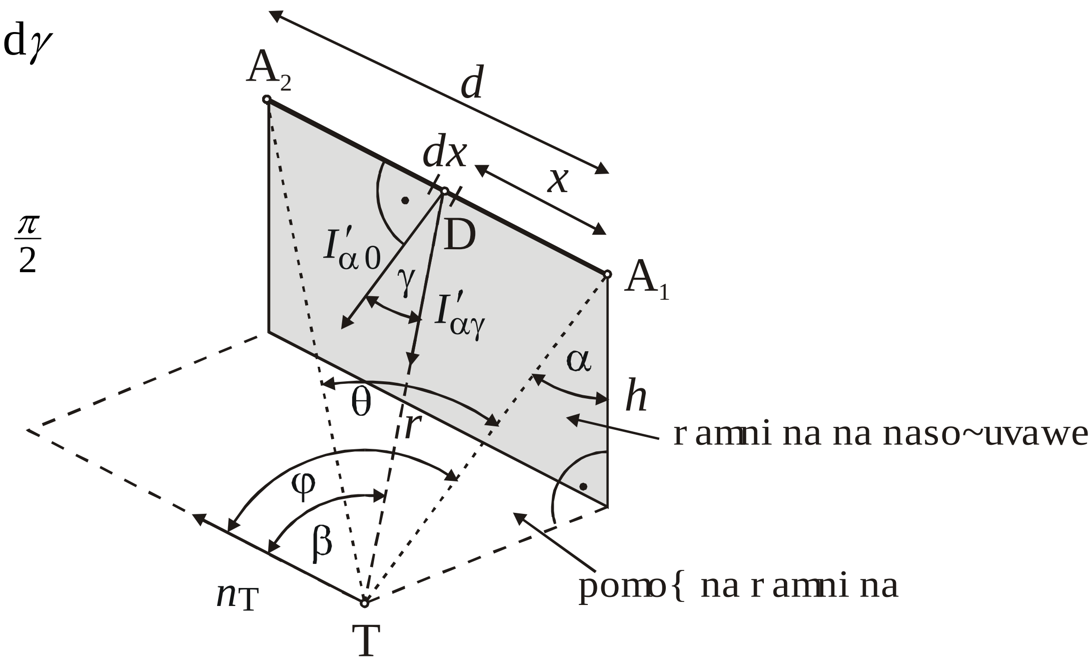
$$E = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_{0}^{\theta} \cos^{s+1}\gamma \cdot \mathrm{d}\gamma$$





Осветлуваната рамнина е нормална на светлечката отсечка

$$E = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \int_0^{\theta} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma$$

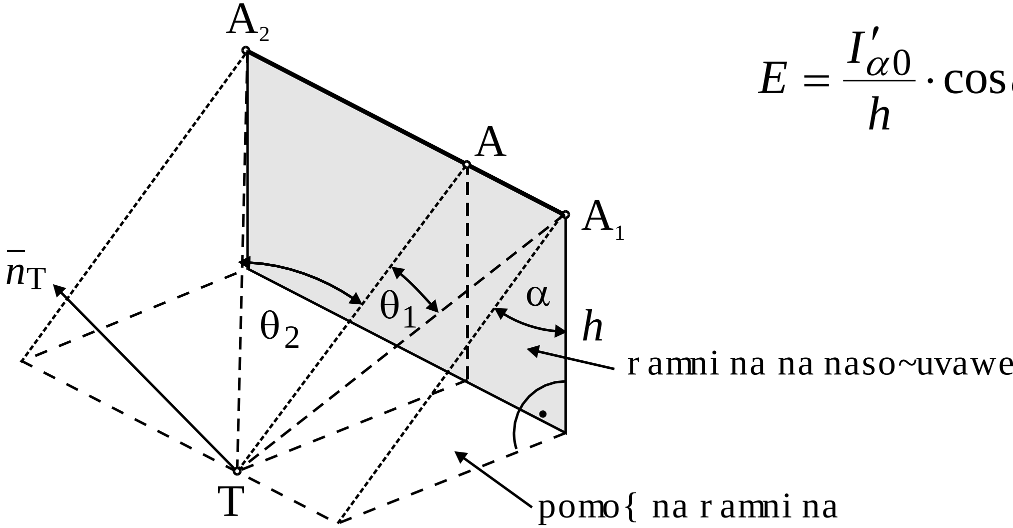


$$\beta + \gamma = \frac{\pi}{2} \qquad \varphi = \frac{\pi}{2}$$

$$\cos\beta = \sin\gamma$$

$$\mathrm{d}E = \frac{I'_{\alpha\gamma}}{h} \cdot \cos\alpha \cdot \sin\gamma \cdot \mathrm{d}\gamma$$

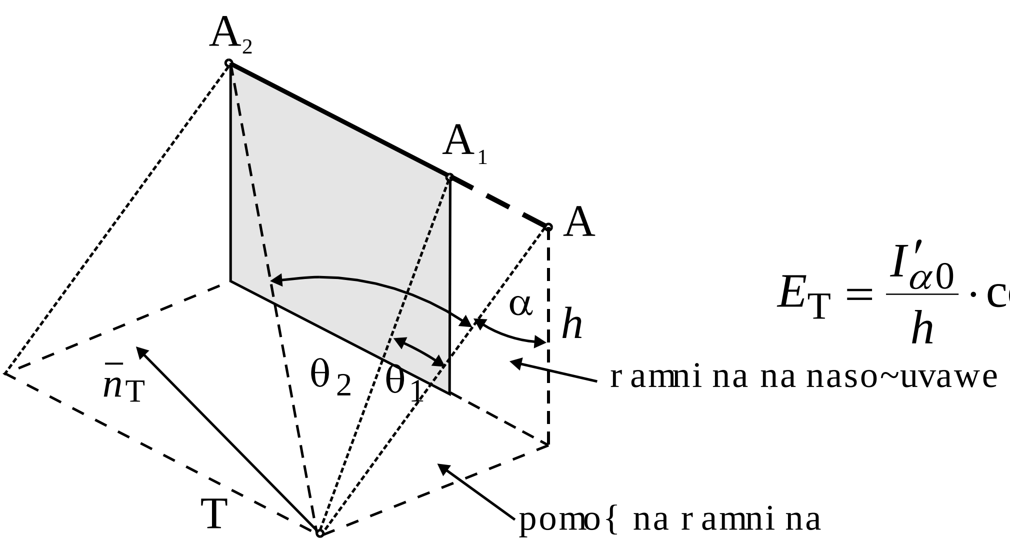
$$E = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \int_0^{\theta} \sin\gamma \cdot \cos^s \gamma \cdot \mathrm{d}\gamma$$



