Observation - Finale of the Junior Astronomy Olympiad 2026

The Swedish Astronomical Youth Associations Olympiad group

12 April 2026
10:30 to 13:00

This is the observational round in the Astronomy Olympiad Junior Sweden 2026. Part I is designed to be completed using only the information in this test. Part II is the planetarium round, where you are tested on your observational abilities in a simulation of the night sky. The 5 participants with the highest scores will be offered a place on the Swedish team in the *International Olympiad on Astronomy & Astrophysics Jr* (IOAA Jr) in Thailand, in November.

Good Luck!

Name	

The exam begins on the next page. Do not turn the page until the clock strikes 10:30. Stop writing immediately in Part I when the clock strikes 11:45 as instructed by the supervisors. Await instructions for Part II.

Part I and Part II together consist of 5 questions, some of which require more calculations than others. Each question may have several parts [a), b), c) ...]. The maximum score is indicated after each question. The exam totals 35 points.

All questions must be answered **in the exam sheet** in both Part I and Part II. Scratch paper is available.
Allowed tools:
Writing utensils, scratch paper, calculator, and **no personal formula sheets** (except for the last page of the exam paper).

For Part II:

1. Keep the formula sheet with you from Part I
2. In addition to the allowed tools, you may bring something to support the exam paper (without notes) as well as a flashlight, if you have one.
3. Do **not** talk during the planetarium round or immediately after time has ended. **Wait until you have left the dome**.
4. Sit with **at least one chair** between each person.

Part I

1 Messi or Messier (5p)

A time traveler with a great interest in astronomy wants to meet Charles Messier, but instead accidentally meets Lionel Messi. However, Messi turns out to have a secret interest in astronomy. Help the time traveler answer Messi's questions.

Figur 1: Lionel Messi

Figur 2: Picture of NGC 3532, "Football Cluster"

a) Messi presents his favorite deep-sky object, **NGC 3532**, "Football Cluster," shown above. What type of deep-sky object is this?

b) Give **one example** of a deep-sky object from the **Messier catalogue** (name or number) that *resembles* NGC 3532 in its structure but is likely older.

c) Which of the following Messier objects does not belong to the same category as in part a) or b)? **M1, M13, M31, M45, M57**

d) Describe the *most likely* future evolution of **NGC 3532**. More or less compact?

2 Star chart (10p)

You have a star chart of an *unknown* location, shown on the **next page**. Answer **in the exam paper**.

a) Determine the observer's latitude from the star chart.

b) Mark Polaris and label it P.

c) Indicate and mark the cardinal directions on the chart.

d) Draw the local meridian and label it M.

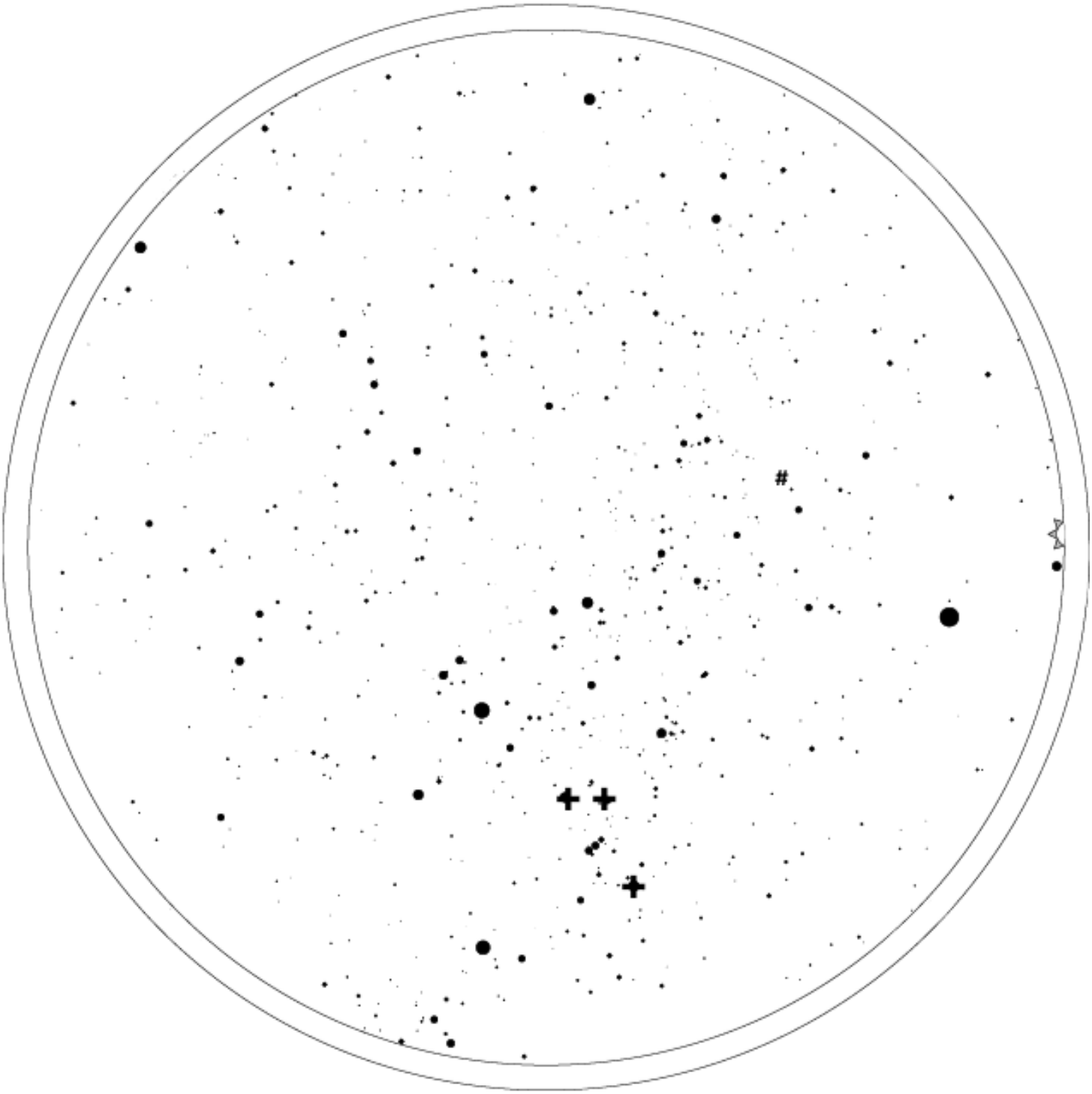
e) Draw the celestial equator and label it H.

