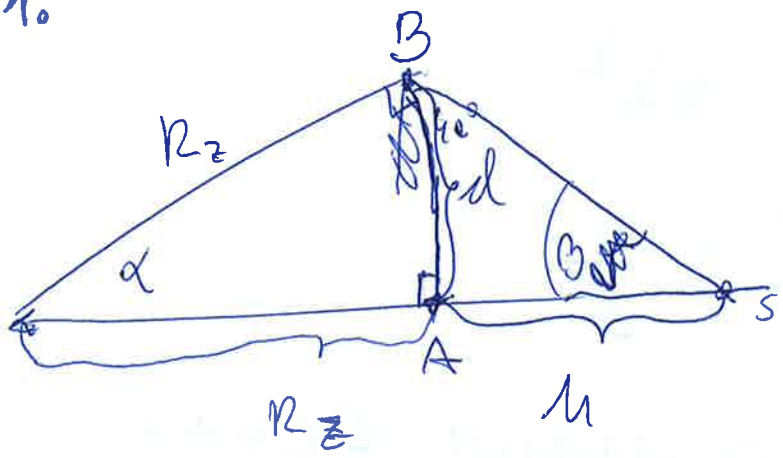
1.



$$d = \frac{O_z \alpha}{360^\circ}$$

$$d = \frac{2\pi R_z \alpha}{360^\circ}$$

$$d = \frac{6{,}28 \cdot 6400 \cdot 45 \cdot 800}{360}$$

$6{,}28 \cdot 800$
$5024{,}00$

$d = 5024\ km \approx 5000\ km$

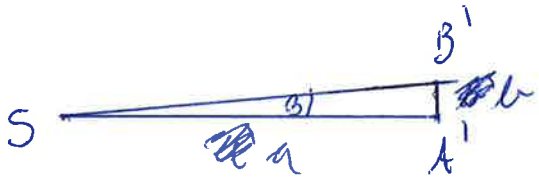
$\alpha = 45^\circ$

$\alpha + \beta = 50^\circ$

$\beta = 50^\circ - 45^\circ$

$\beta = 5^\circ$

RECIMO DA JE $\triangle ASB$ PRAVOUGLI



$$\frac{a}{b} = \frac{l}{d}$$

$$\frac{5010}{5} = \frac{l}{5000\ km}$$

$a = 5000\ km$

$b = 5\ mm$

$l = 10 \cdot 5000\ km$

$l \approx 50000\ km = 5 \cdot 10^7\ m$

11 0000 : 60 = 1833,3
50
20
20
0

1833,3 : 60 = 30,5
33
330
30

$$\frac{a^3}{t^2} = \frac{G M_z}{4\pi^2}$$

$$\frac{a^3}{t^2} = \frac{6{,}67 \cdot 10^{-11} \cdot 6 \cdot 10^{24}}{40}$$

$$\frac{a^3}{t^2} = \frac{40 \cdot 10^{13}}{40}$$

$$t = \sqrt{\frac{a^3}{10^{13}}}$$

$\sqrt{125} \approx 11$

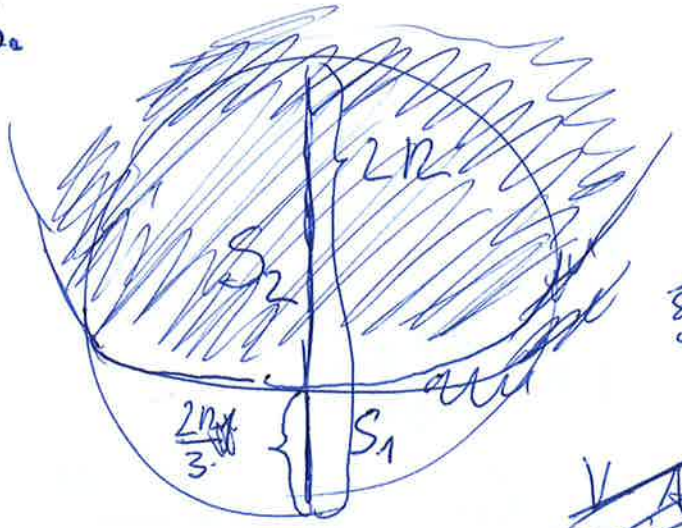
$$t = \sqrt{\frac{125 \cdot 10^{24} \cdot 10^8}{20}}$$

$$t = \sqrt{125 \cdot 10^{32}}$$

$t = 10^{16}\sqrt{125} \doteq 110000\ s = 30\ h\ 3\ min$

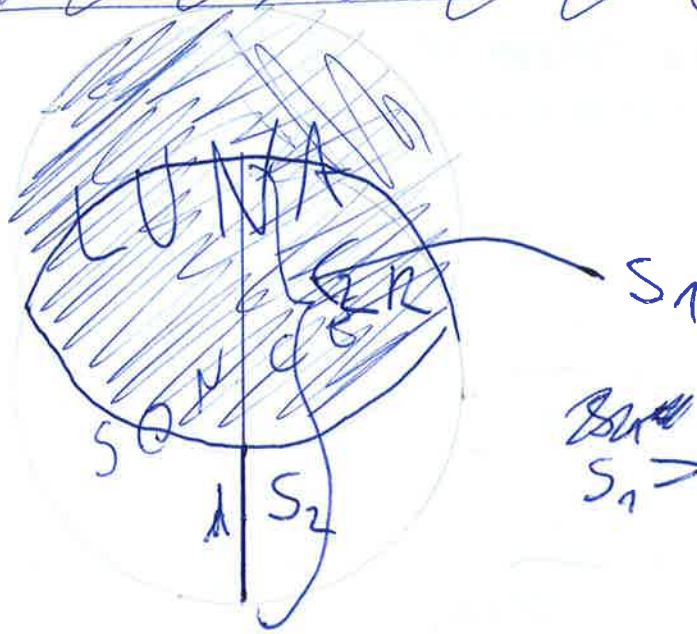
1 DAN 6,5 h

3.



