Introductory Astronomy

Homework 2: The Sky Not to be handed in. Homework solutions are posted already.

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002 qmult 00100 1 1 5 easy memory: Venus, goddess of love

1. In mythology and popular culture Venus has been identified with the:

   a) god of transits. b) devil of retrograde motion. c) imp of recession. d) monk of remonstrance. e) goddess of love.

   SUGGESTED ANSWER: (e) A super easy memory Valentine's day question.

   Wrong answers:
   d) Not very likely. Remonstrance: act of remonstrating, protesting, complaining.

   Redaction: Jeffery, 2001jan01

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002 qmult 00210 1 1 1 easy memory: daytime define

2. Daytime is

   a) the time between sunrise and sunset. b) the time between sunset and sunrise. c) any time of the day or night. d) high noon. e) an optical illusion.

   SUGGESTED ANSWER: (a)

   Wrong answers:
   d) C'mon.

   Redaction: Jeffery, 2001jan01

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002 qmult 00220 1 4 4 easy deducto-memory: point stars

3. Why do all stars, except the Sun, look like twinkling points of light as seen from the Earth? They are:

   a) points of light, literal points of light, without extent or shape. b) the cause eclipses. c) too remote to be seen. d) too remote to resolve their shapes. e) too remote to detect their color.

   SUGGESTED ANSWER: (d) Could be a tougher question if instructor has never dwelt on the point. But wrong answers can be eliminated.

   Wrong answers:
   b) One would have to have lived in a rabbit hole.
   c) This is a red herring.
   d) This is just untrue.
   e) Color is irrelevant to shape (at least to first order).

   Redaction: Jeffery, 2001jan01

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002 qmult 00300 2 1 1 moderate memory: parallax definition

4. Parallax is:

   a) the westward motion of a planet.
   b) the apparent change in position of an object due to the subjective nature of observations.
   c) the apparent change in position of an object due to the change in position of the observer.
   d) an optical illusion, but one that can be used to determine magnitude.

e) the apparent change in position of an object due to the change in position of the observer. Parallax is completely useless in modern astronomy.

SUGGESTED ANSWER: (c) It's moderate rather than easy because weird words are harder to remember.

Wrong answers:
a) That's a retrograde motion.
b) It's quite objective.
d) Can optical illusions ever lead to real information? Maybe but off the top of my head I'd say that if you are deceived then you can only deduce real information by accident.
e) Not at all. It is still very important in determinin the distances to stars and galaxies.

Redaction: Jeffery, 2001jan01

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002 qmult 00510 1 1 1 easy memory: celestial sphere defined

5. The celestial sphere is:

a) an imaginary sphere (centered on the Earth) on which all the celestial bodies are located.
b) a solid sphere (centered on the Earth) on which all the celestial bodies are located.
c) an imaginary sphere (centered on the Sun) on which all the celestial bodies are located.
d) the path of the Sun on the sky.
e) cause of eclipses.

SUGGESTED ANSWER: (a)

Wrong answers:
e) As Lurch would say: "Aaaaah."

Redaction: Jeffery, 2001jan01

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002 qmult 00800 2 5 1 moderate thinking: celestial sphere described

6. Briefly describe the celestial sphere.

a) It is an imaginary sphere **CENTERED** on **EARTH**. All the heavenly bodies are located on it. It is **SO LARGE** that the size of the Earth is **INSIGNIFICANT** in comparison: this implies that every point on Earth is effectively exactly at the center of the celestial sphere. The axis of the celestial sphere is an extension of Earth's axis: the northern end of the axis is the north celestial pole and the southern end, the south celestial pole. The celestial equator is just a projection on the sky from the Earth's center of the Earth's equator. The celestial sphere rotates west once per day. The stars are carried with this motion, but are fixed to high approximation in relative orientation: they are called the fixed stars. The solar system bodies move on the celestial sphere relative to the fixed stars. The celestial sphere is a **USEFUL** description of the appearance of sky.
b) It is an imaginary sphere **CENTERED** on **EARTH**. All the heavenly bodies are located on it. It is **SMALL ENOUGH** that the relative positions of the stars and planets **DEPEND ON** one's location on Earth. This agrees with actual appearance of the sky. The axis of the celestial sphere is an extension of Earth's axis: the northern end of the axis is the north celestial pole and the southern end, the south celestial pole. The celestial equator is just a projection on the sky from the Earth's center of the Earth's equator. The celestial sphere rotates west once per day. The stars are carried with this motion, but are fixed to high approximation in relative orientation: they are called the fixed stars. The solar system bodies move on the celestial sphere relative to the fixed stars. The celestial sphere is a **USEFUL** description of the appearance of sky.
c) It is an imaginary sphere **CENTERED** on **EARTH**. All the heavenly bodies are located on it. It is **SO LARGE** that the size of the Earth is **INSIGNIFICANT** in comparison: this implies

that every point on Earth is effectively exactly at the center of the celestial sphere. The axis of the celestial sphere is an extension of Earth's axis: the northern end of the axis is the north celestial pole and the southern end, the south celestial pole. The celestial equator is just a projection on the sky from the Earth's center of the Earth's equator. The celestial sphere rotates west once per day. The stars are carried with this motion, but are fixed to high approximation in relative orientation: they are called the fixed stars. The solar system bodies move on the celestial sphere relative to the fixed stars. Because the celestial sphere has no physical reality it is perfectly **USELESS**. It is just a relic of historical astronomy.

d) It is just a projection on the sky from the Earth's center of the Earth's equator.
e) It is just the extension of the Earth's axis into space.

SUGGESTED ANSWER: (a)

Wrong answers:
c) It is useful for understanding appearance. Otherwise it wouldn't be taught.