$$E = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \int_0^{\theta} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma$$

$$E_{\mathrm{T}} = E_{\mathrm{T}\left(\overline{\mathrm{AA}_1}\right)} + E_{\mathrm{T}\left(\overline{\mathrm{AA}_2}\right)}$$

$$E_{\mathrm{T}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \left(\int_0^{\theta_1} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma + \int_0^{\theta_2} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma \right)$$



$$E_{\mathrm{T}} = E_{\mathrm{T}\left(\overline{\mathrm{AA}_2}\right)} - E_{\mathrm{T}\left(\overline{\mathrm{AA}_1}\right)}$$

$$E_{\mathrm{T}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \left(\int_0^{\theta_2} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma - \int_0^{\theta_1} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma \right)$$

$$E_{\mathrm{T}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \left(\int_{\theta_1}^{\theta_2} \cos\beta \cdot \cos^s \gamma \cdot \mathrm{d}\gamma \right)$$

Задача 4.5.3 Коцка е поставена така што нејзините две страни се хоризонтални. Должината на работ на коцката е *a*=3 m. Четири еднакви светлечки отсечки се поставени така што се поклопуваат со рабовите на горната страна на коцката. За секој од изворите е познато дека во секоја рамнина што го содржи изворот максималната светлинска јачина изнесува 180 cd/m и дека сјајноста на изворот е еднаква во сите правци.

- Да се пресмета хоризонталната осветленост во темињата на коцката што лежат на долната страна на коцката (точки B).
- Да се пресмета хоризонталната осветленост во средиштето на коцката (точка T).

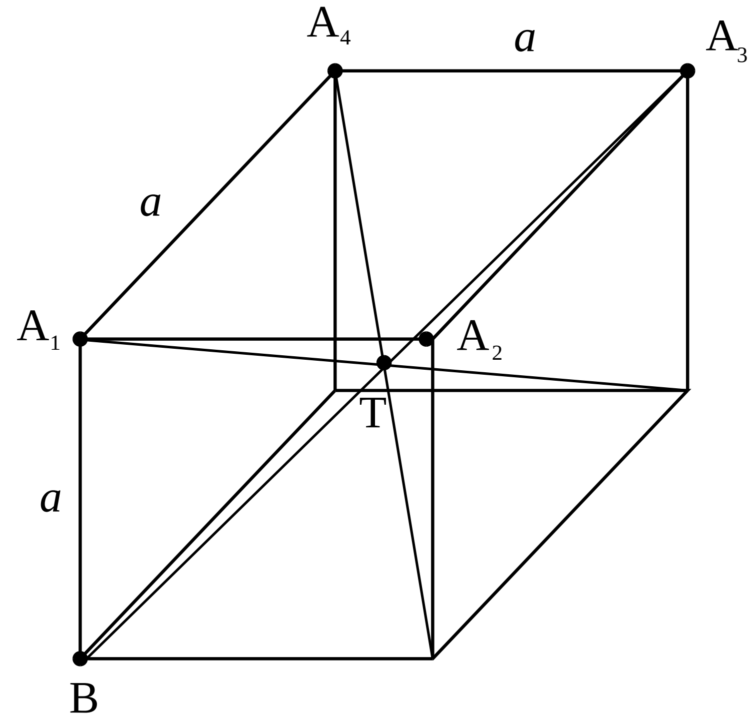
$$a = 3\ \mathrm{m};\ I'_{\alpha 0} = 180\ \mathrm{cd/m}$$

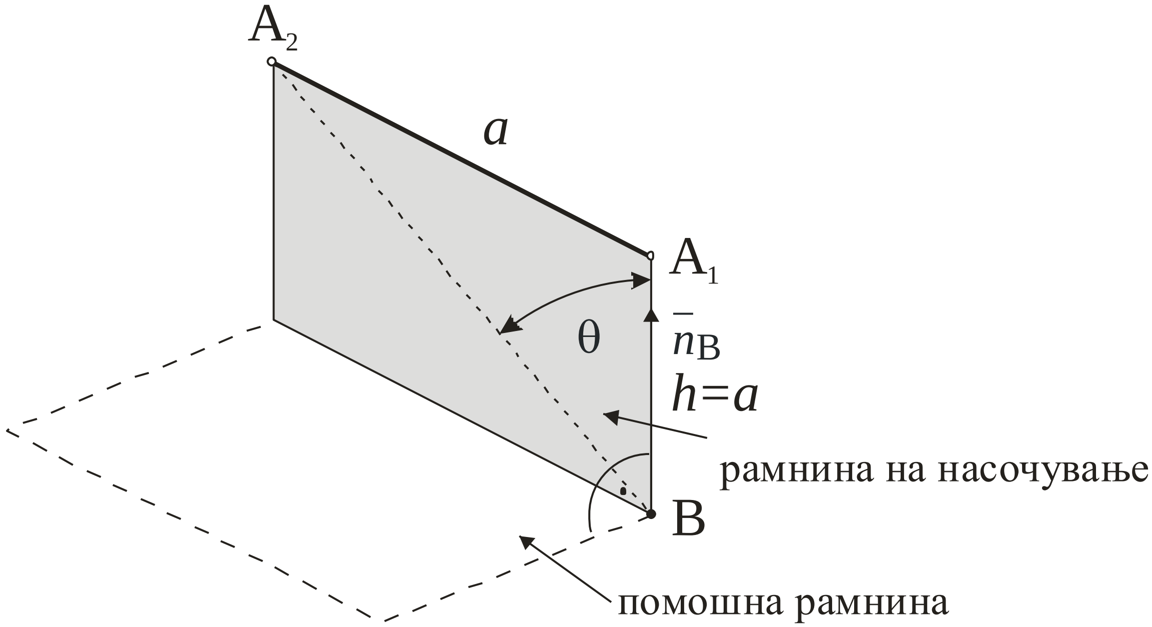
$$a)\ E_{\mathrm{B}} = ?\ b)\ E_{\mathrm{T}} = ?\ c)\ E_{\mathrm{T_{vert\cdot A_1A_2}}} = ?$$