$S = S_1 + S_2$

V ALEKSANDRIJI LUNA POKRIJE OKOLI 2/3 PLOŠČICE SONCA.



V ALEKSANDRIJI LUNA POKRIJE MALO VEČ KOT POLOVICO SONCA

$S_1 > S_2$

1. naloga

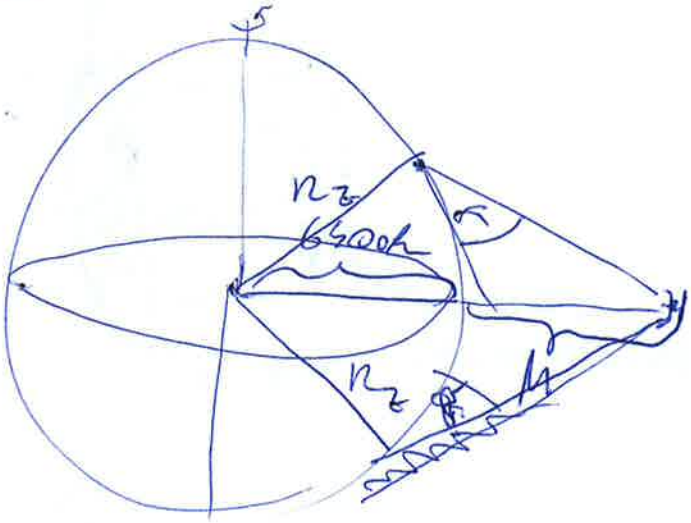
Elon Musk sanja o tem, da bi bil internet dostopen vsem. V ta namen načrtuje, da bi v orbito okoli Zemlje izstrelil množico satelitov, ki bi bili vsi na enaki višini nad površjem Zemlje. Izračunaj obhodno dobo satelitov in njihovo najmanjše število, s katerim bi s signali pokrili vso Zemljo. Predpostavi, da je na tleh komunikacija s satelitom mogoča, če je satelit najmanj 40 stopinj nad obzorjem.

