Tomaž Holc

1. naloga

V prvi polovici septembra 2019 je bil Neptun v opoziciji. Astronom iz Sankt Peterburga je takrat Neptun hotel opazovati na daljavo s teleskopom, ki je postavljen v Čilu. Teleskop je v časovnem pasu univerzalni čas - 3 ure. Kdaj je po Sanktpeterburškem času astronom izvajal ta opazovanja?

~~Assume that 1 day when the Sun is about the horizon is $\frac{1}{2}$ day and when it is night night it is also $\frac{1}{2}$ day.~~

Neptune E earth S Sun

Assume that a day is 12h and night is 12h

$\alpha = 45^\circ$

We know, that you can't see objects if the Sun isn't over 6° under the horizon.

$x = \sqrt{6^{\circ 2} + 6^{\circ 2}}$

$a^2 + b^2 = c^2 \quad c = \sqrt{a^2 + b^2}$

$X = \sqrt{72^{\circ 1}}$

$x = 8{,}5^\circ$

$\sigma_{sun} = 360^\circ$

$\left(\frac{360^\circ}{2}\right) - (8{,}5^\circ \cdot 2) = 163^\circ$

$\frac{163°}{360°} = \frac{x}{24h}$ 1. nal Tomaž Hole

$x = 10h\,52min$

~~$(24:00 - 5:26) - (24:00\ 15:26) =$~~

$24:00 - ((24:00 - 5:26) - (24:00 + 5:26)) =$

$= 24:00 - (18:34 - 5:26) =$

$= 24:00 - 13:08 =$

$= 10:52$

$24:00 - 5:26 =$ $24:00 + 5:26 =$

$= 18:34$ $= 5:26$

He can see the planet from 18:34 ~~to~~ 5:26 in Chile. If we take in acount time zones, the ~~person~~ time in St. Petersburg would be:

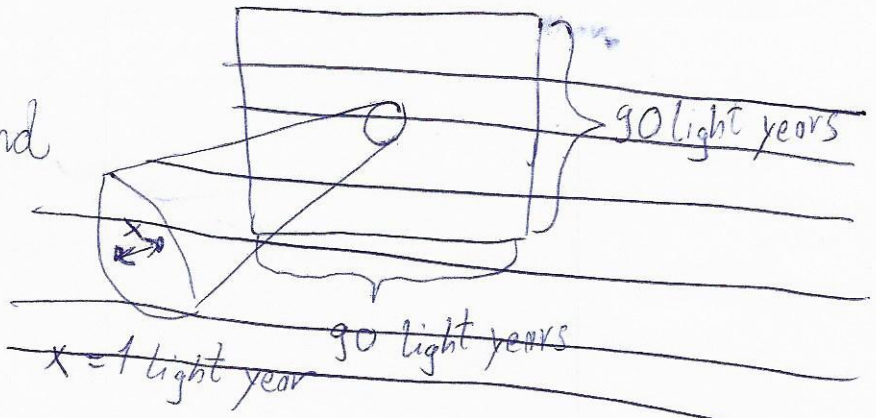
from 23:34 to 10:26

2.naloga

Tomaž Holc

Kroglasta kopica Omega Kentavra je največja taka kopica v Galaksiji in ima premer 90 svetlobnih let. V njej je toliko zvezd, da je povprečna oddaljenost med sosednjimi zvezdami vsega 1 svetlobno leto. Predpostavi, da so vse zvezde v kopici podobne Soncu in si zamisli, da bi jih stikoma postavil v vrsto. Ali bi ta vrsta segala od Sonca do Soncu najbližje zvezde?

* For the first part look at the end of the second page.



~~There are 91×91 = 8281 stars in Omega Kentavra.~~

I can calculate the ~~formula~~ size ~~of~~ the Sun by using that: $\frac{d \cdot 360°}{2 \cdot \pi \cdot r} = 0,5°$

d = diameter of the Sun
r = lenght to the Sun (from Earth)

$d = (0,5° \cdot 2 \cdot \pi \cdot 1 a.e.) : 360°$
$d = 1305555\ km$

The distance from the Sun to it's closet star Proksima Century is 4,3 light years.