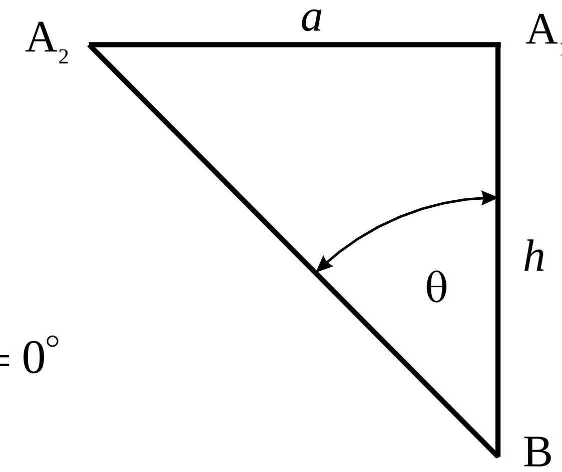
$$I'_{\alpha\gamma} = I'_{\alpha 0} \cdot \cos^s \gamma = I'_{\alpha 0} \cdot \cos\gamma$$

$$E_{\mathrm{B}} = E_{\mathrm{B_{A_1A_2}}} + E_{\mathrm{B_{A_1A_4}}} + E_{\mathrm{B_{A_2A_3}}} + E_{\mathrm{B_{A_3A_4}}}$$

$$E_{\mathrm{B}} = 2 \cdot E_{\mathrm{B_{A_1A_2}}} + 2 \cdot E_{\mathrm{B_{A_3A_4}}}$$







$$\alpha = \varphi = 0^\circ$$

$$h = a$$

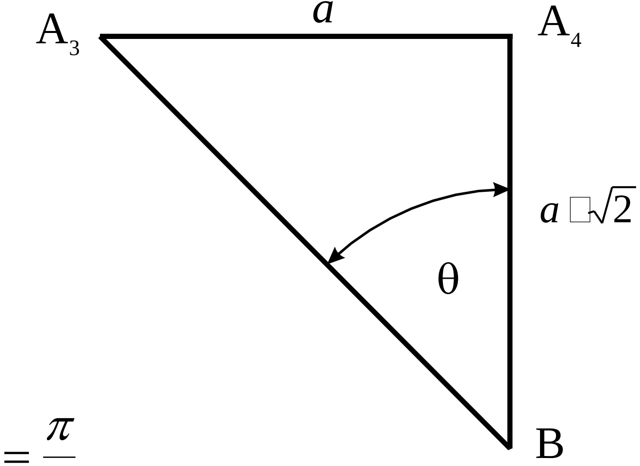
$$\theta = \arctan\frac{a}{h} = \frac{\pi}{4}$$

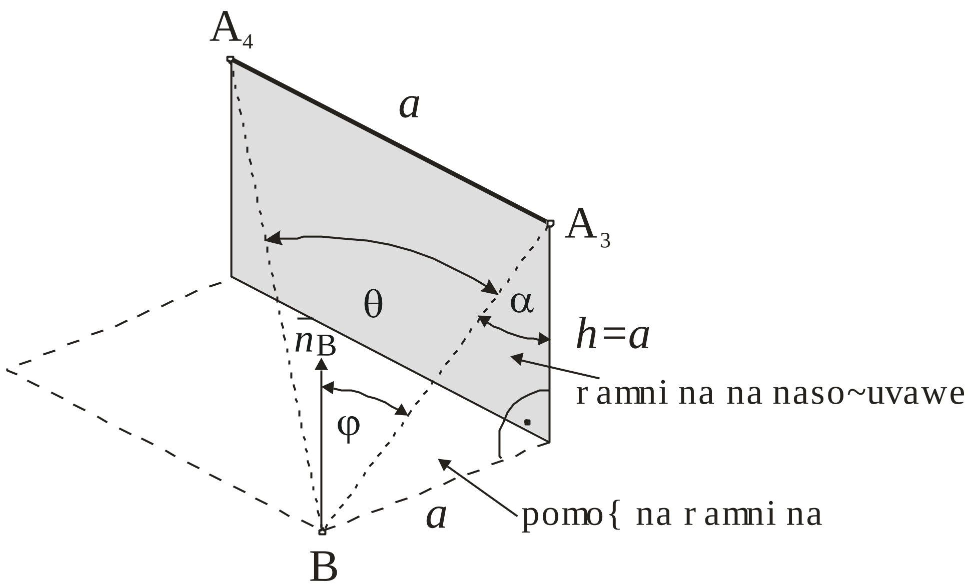
$$E_{\mathrm{B}_{\mathrm{A}_1\mathrm{A}_2}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_0^{\theta} \cos^{s+1}\gamma \cdot \mathrm{d}\gamma$$

$$E_{\mathrm{B}_{\mathrm{A}_1\mathrm{A}_2}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_0^{\theta} \cos^{2}\gamma \cdot \mathrm{d}\gamma = \frac{180}{3} \cdot \cos 0 \cdot \cos 0 \cdot \int_0^{\theta} \frac{1+\cos 2\gamma}{2} \cdot \mathrm{d}\gamma$$

$$E_{\mathrm{B}_{\mathrm{A}_1\mathrm{A}_2}} = 60 \cdot \left(\frac{\gamma}{2} + \frac{\sin 2\gamma}{4}\right)\Bigg|_0^{\theta} = 60 \cdot \left(\frac{\pi}{8} + \frac{\sin\frac{\pi}{2}}{4}\right) = 38{,}6\ \mathrm{lx}$$

$$E_{\mathrm{B}_{\mathrm{A}_3\mathrm{A}_4}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_0^{\theta} \cos^{s+1}\gamma \cdot \mathrm{d}\gamma$$