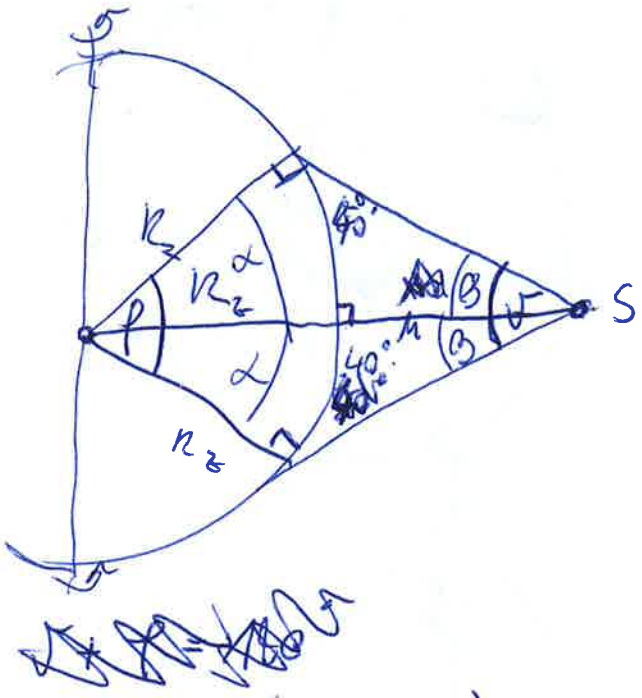
$\gamma = 40°$ $R_z = 6400\,km$

$h =$

$t =$

$n =$





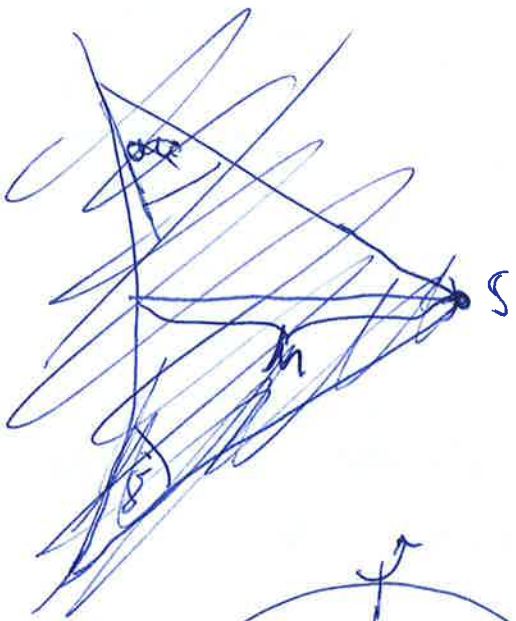
$\gamma + \rho + 2(\beta + 90°) = 360°$

$\gamma + \rho + 260° = 360$

$\gamma + \rho = 100°$

$\alpha = \frac{\rho}{2}$

$\beta = \frac{\gamma}{2}$

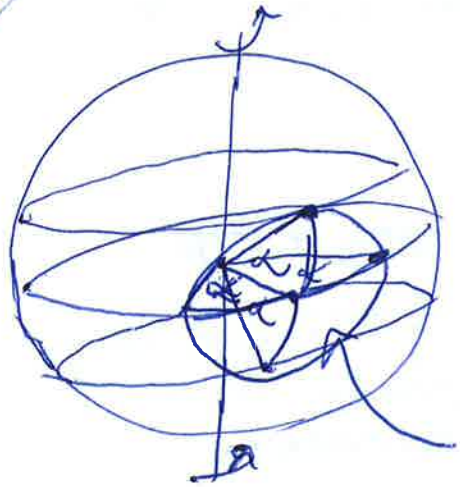


$\alpha + \beta = 50°$

$\Downarrow$

$\alpha < 50°$

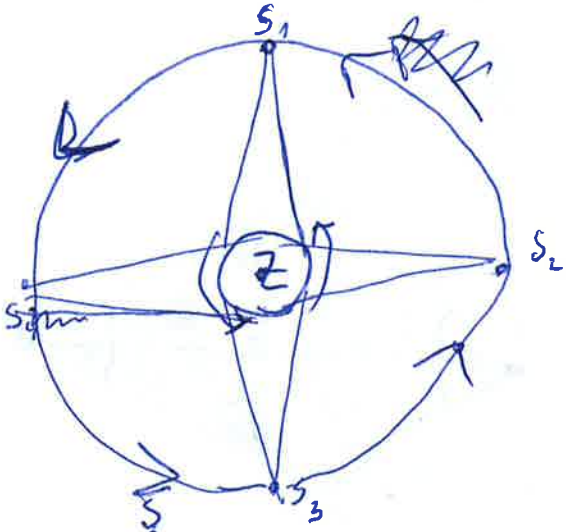
$\rho < 100°$



OBMOČJE, KI GA POKRIJE EN SATELIT

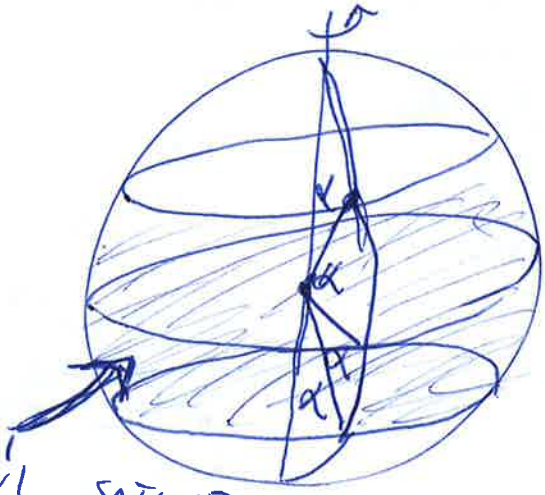
M_E .... ŠTEVILO SATELITOV, KI KROŽIJO OKOLI EKVATORJA

$$M_E = \frac{360^\circ}{\varphi} = \frac{360^\circ}{<100^\circ} \approx 3{,}6 = 4$$

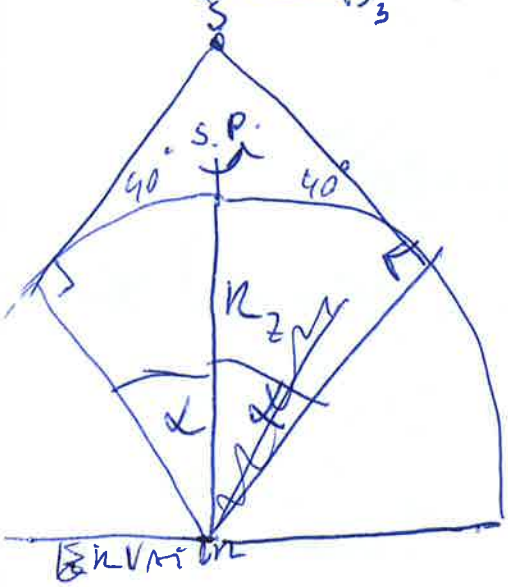


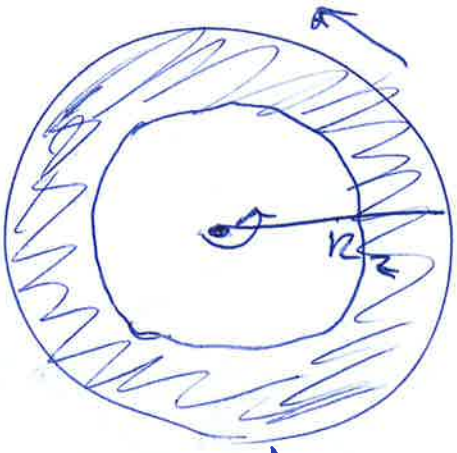
$\alpha < 50^\circ$

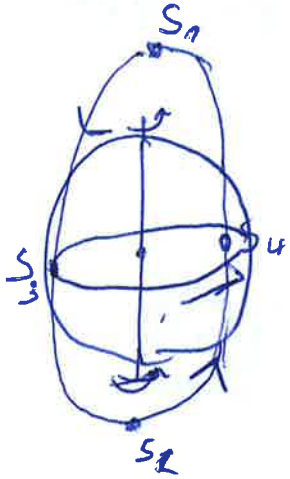
$\alpha \approx 45^\circ$



POKRIJEJO EKVATORIALNI SATELITI







DVA SATELITA NE MOREJO STALNO POKRIVATI POLOV ZATO BI MORALI TO POČETI VSAJ 4.

