



XVII Международная астрономическая олимпиада
XVII International Astronomy Olympiad

Корея, Кванджу

16 – 24. X. 2012

Gwangju, Korea

язык	<u>English</u>
language	

Practical round. Problem 7 to solve

Note. If you find somewhere in the problems an impossible situation, write in English «impossible situation».

7. **Fireball.** A fireball was observed from three different observing sites I, II, III. The position of the observing sites, the altitude and azimuth of start and end points of the fireball's trajectory are given in Table 1. Azimuth is measured eastward from the North direction, and altitude measured above the horizon, and both the angular measurements are in degrees. Following the steps below, find true trajectory and location on the surface of Earth of fallen debris of the fireball (meteorite).

Table 1. Observational Data for a Fireball

observing position			starting point (A)		end point (B)	
	longitude	latitude	azimuth	altitude	azimuth	altitude
I	127.3°E	+35.7°	17°	35°	77°	10°
II	128.5°E	+37.0°	235°	-	139°	-
III	128.5°E	+35.4°	325°	-	48°	-

7.1. You are provided by a scaled marked graph paper. Mark the 3 observing positions (I, II, III) and draw a projected trajectory of the fireball as seen on the surface of Earth.

7.2. Calculate the longitude and latitude of start (λ_A , φ_A) and end (λ_B , φ_B) points of the fireball and total length L of the trajectory projected on the earth surface.

7.3. Find the heights of starting point h_A and end point h_B of the fireball's trajectory above the surface of Earth.

7.4. Where can you find a meteorite, if it survives passage through the atmosphere and hits the ground? Calculate the longitude and latitude (λ_C , φ_C) of the location of the meteorite on the surface of Earth's.

Finally, redraw the table below to your answer-book and fill the empty cells with you results.

point	longitude λ	latitude φ	L (km)	h_A (km)	h_B (km)	You may find the meteorite at	
						longitude λ	latitude φ
A							
B							

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Practical round. Problem 8 to solve

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8. **Moon.** The Korean Astronomy and Space Science Institute (KASI) publishes the Korean Astronomical Almanac every year. You have been provided with an astronomical table extracted from the Korean Astronomical Almanac of 2012 showing the Korean local time of Moon culmination. (See separate sheet, and you may fill the empty cells by necessary content.)

Date	Culmination of Moon		Date	Culmination of Moon		Date	Culmination of Moon	
Mar 2			April 1			May 1		

Also you are provided with a scaled marked graph paper to plot graphs.

- 8.1. Find the date in April 2012 when the Moon is closest to the Earth.
 8.2. Find the date in March 2012 when the Moon is remotest from the Earth.
 8.3. The scaled marked graph paper (a) shows the eccentric orbit of the Moon, the Earth being located at the center. Mark the positions of the Moon by the symbol $\times$ on April 19 and April 23 (with labels A19 and A23).
 8.4. Calculate the ratio of the apparent angular sizes of the Moon (α_{Moon}) and the Sun (α_{Sun}) on July 1.
 8.5. Draw on the scaled marked graph paper the geostationary orbit around the Earth in the given scale.



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Практический тур.
Таблица к задаче 8

Practical round.
Table for Problem 8

Дата	Кульминация Луны		Дата	Кульминация Луны		Дата	Кульминация Луны	
Date	Culmination of Moon		Date	Culmination of Moon		Date	Culmination of Moon	
Mar 2	19 40		April 1	20 02		May 1	20 20	
3	20 31		2	20 52		2	21 10	
4	21 22		3	21 42		3	22 02	
5	22 14		4	22 33		4	22 57	
6	23 05		5	23 25		5	23 56	
7	23 56		6	-		6	-	
8	-		7	0 19		7	0 57	
9	0 48		8	1 16		8	2 01	
10	1 41		9	2 16		9	3 03	
11	2 36		10	3 17		10	4 04	
12	3 32		11	4 19		11	5 00	
13	4 31		12	5 19		12	5 52	
14	5 30		13	6 15		13	6 40	
15	6 29		14	7 08		14	7 26	
16	7 26		15	7 57		15	8 09	
17	8 20		16	8 43		16	8 52	
18	9 11		17	9 28		17	9 35	
19	9 59		18	10 10		18	10 18	
20	10 45		19	10 53		19	11 02	
21	11 29		20	11 36		20	11 48	
22	12 12		21	12 19		21	12 36	
23	12 55		22	13 04		22	13 24	
24	13 38		23	13 51		23	14 14	
25	14 22		24	14 39		24	15 03	
26	15 08		25	15 27		25	15 52	
27	15 54		26	16 17		26	16 40	
28	16 43		27	17 06		27	17 27	
29	17 32		28	17 55		28	18 14	
30	18 22		29	18 43		29	19 02	
31	19 12		30	19 31		30	19 51	