$$\alpha = \varphi = \frac{\pi}{4}$$

$$h = a$$

$$\theta = \arctan\frac{a}{a \cdot \sqrt{2}} = 0{,}6155 \text{ rad}$$

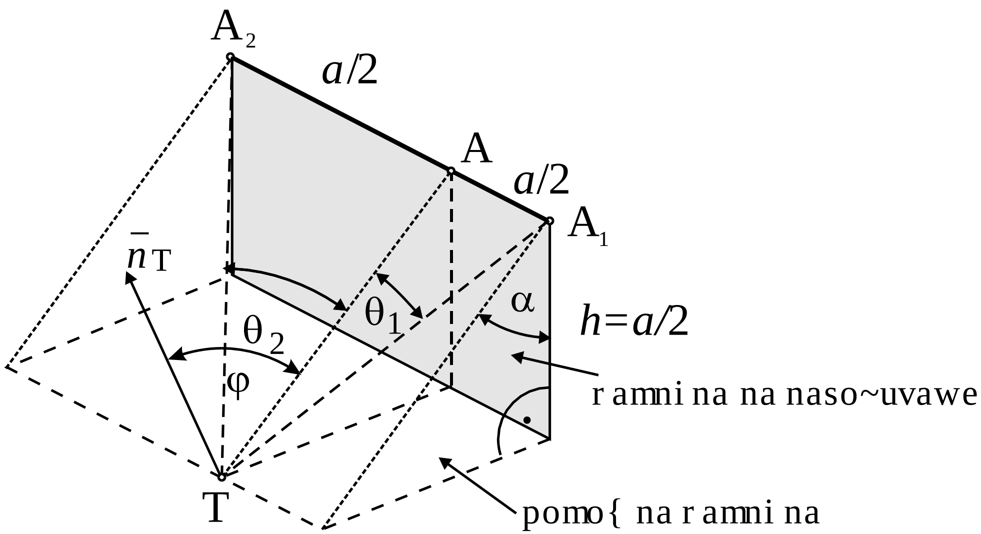
$$E_{\mathrm{B}_{\mathrm{A}_3\mathrm{A}_4}} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_0^{\theta} \cos^{2}\gamma \cdot \mathrm{d}\gamma = \frac{180}{3} \cdot \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2}}{2} \cdot \int_0^{\theta} \frac{1+\cos 2\gamma}{2} \cdot \mathrm{d}\gamma$$

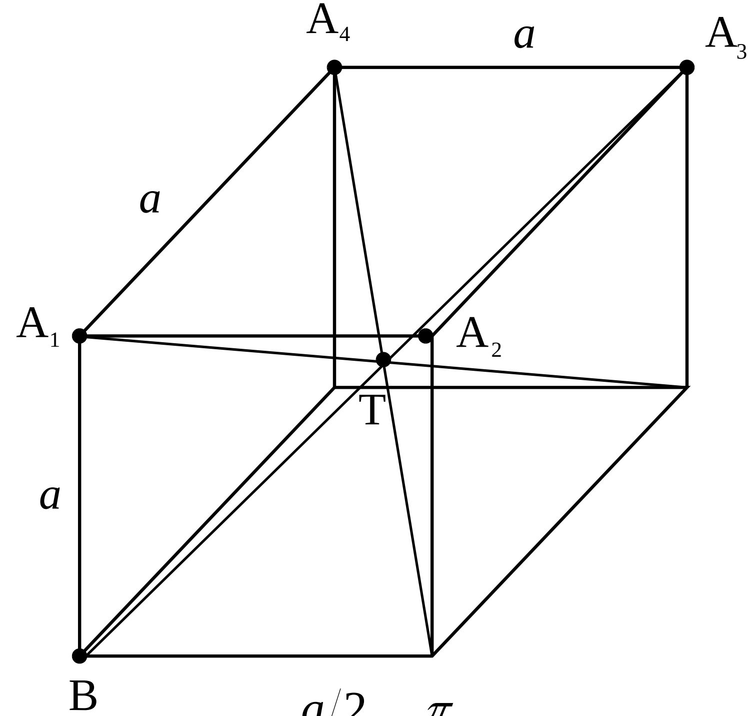
$$E_{\mathrm{B}_{\mathrm{A}_3\mathrm{A}_4}} = 30 \cdot \left(\frac{\gamma}{2} + \frac{\sin 2\gamma}{4} \right) \Bigg|_0^{\theta} = 30 \cdot \left(\frac{0{,}6155}{2} + \frac{\sin 1{,}2310}{4} \right) = 16{,}3 \text{ lx}$$

$$E_{\mathrm{B}} = 2 \cdot E_{\mathrm{B}_{\mathrm{A}_1\mathrm{A}_2}} + 2 \cdot E_{\mathrm{B}_{\mathrm{A}_3\mathrm{A}_4}} = 2 \cdot 38{,}6 + 2 \cdot 16{,}3 = 109{,}8 \text{ lx}$$

$$E_T = E_{TA_1A_2} + E_{TA_1A_4} + E_{TA_2A_4} + E_{TA_3A_4} = 4 \cdot E_{TA_1A_2}$$

$$E_T = 4 \cdot \left(E_{TAA_1} + E_{TAA_2} \right) = 8 \cdot E_{TAA_1}$$





$$\alpha = \varphi = \arctan \frac{a/2}{h} = \frac{\pi}{4}$$

$$h = \frac{a}{2}$$

$$\theta_1 = \theta_2 = \arctan \frac{a/2}{a \cdot \sqrt{2}/2} = 0{,}6155 \text{ rad}$$

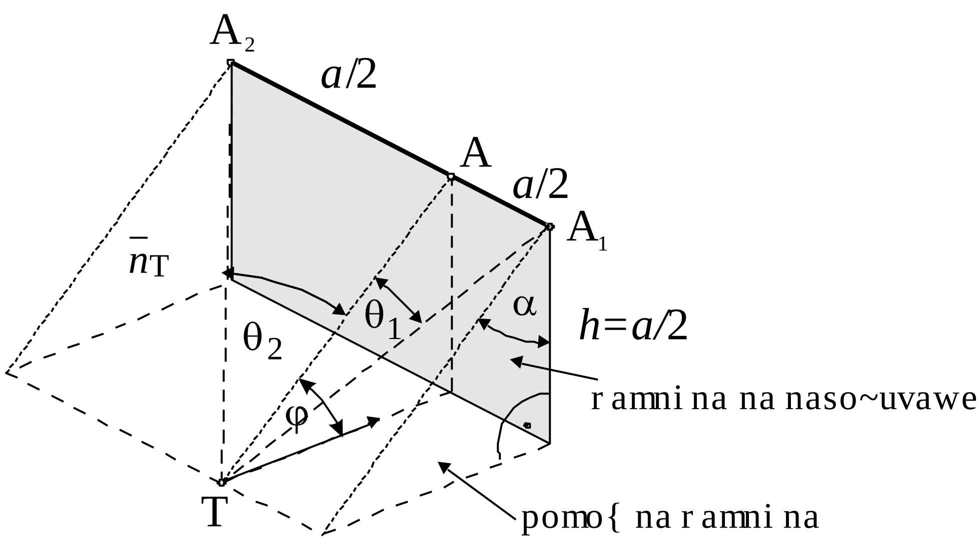
$$E_{TAA_1} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_0^{\theta} \cos^2\gamma \cdot \mathrm{d}\gamma = \frac{180}{1{,}5} \cdot \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2}}{2} \cdot \int_0^{\theta_1} \frac{1+\cos 2\gamma}{2} \cdot \mathrm{d}\gamma$$

