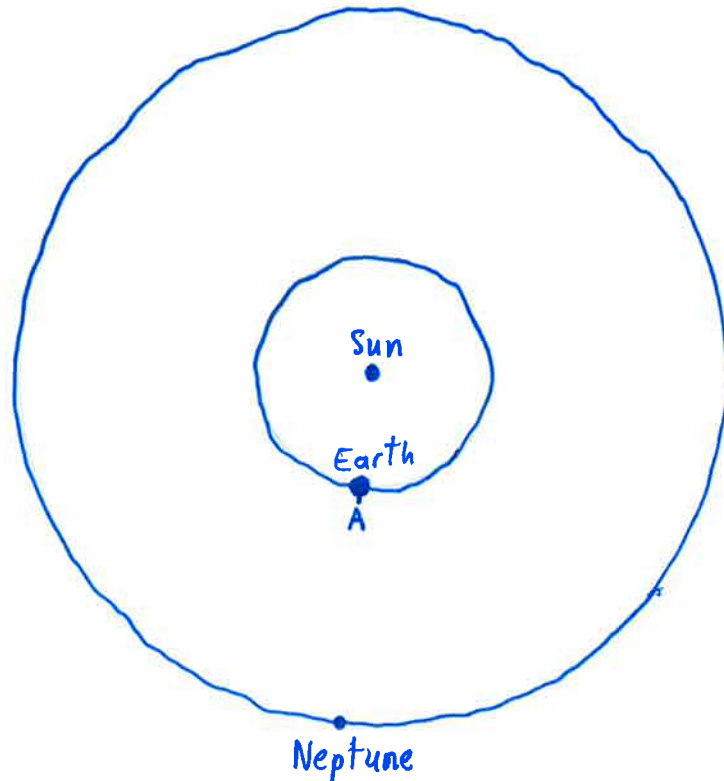1. naloga

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?

Sun

Earth

A

Neptune

The best time to observe Neptune is when you are on point A. This is at midnight.

Sankt Peterburg is in ~~∞~~ +2h time zone. This means that he will observe Neptune five hours after midnight because that is when midnight in Chile is. He will observe Neptune at **4.00 am (** ~~∞~~ **4.00 in the morning)**

2. naloga

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?

V_{OK} — volume of Omega ~~Kentav~~ Centauri, r_{OK} — radius of Omega Centauri

$$V_{OK} = \frac{4\pi r_{OK}^3}{3}$$

$$= \frac{4\pi \cdot 45 \, l.y.^3}{3}$$

$$\approx 192000 \text{ cubic light years}$$

One star takes up about:

$$V_s = \frac{4\pi r^3}{3}$$

$$= \frac{4\pi \cdot 0,5 \, l.y.^3}{3}$$

$$\approx \boxed{0,5 \text{ cubic light year}}$$

In Omega Centauri there are about 384000 stars:

~~192000 · 0,5   192000 cubic li~~

192000 cubic light years : 0,5 cubic light year =

= 384000

I will calculate Sun's diameter using its angular size:

$$\ell = \frac{\alpha}{360°} \, 2\pi r$$

$$= \frac{0,5°}{360°} \, 2\pi \cdot ~~\text{~~}~~ 150 \cdot 10^6 \, km$$

$$\approx ~~\text{~~}~~ 1,6 \cdot 10^6 \, km$$

distance from Sun to Proxima Centauri

$$d_{s-p} = 4,3 \text{ light years} \approx ~~\text{~~}~~ 40 \cdot 10^{12} \, km$$