$M_P = 4$

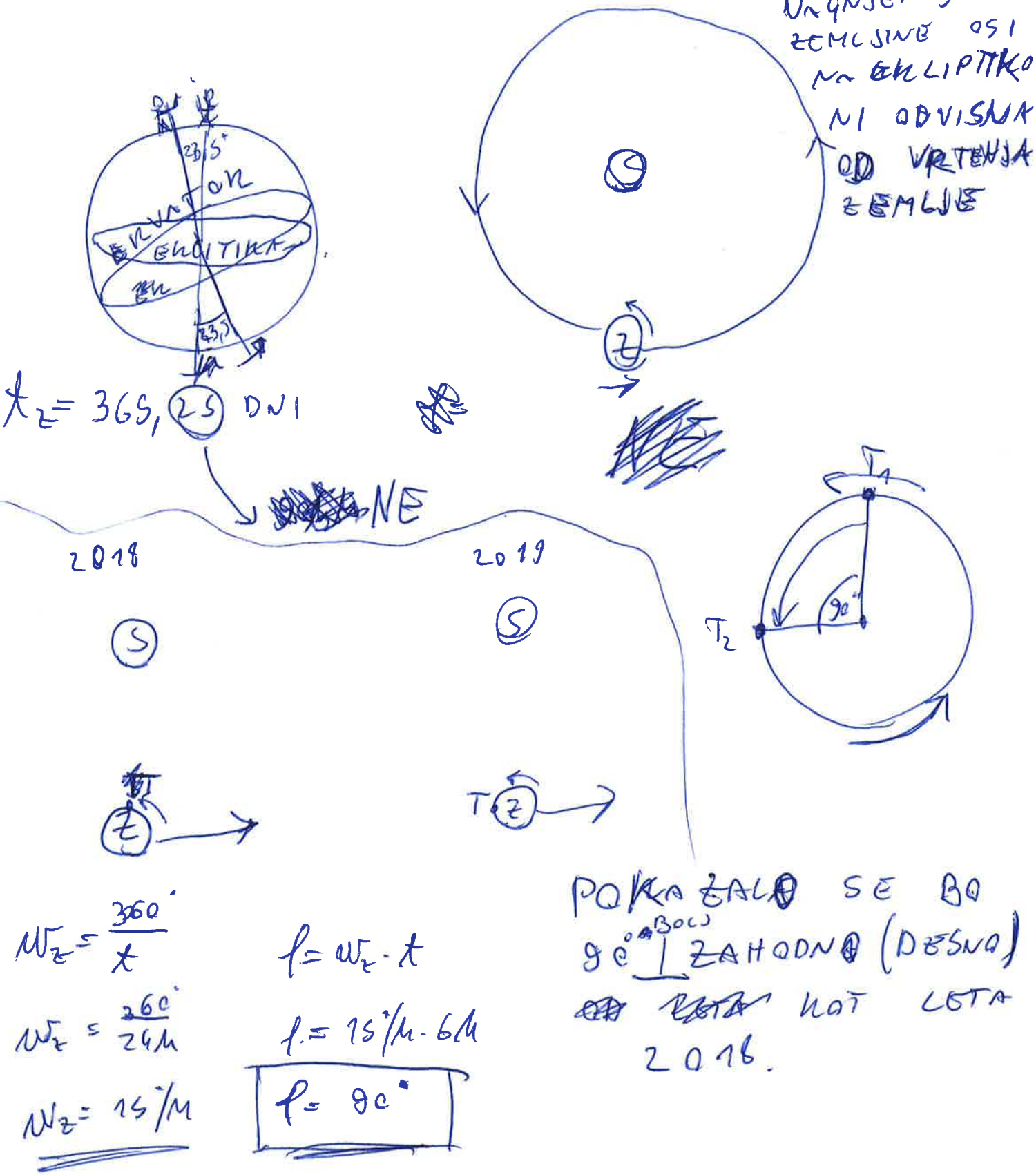
$$M = M_E + M_P$$

$$\boxed{M = 8 \text{ SATELITOV}}$$

MINIMALNO

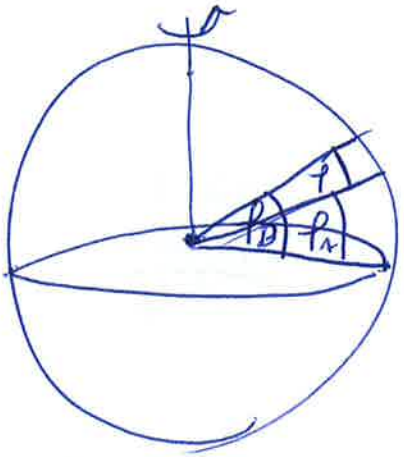
2. naloga

Raziskovalec je leta 2018 na severnem polu Zemlje opazoval vzhod Sonca in ugotovil, da se je zgornji rob ploskvice Sonca pokazal prav na določeni točki obzorja. Se bo leta 2019 zgornji rob Sonca pokazal na isti točki obzorja ali ne? Če ne, kolikšen bo kot med smerjo proti točki iz leta 2018? V katero stran od točke iz leta 2018 bo v tem primeru točka pojavljanja roba Sonca leta 2019? Vplive ozračja zanemari.