$$E_{TAA_1} = 60 \cdot \left(\frac{\gamma}{2} + \frac{\sin 2\gamma}{4} \right) \Bigg|_0^{\theta_1} = 60 \cdot \left(\frac{0{,}6155}{2} + \frac{\sin 1{,}2310}{4} \right) = 32{,}6 \text{ lx}$$

$$E_T = 8 \cdot E_{TAA_1} = 8 \cdot 32{,}6 \approx 261 \text{ lx}$$

c) вертикална осветленост во Т ако вертикалната рамнина е паралелна на отсечката и точката е осветлена само од две отсечки паралелни на неа

$$E_{\mathrm{T_{vert.A_1A_2}}} = 2 \cdot E_{\mathrm{T_{vert.AA_2}}}$$



$$\alpha = \varphi = \arctan\frac{a/2}{h} = \frac{\pi}{4}$$

$$h = \frac{a}{2}$$

$$\theta_1 = \theta_2 = \arctan\frac{a/2}{a\cdot\sqrt{2}/2} = 0{,}6155 \text{ rad}$$

$$E_{\mathrm{T_{vert.A_1A_2}}} = 2 \cdot E_{\mathrm{T_{vert.AA_2}}} = 2\cdot\frac{180}{1{,}5}\cdot\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{2}}{2}\cdot\int_0^{\theta_1}\frac{1+\cos 2\gamma}{2}\cdot \mathrm{d}\gamma$$

$$E_{\mathrm{T_{vert.A_1A_2}}} = 120\cdot\left(\frac{0{,}6155}{2}+\frac{\sin 1{,}2310}{4}\right) = 65{,}2 \text{ lx}$$

Напомена: Бидејќи максималната светлинска јачина во сите рамнини што ја содржат светлечката отсечка е еднаква, изборот на референтната рамнина (рамнината на насочување) е произволен. Во сите три случаја може да се избере рамнината на насочување да поминува низ точките во коишто пресметуваме осветленост:

$a)$

$$\alpha = \varphi = 0^\circ \qquad h = a \qquad \theta = \arctan\frac{a}{h} = \frac{\pi}{4}$$

$$E_{\mathrm{B_{A_1A_2}}} = 60 \cdot \left(\frac{\gamma}{2} + \frac{\sin 2\gamma}{4}\right)\Bigg|_0^\theta = 60 \cdot \left(\frac{\pi}{8} + \frac{\sin\frac{\pi}{2}}{4}\right) = 38{,}6\ \mathrm{lx}$$

$$\alpha = 0 \qquad \varphi = \frac{\pi}{4} \qquad h = a\cdot\sqrt{2} \qquad \theta = \arctan\frac{a}{h} = \arctan\frac{1}{\sqrt{2}} = 0{,}6155$$

$$E_{\mathrm{B_{A_3A_4}}} = \frac{I'_{\alpha 0}}{h}\cdot\cos\alpha\cdot\cos\varphi\cdot\int_0^\theta \cos^2\gamma\cdot \mathrm{d}\gamma = \frac{180}{3\cdot\sqrt{2}}\cdot\cos 0\cdot\cos\frac{\pi}{4}\cdot\int_0^\theta \frac{1+\cos 2\gamma}{2}\cdot\mathrm{d}\gamma$$

$$E_{\mathrm{B_{A_3A_4}}} = \frac{180}{3\cdot\sqrt{2}}\cdot\cos 0\cdot\cos\frac{\pi}{4}\cdot\left(\frac{0{,}6155}{2} + \frac{\sin 1{,}2310}{4}\right) = 30\cdot\left(\frac{0{,}6155}{2} + \frac{\sin 1{,}2310}{4}\right) = 16{,}3\ \mathrm{lx}$$

$$E_{\mathrm{B}} = 2\cdot E_{\mathrm{B_{A_1A_2}}} + 2\cdot E_{\mathrm{B_{A_3A_4}}} = 2\cdot 38{,}6 + 2\cdot 16{,}3 = 109{,}8\ \mathrm{lx}$$

$b)$ $h=\frac{a\cdot\sqrt{2}}{2}$ $\alpha=0$ $\varphi=\arccos\frac{a/2}{h}=\frac{\pi}{4}$ $\theta_1=\theta_2=\arctan\frac{a/2}{a\cdot\sqrt{2}/2}=0{,}6155\ \text{rad}$

$$E_{\mathrm{T}}=4\cdot\left(E_{\mathrm{T_{AA_1}}}+E_{\mathrm{T_{AA_2}}}\right)=8\cdot E_{\mathrm{T_{AA_1}}}$$

$$E_{\mathrm{T_{AA_1}}}=\frac{I'_{\alpha 0}}{h}\cdot\cos\alpha\cdot\cos\varphi\cdot\int_0^{\theta}\cos^2\gamma\cdot\mathrm{d}\gamma=\frac{180}{1{,}5\cdot\sqrt{2}}\cdot 1\cdot\frac{\sqrt{2}}{2}\cdot\int_0^{\theta_1}\frac{1+\cos 2\gamma}{2}\cdot\mathrm{d}\gamma$$

$$E_{\mathrm{T_{AA_1}}}=60\cdot\left(\frac{\gamma}{2}+\frac{\sin 2\gamma}{4}\right)\Bigg|_0^{\theta_1}=60\cdot\left(\frac{0{,}6155}{2}+\frac{\sin 1{,}2310}{4}\right)=32{,}6\ \text{lx}$$