$4,3$ light years $= 4,3 \cdot 365 \cdot 24 \cdot 60 \cdot 60 \cdot 300\,000 km =$
$= 4,068 \cdot 10^{12} km$

The diameter of all stars equals

~~$d = 30375 \cdot 130\,5555\,km =$~~

~~$= 1,2066\ 10^{11}\,km$~~

2. Nal Tomaž Holc

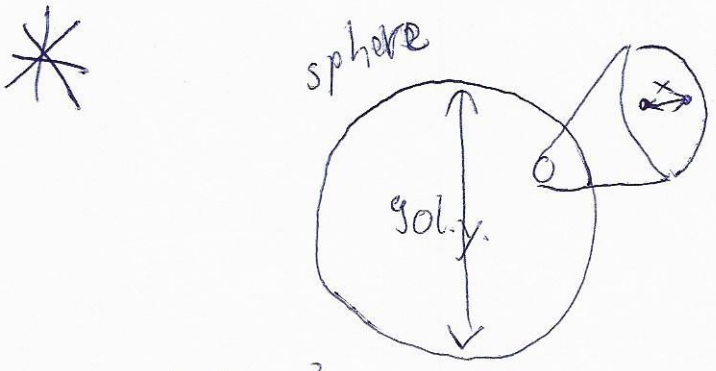
$378030 \cdot 130\,5555\,km =$

$= 4,9413895\,6650 \cdot 10^{11}\,km$

No it wouldn't because

~~$4,9414 \cdot 10^{11}\,km$~~ $< 4,068 \cdot 10^{12}\,km$

Final.



~~$V = \frac{4 \cdot \pi \cdot r^3}{3} =$~~

$= \frac{(90\,l.y.)^3}{3} = \frac{1134090\,l.y.^3}{3} =$

$= 378030\,l.y^3.$

There are ~~37803~~0 stars in Omega Century

3. naloga

Tomaž Hole

26. decembra je Luna zakrila (okultirala) Jupiter. Istega dne je bil tudi kolobarjasti Sončev mrk. Ali je danes mogoče Jupiter videti na jutranjem ali večernem nebu? Oceni zemljepisne širine, na katerih Jupitra danes sploh ni mogoče videti.

Today is 3rd February.

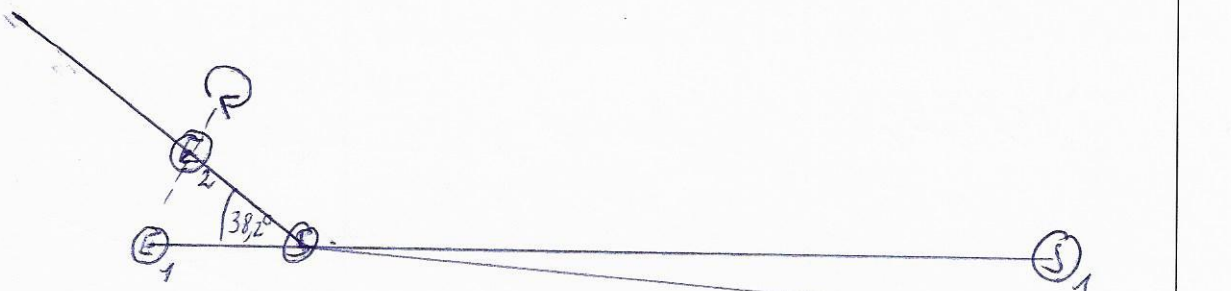
26. dec – 3. feb. = 39 days

1 year on Jupiter = 4333 Earth days = 360°

$\frac{39 \text{ days}}{4333 \text{ days}} = \frac{1}{111}$ $\frac{1}{111} \cdot 360° \approx 3,24°$

1 year on Earth = 365 days = 360°

$\frac{39 \text{ days}}{365 \text{ days}} = \frac{1}{9,4}$ $\frac{1}{9,4} \cdot 360° \approx 38,2°$

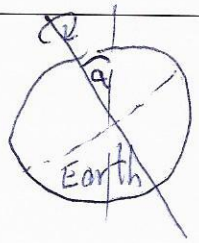


We know the Earth is rotating clockwise. That means (because Earth is faster than Jupiter) Earth is catching up to Jupiter. That means Jupiter is seen in the morning.

~~That mean Jup~~

3. NaL. Tomaž Holc

$\alpha = 23,5^\circ$



On 21. december we are under a 23,5° angle (relative to the Sun). On 21. march we are at 0°.
That means we are right now:

$\frac{45 \text{ days}}{84 \text{ days}}$ between 0° and 23,5°.
That is 12°.