$\boxed{40 \cdot 10^{12} \, km > 0,58 \cdot 10^{12} \, km}$

the line of stars will NOT be long enough.
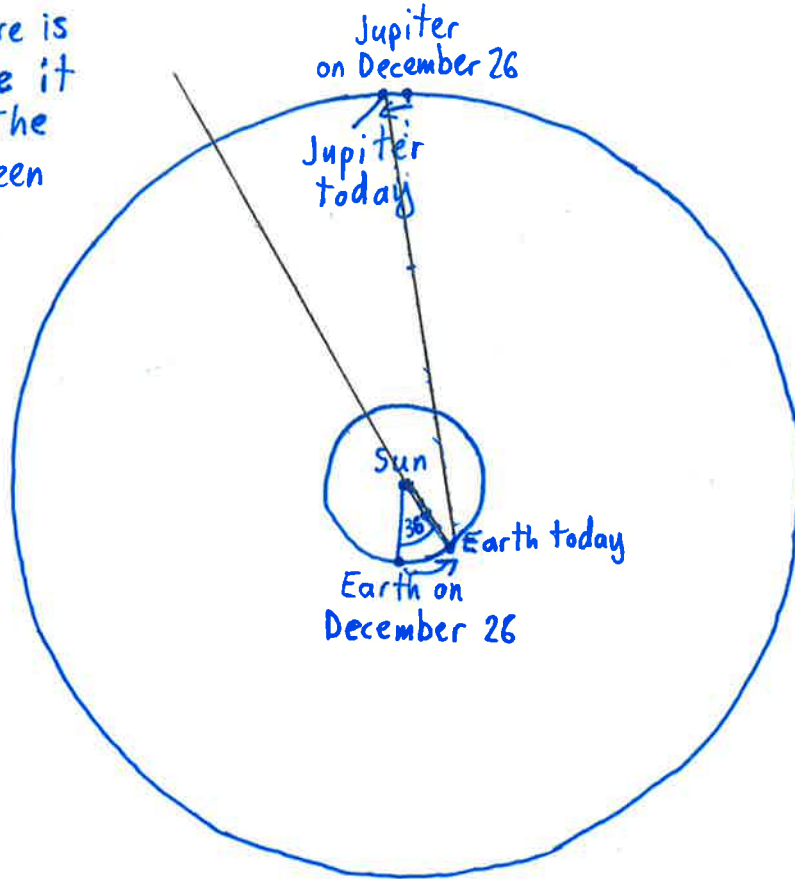
If we put ~~one star~~ stars from Omega Centauri in a line ~~they will be~~ the line will be $0,58 \cdot 10^{12} \, km$ long:

~~384000~~ $384000 \cdot 1,6 \cdot 10^6 \, km \approx \underline{0,58 \cdot 10^{12} \, km}$

3. naloga

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.

When there is a solar eclipse it is new Moon. The Moon is between Earth and Sun. So if the Moon makes an ocultation of Jupiter, Jupiter has to be in conjunction.

Jupiter on December 26

Jupiter today

Sun

36

Earth today

Earth on December 26

Today, 36 days later, Earth will move for about 36°:

365 days : 36 days ≈ 10 ⟹ 360° : 10 = 36°
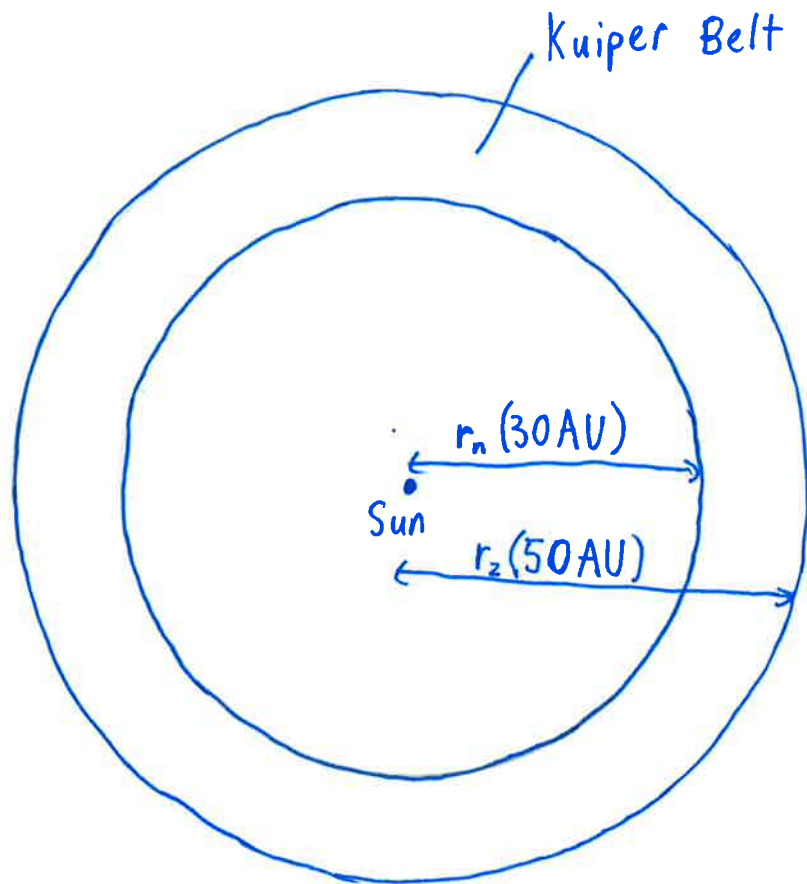
Jupiter needs 12 more times to orbit the Sun, so it will move 12 times less:

36° : 12 = 3°

Today Jupiter is in western elongation, so it can be seen just befor the sunrise, in the morning sky.