f) Draw the ecliptic and label it E.

g) Identify and draw five constellations on the chart.

h) Name five stars on the chart.

i) Draw the circumpolar circle.



Figur 3: Star chart of an unknown location.

3 The moon's dissapearing(5p)

You look up at the sky a number of days after the Astronomy Olympiad Junior camp and remember all the fun you experienced.

Figur 4: An image of the Moon a certain number of days after the AO Jr 2026 camp. Source: Getty Images/Claudio Divizia

a) How many days after the camp, which ends on April 12, do you observe the Moon if you know that it was a full moon on April 1, seven days before the start of the camp?

b) Determine the Sun's declination at the time of the full moon.

c) Assume that the Sun has a right ascension of 1h 20min at the time of the test (11:00 on April 12). Determine its angular distance in degrees from the vernal equinox.

ANSWER-SHEET (ONLY FOR QUESTION 3.):

Part I is finished. Stop writing immediately 11:45 am when the leaders announces and wait for further instructions.

Part II

Namn	

4 Three Skies (7.5 pts)

During the planetarium session, three different night skies from different locations on Earth are shown. For each simulation, the presenter points out two objects.

Fill in the table below for **each** sky.

	Sky 1	**Sky 2**	**Sky 3**
Latitude (approx.)			
Constellation 1			
Constellation 2			
Is it the ecliptic or not? (Yes/No)			
How many hours have passed?			

Note: The presenter will point out two constellations per simulation and possibly the ecliptic. These should be entered in the table above.

5 Celestial Forensics (7.5 pts)

A: Frozen Sky

The simulation begins in a frozen state. Two large bands are clearly visible across the sky and are tilted relative to each other.

a) Identify the two bands.

- **i)** What is the **yellow** band?
- **ii)** What is the **red** band?

b) Determine at which **location in the Solar System** the observer is situated.

- **i)** State which **planet** the observer is most likely located on. Justify your answer using at least **two observational clues** from the image.
- **ii)** State the observer's approximate **latitude** (e.g., near the equator, mid-latitudes, or near the pole).

B: The Sky in Motion

Time is now started and a **timer** appears on the screen.

You observe that several small points of light move back and forth. These are moons.

c) Rank **any three moons** from closest to the planet to farthest away.

d) During the simulation, the planet rotates under the observer. Is the observer on the **dayside** or **nightside** of the planet?

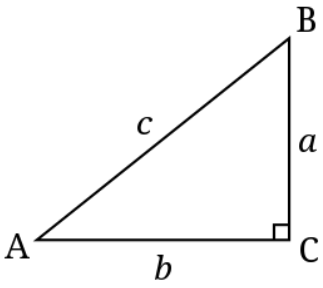
Given Values and Formulae

Name	Value	Unit
Sidereal day	23.9344696	h
Julian year	365.25	days (24h)
Synodic month	29.53	days (24h)
Date of Vernal Equinox 2026	20 mars 2026	
The Vernal Equinox , declination	$0°$	
The Vernal Equinox, RA	0^{h}	

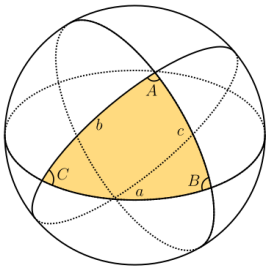
Tabell 1: Fundamental values

Name	Formula
Solar declination	$\sin(\delta_\odot) = \sin(\varepsilon)\sin(\lambda_\odot)$
Solar right ascension	$\tan(\alpha_\odot) = \cos(\varepsilon)\tan(\lambda_\odot)$
Solar ecliptic longitude	$\lambda(t) \approx \frac{360°}{365.25}\,N, \quad N = \text{current date} - \text{vernal equinox date}$
Sine	$\sin A = \frac{a}{c}$
Cosine	$\cos A = \frac{b}{c}$
Tangent	$\tan A = \frac{a}{b}$
Pythagorean theorem	$c^2 = a^2 + b^2$
Law of sines	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Law of cosines	$c^2 = a^2 + b^2 - 2ab\cos C$
Spherical law of cosines	$\cos c = \cos a \cos b + \sin a \sin b \cos C$
Spherical law of sines	$\frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}$
Angular distance on the celestial sphere	$\cos\theta = \sin\delta_1 \sin\delta_2 + \cos\delta_1 \cos\delta_2 \cos(\alpha_1 - \alpha_2)$
Common logarithm	$10^{\log_{10} a} = a$
Logarithm multiplication	$\log(ab) = \log a + \log b$
Logarithm division	$\log\left(\frac{a}{b}\right) = \log a - \log b$
Logarithm powers	$\log(a^x) = x \log a$

Tabell 2: Mathematical and spherical trigonometric formulae



Figur 5: Right triangle for the definition of trigonometric formulae



Figur 6: Spherical triangle on a sphere