~~Every place on Earth with:~~

$90^\circ - x + (-12^\circ) \leq 0^\circ$

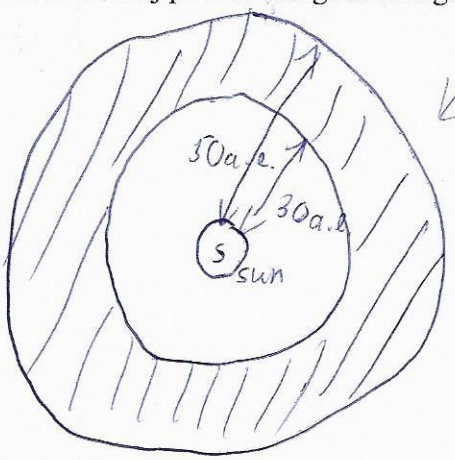
~~$x = \{78^\circ, \ldots\}$~~ $x = \{78^\circ, 79^\circ, 80^\circ, \ldots\}$

Jupiter can't be seen from places that are more than 78° north.

4. naloga

Tomaž Holc

Neka raziskava je pokazala, da je skupna masa teles v Kuiperjevem pasu 1 % mase Zemlje. V modelu je Kuiperjev pas zamišljen kot sploščen kolobar brez debeline z notranjim polmerom 30 astronomskih enot (a.e) in zunanjim polmerom 50 a.e. Izračunaj površinsko gostoto tega kolobarja v gramih na kvadratni meter.



$r_1 = 30$ a.e.

$r_2 = 50$ a.e.

$p_1 = \pi \cdot r_1^2 = 6,3585 \cdot 10^{19}\ km^2$

$p_2 = \pi \cdot r_2^2 = 1,76625 \cdot 10^{20}\ km^2$

$p_2 - p_1 = a$ (Kuiper belt)

a (Kuiper belt) $= 1,1304 \cdot 10^{20}\ km^2$

$m_{Earth} = 6 \cdot 10^{24}$ kg

$1\%\ m_{earth} = 6 \cdot 10^{22}$ kg

$\rho = \frac{m}{a} = \frac{6 \cdot 10^{22}\ kg}{1,1304 \cdot 10^{20}\ km^2} = \frac{6 \cdot 10^{25}\ g}{1,1304 \cdot 10^{26}\ m^2}$

$= 0,5308\ g/m^2$

$= 1,884\ g/m^2$

4. nal. Tomaž Holc

$$\frac{g}{m^2} = \frac{m}{a} = \frac{6 \cdot 10^{22}\,kg}{4,1304 \cdot 10^{20}\,km^2} = \frac{6 \cdot 10^{25}\,g}{1,1304 \cdot 10^{26}\,m^2} =$$

$$= \frac{0,6 \cdot 10^{26}\,g}{1,1304 \cdot 10^{26}\,m^2} =$$

$$= 0,53\,g/m^2$$

5. naloga Tomaž Holc

Ali je mogoče iz kateregakoli kraja v Rusiji videti obe zvezdi Altair in Alnair? Pomagaj si s sledečimi podatki. V Sankt Peterburgu zvezda Altair ni nikoli več kot 25 stopinj pod obzorjem. Največja višina zvezde Alnair v opazovališču na ekvatorju je 43 stopinj nad obzorjem. Najbolj severna točka Rusije ima zemljepisno širino 82 stopinj severno, najbolj južna točka Rusije pa zemljepisno širino 41 stopinj severno.

S. petersburg is 60° North.

We calculate the "height" of something by

$90° - \underset{\text{latitude}}{\text{longitude}} + \text{angle of the Earth} = \text{"height"}$

$\text{Altair}_{(S.P.)}$ $90° - 60° + x = (-25)°$

$x = -55°$

$-55° + 57° = 2°$

X can be 57° bigger. $23,5° \cdot 2 = 57°$

$90° - 82° + 2° = 10°$

Altair can be seen from anywhere in Russia.

$\text{Antair}_{(\text{equator})}$ ~~$90° - 0° + (\text{Alnair}) = 43°$~~

$90° - 0° + x = 43°$

$x = (-47°)$

x can be 57° bigger.

5. nal. Tomaž Hole

$-47° + 57° = 10°$

$90° - 82° + 10° = 18°$

Alnair can be seen from everywhere in Russia.

Yes, they both can be seen.