Jupiter won't be seen on the north pole because the Sun won't rise because it's winter.

4. naloga

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.

Kuiper Belt

r_n (30 AU)

Sun

r_z (50 AU)

$$S_K = \pi r_z^2 - \pi r_n^2$$

$$= \pi \cdot 2500 \, AU^2 - \pi \cdot 900 \, AU^2$$

$$= 7850 \, AU^2 - 2826 \, AU^2$$

$$= 5024 \, AU^2$$

$$\rho_K = \frac{1\% \, m_E}{5024 \, AU^2}$$

$$\approx \frac{2\permil \, m_E}{1 \, AU^2}$$

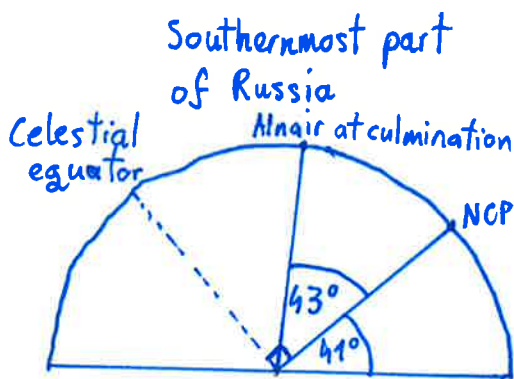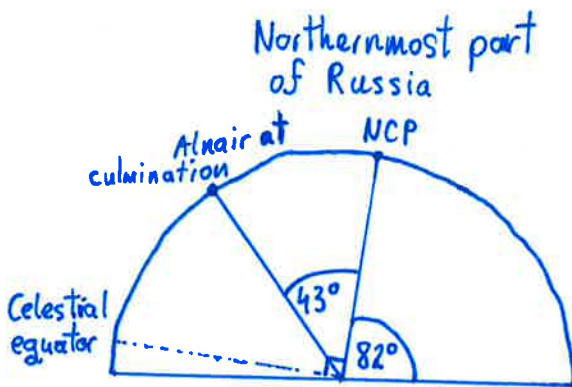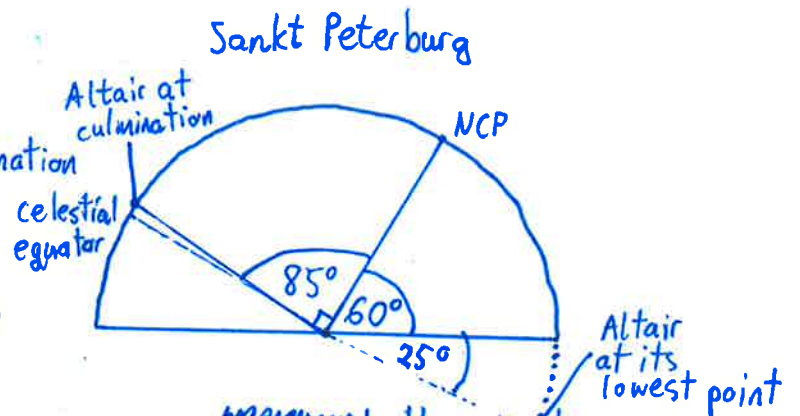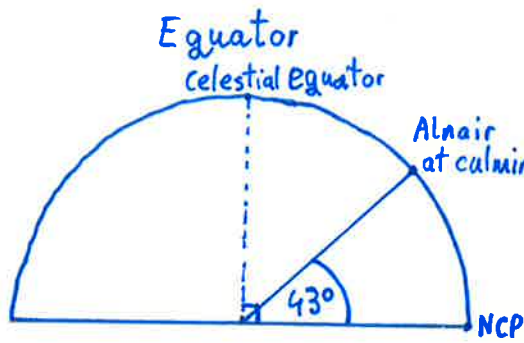$$\approx \frac{2\permil \, m_E}{225 \cdot 10^{20} \, m^2}$$

S_K – area of the Kuiper Belt
ρ_K – density of the Kuiper Belt
m_E – mass of Earth

5. naloga

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.

Alnair

Altair

Equator
Celestial Equator
Alnair at culmination
43°
NCP

Sankt Peterburg
Altair at culmination
celestial equator
NCP
85°
60°
25°
Altair at its lowest point

Northernmost part of Russia
Alnair at culmination
NCP
Celestial equator
43°
82°

Northernmost part of Russia
Altair at culmination
celestial equator
NCP
85°
82°

Southernmost part of Russia
Celestial equator
Alnair at culmination
NCP
43°
41°

Altair at culmination
Southernmost part of Russia
Celestial equator
NCP
85°
41°

NCP - North celestial Pole

Yes, both stars can be seen from all parts of Russia.