$c)$ $h=\frac{a}{2}\cdot\sqrt{2}$ $\alpha=0$ $\varphi=\arccos\frac{a/2}{h}=\frac{\pi}{4}$ $\theta_1=\theta_2=\arctan\frac{a/2}{a\cdot\sqrt{2}/2}=0{,}6155\ \text{rad}$

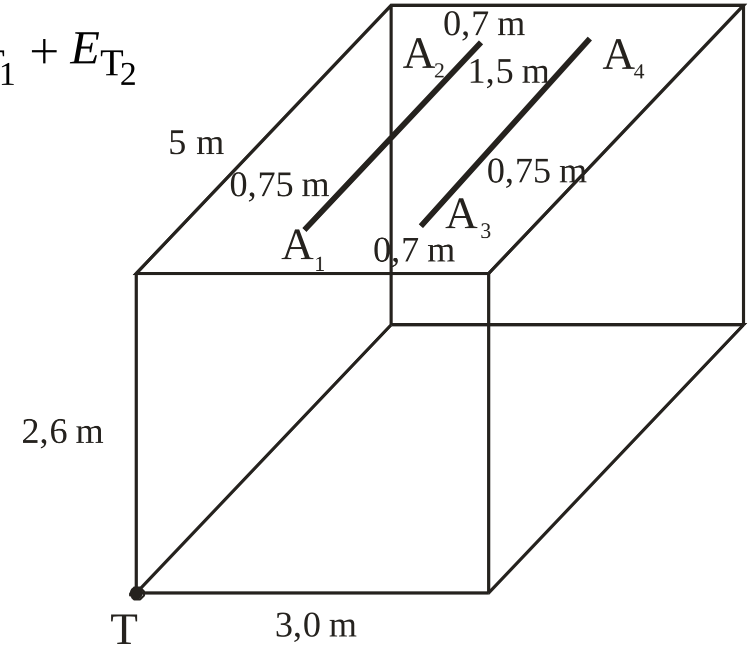
$$E_{\mathrm{T_{vert\cdot A_1A_2}}}=2\cdot E_{\mathrm{T_{vert\cdot AA_2}}}$$

$$E_{\mathrm{T_{vert\cdot A_1A_2}}}=2\cdot E_{\mathrm{T_{vert\cdot AA_2}}}=2\cdot\frac{180}{1{,}5\cdot\sqrt{2}}\cdot 1\cdot\frac{\sqrt{2}}{2}\cdot\int_0^{\theta_1}\frac{1+\cos 2\gamma}{2}\cdot\mathrm{d}\gamma$$

$$E_{\mathrm{T_{vert\cdot A_1A_2}}}=120\cdot\left(\frac{0{,}6155}{2}+\frac{\sin 1{,}2310}{4}\right)=65{,}2\ \text{lx}$$

Задача 4.5.8

$$E_{T} = E_{T_{A_1A_2}} + E_{T_{A_3A_4}} = E_{T_1} + E_{T_2}$$



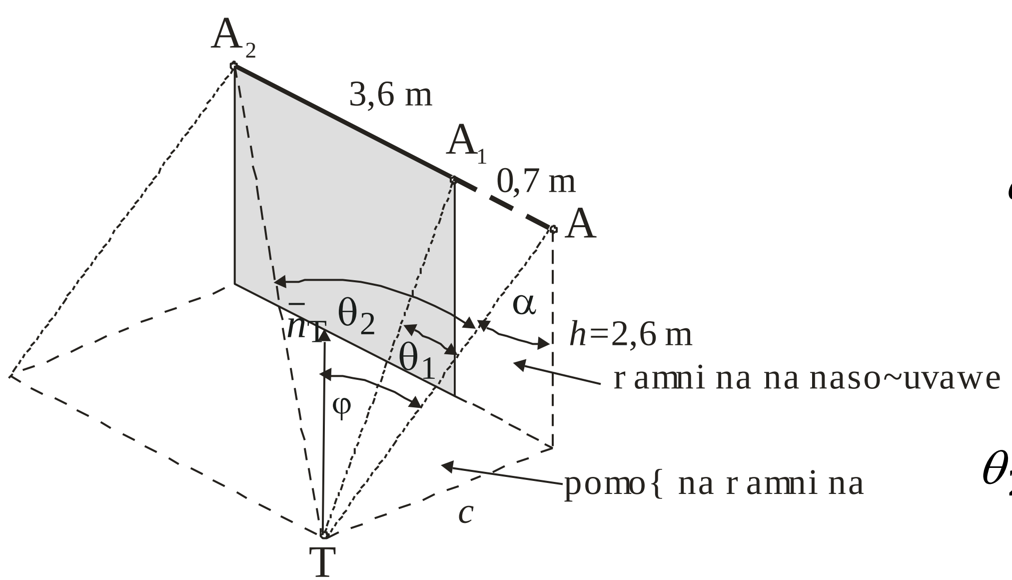
$$\Phi_{\text{si j.}} = 3200 \text{ lm}$$

$$\Phi = \pi^2 \cdot I_{\max} = \pi^2 \cdot I_{\alpha 0}$$

$$I_{\alpha 0} = \frac{\Phi}{\pi^2} = \frac{3200}{\pi^2} = 324,23 \text{ cd}$$

$$I'_{\alpha 0} = \frac{I_{\alpha 0}}{1,2} = \frac{324,23}{1,2} \approx 270 \text{ cd/m}$$

Осветленост од отсечката A_1A_2



$$\overline{AT} = \sqrt{h^2 + c^2} = \sqrt{2,6^2 + 0,75^2} \approx 2,7 \text{ m}$$

$$\alpha = \varphi = \arctan\frac{c}{h} = \arctan\frac{0,75}{2,6} = 0,2808 \text{ rad}$$

$$\theta_1 = \arctan\frac{0,7}{\overline{\overline{AT}}} = \arctan\frac{0,7}{2,7} = 0,2537 \text{ rad}$$

$$\theta_2 = \arctan\frac{0,7 + 3,6}{\overline{AT}} = \arctan\frac{4,3}{2,7} = 1,0101 \text{ rad}$$

$$E_{T_1} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_{\theta_1}^{\theta_2} \cos^2\gamma \cdot d\gamma = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_{\theta_1}^{\theta_2} \frac{1+\cos 2\gamma}{2} \cdot d\gamma$$

$$E_{T_1} = \frac{270}{2,6} \cdot \cos^2 0,2808 \cdot \left(\frac{\gamma}{2} + \frac{\sin 2\gamma}{4} \right) \Bigg|_{\theta_1}^{\theta_2}$$

$$E_{T_1} = \frac{270}{2,6} \cdot \cos^2 0,2808 \cdot \left(\frac{\theta_2 - \theta_1}{2} + \frac{\sin 2\theta_2 - \sin 2\theta_1}{4} \right) \quad E_{T_1} = \frac{270}{2,6} \cdot \cos^2 0,2808 \cdot 0,4819 = 46,2 \text{ lx}$$