3. naloga

Agatoklov Sončev mrk, eden najznamenitejših opisanih antičnih mrkov, je bil 15. avgusta 310 pred našim štetjem. Kot popolni je bil viden nad morsko ožino Dardanele (40 stopinj severne zemljepisne širine, 30 stopinj vzhodne zemljepisne dolžine). Znano je, da so ta mrk videli tudi učenjaki v Aleksandriji (30 stopinj severne zemljepisne širine, 30 stopinj vzhodne zemljepisne dolžine), ki so opazili, da se je Lunina senca gibala pravokotno na nebesni poldnevnik. Oceni največjo fazo tega Sončevega mrka v Aleksandriji.



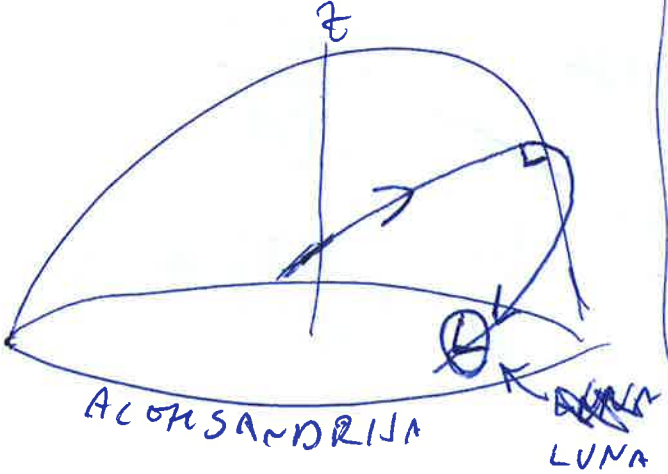
$\varphi = \varphi_D - \varphi_A$

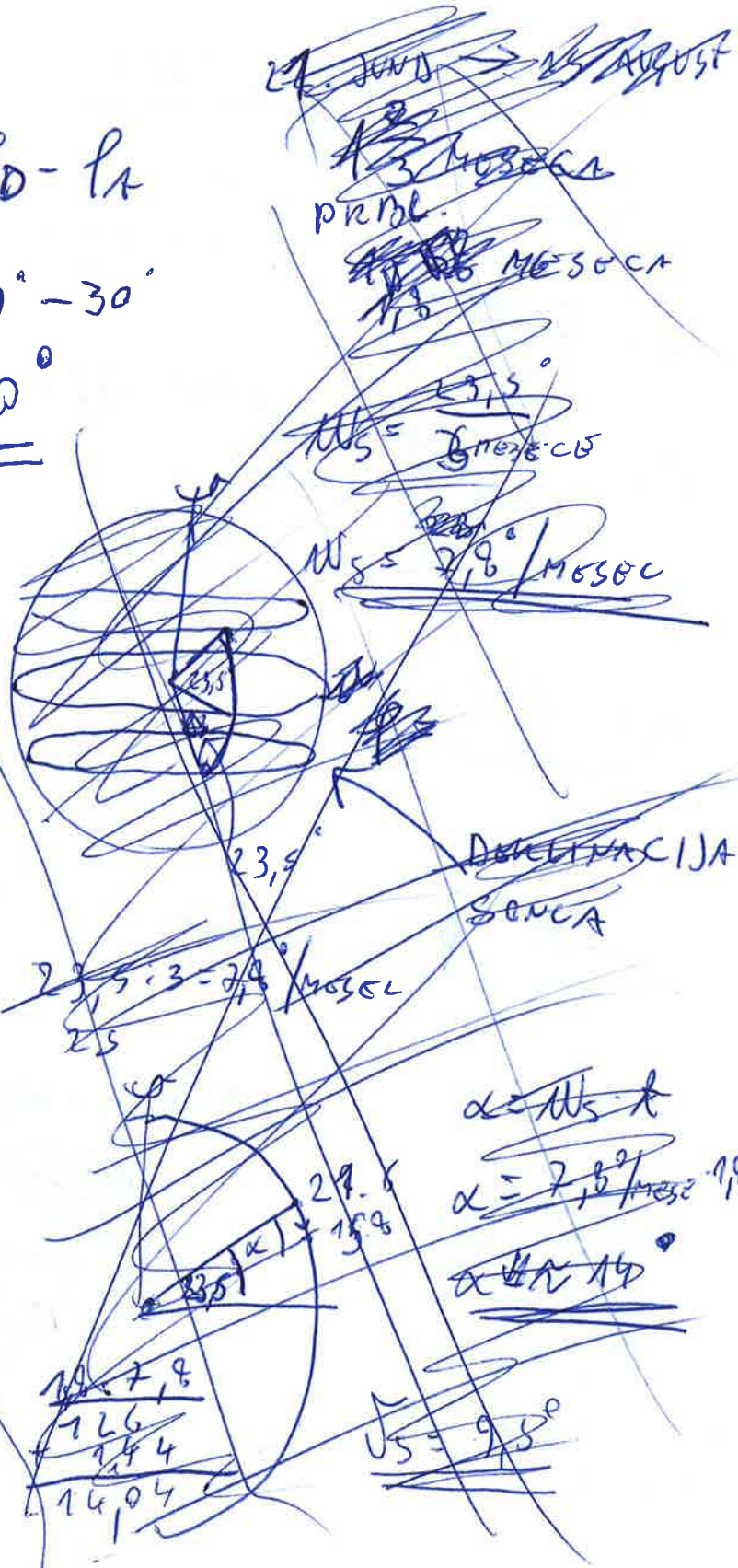