Осветленост од отсечката A_3A_4

$$\overline{AT} = \sqrt{h^2 + c^2} = \sqrt{2,6^2 + 2,25^2} \approx 3,4 \text{ m} \qquad \alpha = \varphi = \arctan\frac{c}{h} = \arctan\frac{2,25}{2,6} = 0,7134 \text{ rad}$$

$$\theta_1 = \arctan\frac{0,7}{\overline{\overline{AT}}} = \arctan\frac{0,7}{3,4} = 0,2030 \text{ rad} \qquad \theta_2 = \arctan\frac{0,7+3,6}{\overline{AT}} = \arctan\frac{4,3}{3,4} = 0,9018 \text{ rad}$$

$$E_{T_2} = \frac{I'_{\alpha 0}}{h} \cdot \cos\alpha \cdot \cos\varphi \cdot \int_{\theta_1}^{\theta_2} \frac{1+\cos 2\gamma}{2} \cdot d\gamma = \frac{270}{2,6} \cdot \cos^2 0,7134 \cdot \left(\frac{\gamma}{2} + \frac{\sin 2\gamma}{4} \right) \Bigg|_{\theta_1}^{\theta_2}$$

$$E_{T_2} = 47,14 \cdot \left(\frac{\theta_2 - \theta_1}{2} + \frac{\sin 2\theta_2 - \sin 2\theta_1}{4} \right) \quad E_{T_2} = 47,14 \cdot 0,4939 = 23,3 \text{ lx}$$

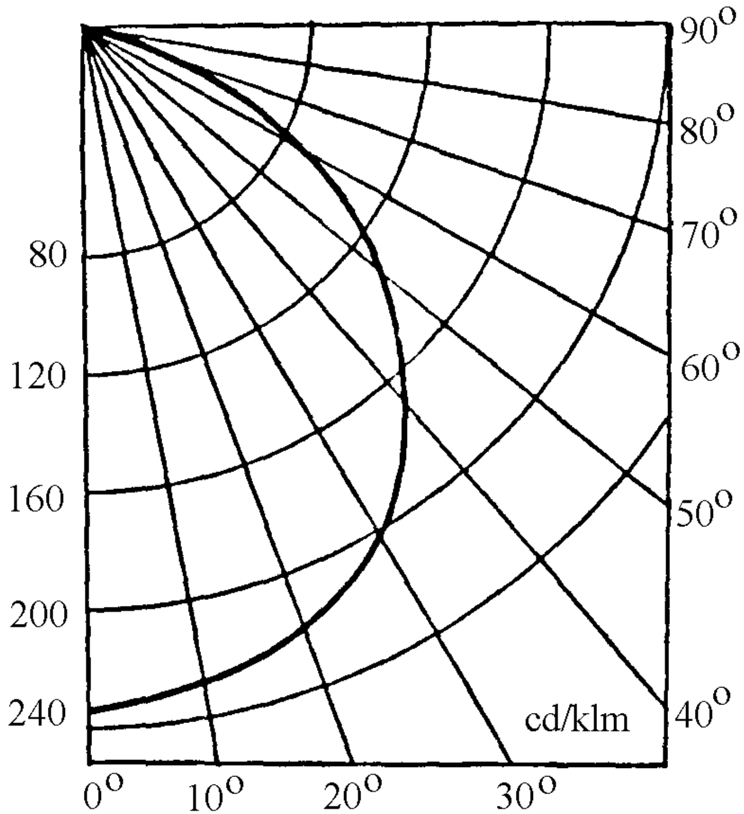
$$E_T = E_{T_1} + E_{T_2} = 46,2 + 23,3 = 69,5 \text{ lx}$$