$\varphi = 40^\circ - 30^\circ$

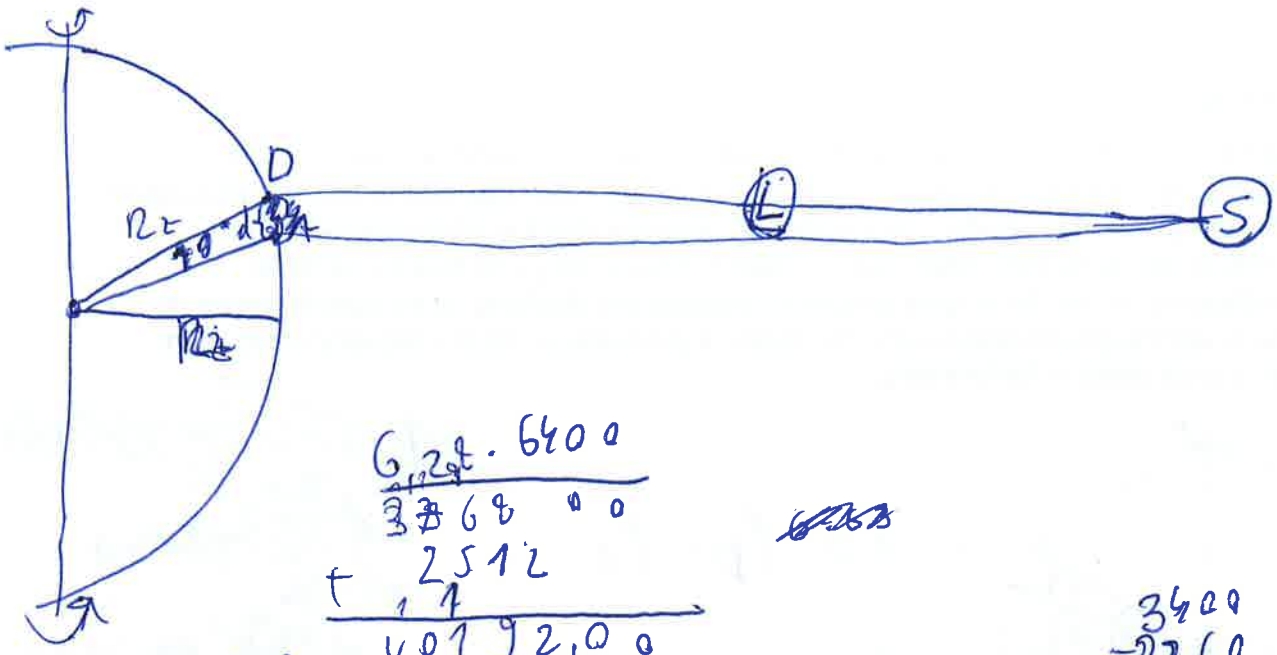
$\varphi = 10^\circ$

$\varphi_D = 40^\circ$

$\varphi_A = 30^\circ$







$$d = \frac{\alpha_z \cdot l}{360^\circ}$$

$$d = \frac{2\pi r \cdot \alpha}{360}$$

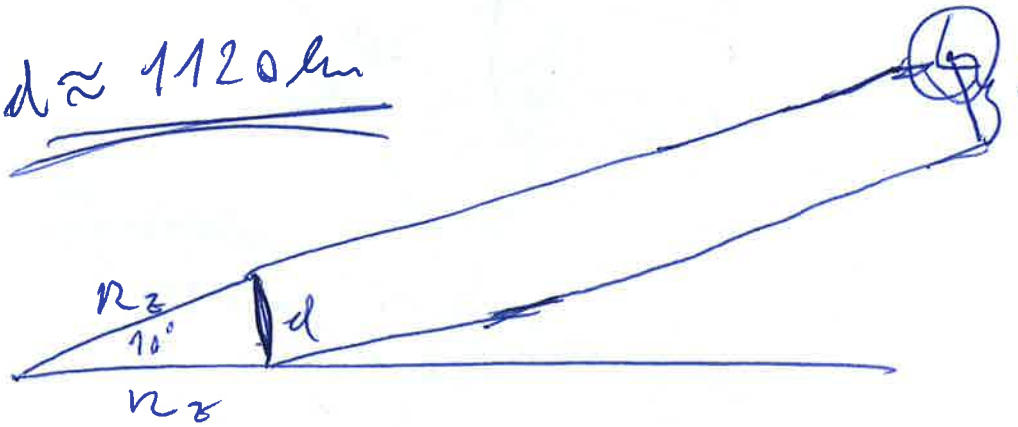
$$d = \frac{6{,}28 \cdot 6400}{36}$$

$$d \approx 1120\ km$$

$$6{,}28 \cdot 6400 = 40192{,}00$$

$$40192 : 36 = 1116$$

$$3400 : 1120 = 3$$



DARDANELE

POPOLNI SONČEV MRK

ALEKSANDRIJA

DOLNI SONČEV MRK

$$\frac{2R_L}{d} = \frac{3400}{1120} \approx 3$$

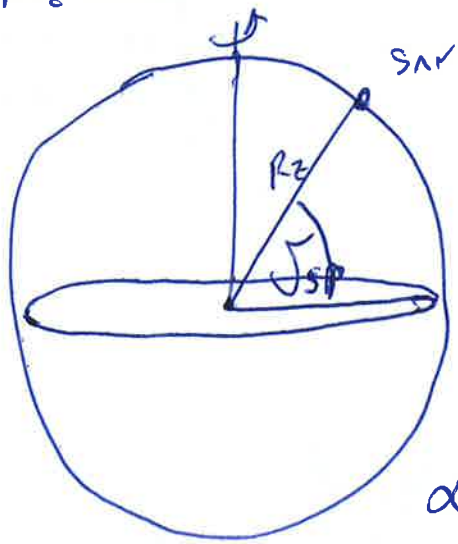
4. naloga