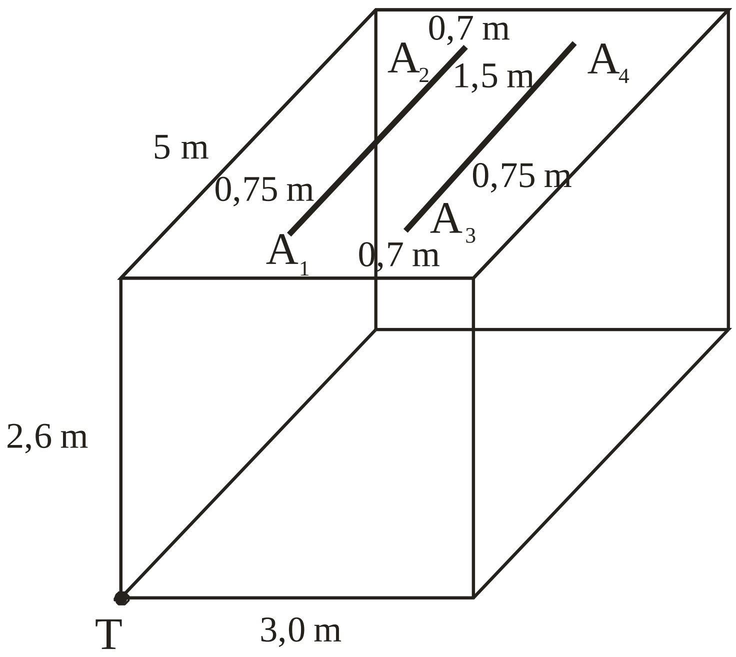
Задача 4.5.9

$$E_T = E_{T_{A_1A_2}} + E_{T_{A_3A_4}} = E_{T_1} + E_{T_2}$$

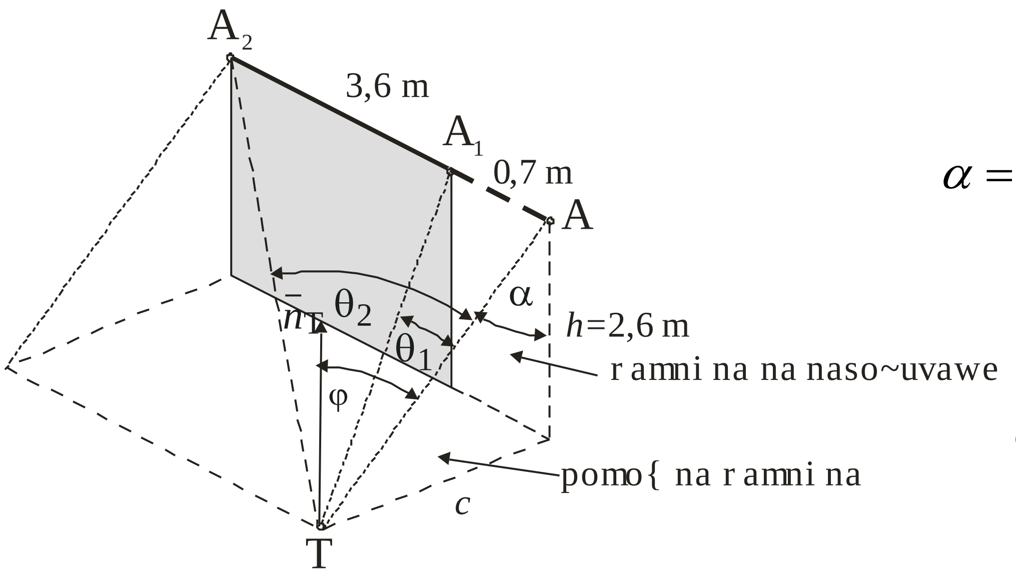
$$\Phi_{\text{si j.}} = 3200 \text{ lm}$$

$$I'_{\alpha 0} = \frac{I_{\alpha 0}}{1,2} = \frac{3,2 \cdot I_{\alpha(1000 \text{ lm})}}{1,2}$$





Осветленост од отсечката A_1A_2



$$\overline{\mathrm{AT}} = \sqrt{h^2 + c^2} = \sqrt{2{,}6^2 + 0{,}75^2} \approx 2{,}7\ \mathrm{m}$$

$$\alpha = \varphi = \arctan\frac{c}{h} = \arctan\frac{0{,}75}{2{,}6} = 0{,}2808\ \mathrm{rad} = 16^\circ$$

$$\theta_1 = \arctan\frac{0{,}7}{\overline{\mathrm{AT}}} = \arctan\frac{0{,}7}{2{,}7} = 0{,}2537\ \mathrm{rad}$$

$$\theta_2 = \arctan\frac{0{,}7+3{,}6}{\overline{\mathrm{AT}}} = \arctan\frac{4{,}3}{2{,}7} = 1{,}0101\ \mathrm{rad}$$

$$I'_{16;0} = \frac{I_{16;0}}{1{,}2} = \frac{3{,}2\cdot 225}{1{,}2} = 600\ \mathrm{cd/m}$$

$$E_{\mathrm{T}_1} = \frac{I'_{\alpha 0}}{h}\cdot\cos\alpha\cdot\cos\varphi\cdot\int_{\theta_1}^{\theta_2}\cos^2\gamma\cdot\mathrm{d}\gamma = \frac{I'_{\alpha 0}}{h}\cdot\cos\alpha\cdot\cos\varphi\cdot\int_{\theta_1}^{\theta_2}\frac{1+\cos 2\gamma}{2}\cdot\mathrm{d}\gamma$$

$$E_{\mathrm{T}_1} = \frac{600}{2{,}6}\cdot\cos^2 0{,}2808\cdot\left(\frac{\gamma}{2}+\frac{\sin 2\gamma}{4}\right)\Bigg|_{\theta_1}^{\theta_2}$$

$$E_{\mathrm{T}_1} = \frac{600}{2{,}6}\cdot\cos^2 0{,}2808\cdot\left(\frac{\theta_2-\theta_1}{2}+\frac{\sin 2\theta_2-\sin 2\theta_1}{4}\right) \quad E_{\mathrm{T}_1} = \frac{600}{2{,}6}\cdot\cos^2 0{,}2808\cdot 0{,}4819 = 102{,}2\ \mathrm{lx}$$

Осветленост од отсечката A_3A_4

$$\overline{\mathrm{AT}} = \sqrt{h^2 + c^2} = \sqrt{2{,}6^2 + 2{,}25^2} \approx 3{,}4\ \mathrm{m} \quad \alpha = \varphi = \arctan\frac{c}{h} = \arctan\frac{2{,}25}{2{,}6} = 0{,}7134\ \mathrm{rad} \approx 40^\circ$$

$$\theta_1 = \arctan\frac{0{,}7}{\overline{\mathrm{AT}}} = \arctan\frac{0{,}7}{3{,}4} = 0{,}2030\ \mathrm{rad} \quad \theta_2 = \arctan\frac{0{,}7+3{,}6}{\overline{\mathrm{AT}}} = \arctan\frac{4{,}3}{3{,}4} = 0{,}9018\ \mathrm{rad}$$

$$I'_{40;0} = \frac{I_{40;0}}{1{,}2} = \frac{3{,}2\cdot 170}{1{,}2} = 453\ \mathrm{cd/m}$$

$$E_{\mathrm{T}_2} = \frac{I'_{\alpha 0}}{h}\cdot\cos\alpha\cdot\cos\varphi\cdot\int_{\theta_1}^{\theta_2}\frac{1+\cos 2\gamma}{2}\cdot \mathrm{d}\gamma = \frac{453}{2{,}6}\cdot\cos^2 0{,}7134\cdot\left(\frac{\gamma}{2}+\frac{\sin 2\gamma}{4}\right)\Bigg|_{\theta_1}^{\theta_2}$$

$$E_{\mathrm{T}_2} = 99{,}6\cdot\left(\frac{\theta_2-\theta_1}{2}+\frac{\sin 2\theta_2 - \sin 2\theta_1}{4}\right)$$

$$E_{\mathrm{T}_2} = 99{,}6\cdot 0{,}4939 = 49{,}2\ \mathrm{lx}$$

$$E_{\mathrm{T}} = E_{\mathrm{T}_1} + E_{\mathrm{T}_2} = 102{,}2 + 49{,}2 = 151{,}4\ \mathrm{lx}$$