Oceni, kolikšen delež vseh zvezd, ki kadarkoli pridejo nad obzorje v Sankt Peterburgu, pride v zgornjo kulminacijo severno od zenita.

$\varphi_{SP} = 60°$

$R_Z = 6400\ km$

ČE SO ZVEZDE RAZPOREJENE ENAKOMERNO

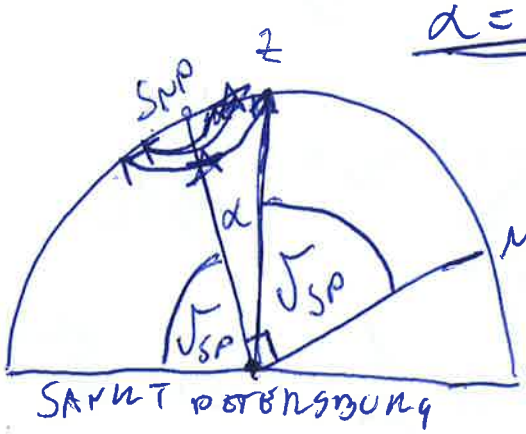


$\varphi_A > \varphi_{SP}$

$\varphi_A > 60°$

$\alpha = 90° - \varphi_{SP}$

$\alpha = 30°$



VSO NEBO

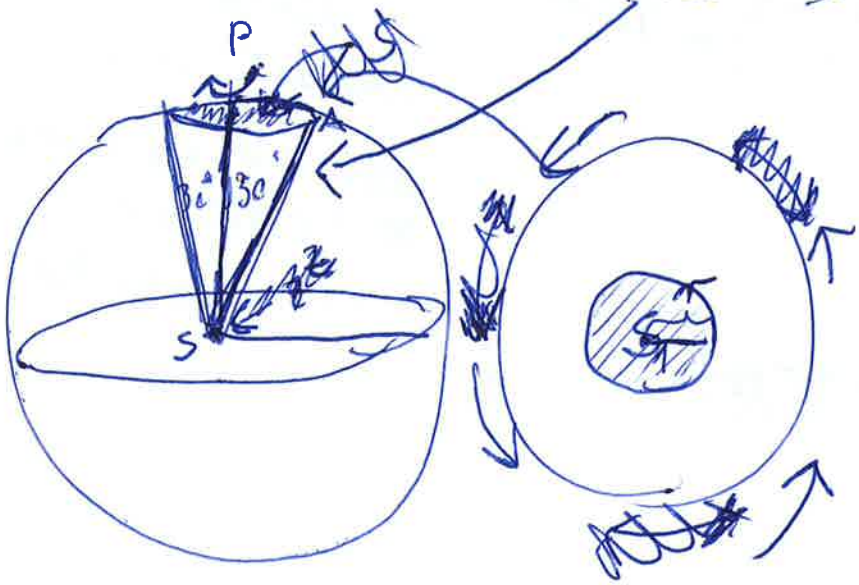
$S = 4\pi R^2$

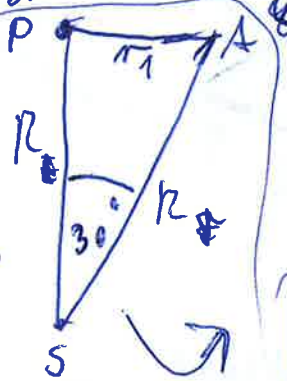
DELEŽ ZVEZD KULMINIRAJO SEVERNO OD ZENITA

$S_1 \approx \pi r_1^2$

PRAVOKOTEN ROČAJ

RECIMO DA JE ΔSPA





$\sin 30° = \frac{r_1}{R}$

$\cos\varphi = \frac{r_1}{R}$

$\frac{R}{r_1} = 2$

S_{SP} ... VSE ZVEZDE VIDNE V SANKT P.

VSO NEBO $S = 4\pi R^2$

ZVEZDE NI KULMINIRALE SEVERNO OD ZENITA $S_1 = \pi r^2$

$S_2 = \pi R^2$ ZVEZDE, NI JIH NE VIDI

$S_{SP} = S - S_2$

$S_{SP} = 4\pi R^2 - \pi R^2$

$S_{SP} = 3\pi R^2$

$\frac{S}{S_1} = \frac{4\pi R^2}{\pi r^2}$

$\frac{S}{S_1} = \frac{4R^2}{(0{,}5R)^2}$

$\frac{S}{S_1} = \frac{4R^2}{0{,}25R^2}$

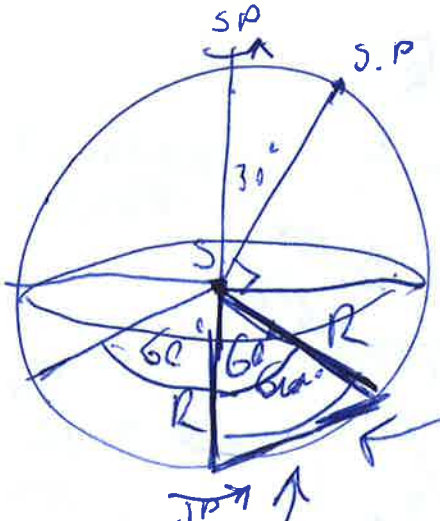
$\frac{S}{S_1} = 16$

$S_1 = \frac{S}{16}$

$\frac{S_{SP}}{S_1} = \frac{3\pi R^2}{\pi r^2}$

$\frac{S_{SP}}{S_1} = \frac{3R^2}{(0{,}5R)^2} = \frac{3R^2}{0{,}25R^2} = 12$

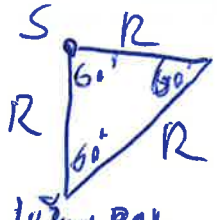
$S_1 = \frac{S_{SP}}{12}$



$\frac{1}{12}$ VSEH ZVEZD VIDNIH V SANKT PETERSBURGU KULMINIRA SEVERNO OD ZENITA

ENAKOSTRANIČNI TRIKOTNIK

$S_2 = \pi R^2$



5. naloga

Neka zvezda ima navidezno magnitudo +7, njeno lastno gibanje na nebu pa ni enako nič. Kolikšna bo njena navidezna magnituda, ko bo njeno lastno gibanje na nebu štirikrat manjše? Predpostavi, da se hitrost zvezde, s katero se giblje po vesolju, ne spreminja.

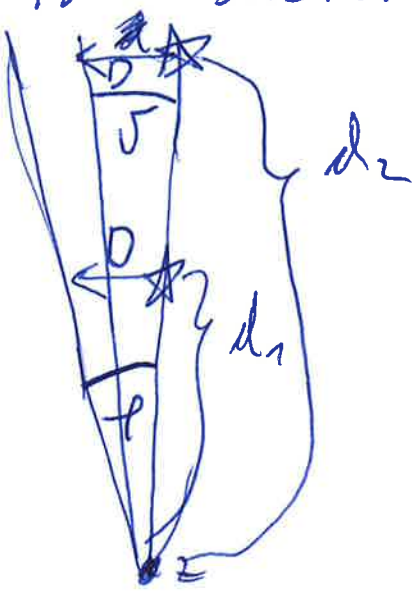
ČE PREDPOSTAVIMO DA SE GIBLJE ČE VODNO V ISTO SMER.

$l = +7$

$v_1 = 4v_2$

$l_2 =$

$v_1 = v_2$

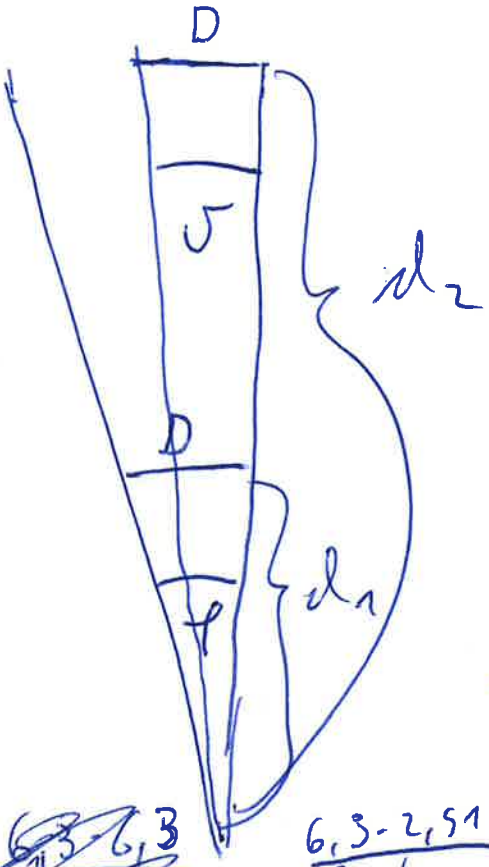


$$\frac{l_1}{l_2} = \frac{\frac{K}{\pi d_1^2}}{\frac{K}{\pi (4d_1)^2}}$$

$$\frac{l_1}{l_2} = \frac{16 d_1^2}{d_1^2}$$

$t = 4v$

$t = 4v$



$$\frac{D}{d_1} = 4\frac{D}{d_2}$$

$$d_1 = \frac{D d_2}{4D}$$

$$d_1 = \frac{d_2}{4}$$

$$\frac{l_1}{l_2} = 16$$

$$l_2 = \frac{l_1}{16}$$

$$l_2 \approx l_1 + 3m$$

$$l_2 = +10m$$

2,51 · 2,51
502
+ 1255
+ 12,51
6,3001

6,3 · 6,3
126
+ 378
+ 1890
39,69

6,3 - 2,51
126
+ 315
+ 63
15,813