Redaction: Jeffery, 2001jan01

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002 qmult 00820 1 1 1 easy memory: celestial equator

7. What is the celestial equator?

a) The projection of the Earth's equator onto the celestial sphere. b) The Zodiac by another name. c) An ancient Chinese astronomical device. d) A circumpolar constellation. e) The belt of Orion.

SUGGESTED ANSWER: (a)

Wrong answers:
e) Sounds sort of plausible.

Redaction: Jeffery, 2001jan01

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002 qmult 00900 2 4 3 moderate deducto-memory: declination defined

8. What is declination?

a) The point directly below.
b) The point directly above.
c) The angular position of an object measured north or south from the celestial equator.
d) The angular position of an object measured east or west from the celestial equator.
e) The azimuthal angular position of an object measured east from the spring (or vernal) equinox.

SUGGESTED ANSWER: (c)

Wrong answers:
a) This is nadir.
b) This is zenith.
d) Not east, not west.
e) This right ascension. See Skilling p. 55–57. Who is Skilling?

Redaction: Jeffery, 2001jan01

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002 qmult 01100 2 4 3 moderate deducto-memory: transit the meridian

9. What does "to transit the meridian" mean? It means that:

a) an object passes through the zenith.

b) an object crosses the meridian of **GREENWICH** due to the rotation of the Earth.
c) an object crosses the meridian (i.e., the **LOCAL MERIDIAN**) due to the rotation of the Earth.
d) an object is in conjunction with the Sun.
e) an object is in opposition (to the Sun).

SUGGESTED ANSWER: (c)

Wrong answers:
a) It can pass through zenith when it transits the meridian.

Redaction: Jeffery, 2001jan01

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002 qmult 01110 2 1 2 moderate memory: zenith and nadir
10. What is zenith? What is nadir?

a) The point directly to the east; the point directly below.
b) The point directly above; the point directly below.
c) A kind of television; a kind of refrigerator.
d) The point directly above; the point directly west.
e) The name of the spring equinox point; the name of the fall equinox point.

SUGGESTED ANSWER: (b)

Wrong answers:
c) For zenith this is not the best answer in the context of astronomy. I've never heard of Nadir Refrigerators. Sounds as good as Nauseous Lotion.

Redaction: Jeffery, 2001jan01

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002 qmult 01600 2 4 2 moderate deducto-memory: circumpolar stars
11. Circumpolar stars are those stars that:

a) are located at the north celestial pole (NCP). b) never go below the horizon or never rise above it. c) are in the Zodiac constellations. d) circle the zenith. e) are below the horizon as seen from all latitudes.

SUGGESTED ANSWER: (b) Essentially just an easy definition question. The complication is that definition isn't fixed in the literature. Seeds and Fraknoi use the above and below version. Zeilik and Friedlander use the just above version. So I'd better phrase the answers to allow only for one version which I have decided will be the broader "Seeds-Fraknoi" version. ¡p¿

Wrong answers:
e) No star is below the horizon from all latitudes.

Redaction: Jeffery, 2001jan01

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002 qmult 01800 2 4 3 moderate deducto-memory: Polaris position
12. How far in angle is Polaris (called alpha Ursa Minoris or α Ursa Minoris or some abbreviation thereof in tables) from the north celestial pole in Epoch 2000 coordinates? **Note:** Epoch 2000 coordinates are just the preferred modern astronomical latitude and longitude system for the celestial sphere. All the student needs to know is that declination is like latitude and the angle from the north celestial pole (NCP) is 90° minus declination. And by the way, arcminutes are indicated by prime symbols (e.g., $10'$ is 10 arcminutes) and arcseconds by double prime symbols (e.g., $10''$ is 10 arcseconds). **Hints:** Try the SEDS (Students for the Exploration and Development of Space) web site and click down through **constellations, 88 constellations, Ursa Minor,** and **stellar data.**

a) 90°. b) 10°. c) 44 arcminutes, 9 arcseconds. d) 30 arcminutes, 45 arcseconds. e) 1°, 30 arcminutes, 45 arcseconds.

SUGGESTED ANSWER: (c) My answer came from seds. There could be a difficulty if people have a mental block on sexagesimal arithmetic:

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  90 00 00    changes to   89 59 60
- 89 15 51                - 89 15 51
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 ?  ?  ?                  00 44 09
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where 00 is in degrees, 44 is in arcminutes, and 09 is in arcseconds.

Wrong answers:
a) We know Polaris is very close to the pole.
b) Even this is not close enough to coincide with common knowledge.

Redaction: Jeffery, 2001jan01

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002 qmult 02300 1 1 4 easy memory: Polaris at zenith

13. Polaris is at zenith. You are:

a) on the equator. b) in New York City. c) in Las Vegas. d) near the north pole. e) below the horizon.

SUGGESTED ANSWER: (d)

Wrong answers:
a) Polaris would be on the horizon.
b) Oh c'mon, you know you're not.
c) Have you ever seen it at Zenith in Las Vegas?
e) Well relative to someone else I suppose.

Redaction: Jeffery, 2001jan01

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002 qmult 02500 3 4 3 tough deducto-memory: Polaris in Vegas

14. The altitude of Polaris is 36°. (Recall altitude in astronomy is angle measured straight up from the horizon.) You are:

a) on the equator. b) at the latitude of Fairbanks, Alaska. c) at the latitude of Las Vegas, Nevada. d) near the north pole. e) below the horizon.

SUGGESTED ANSWER: (c) The student could remember that the altitude of the NCP, and therefore approximately of Polaris, is always the same as latitude. This is directly true for the northern hemisphere. For the southern hemisphere the altitude of the NCP is negative: i.e., it is below the horizon. The absolute value of negative altitude is latitude south.

Wrong answers:
a) Polaris would be exactly on the northern horizon in idealized case.
b) Fairbanks is pretty far north. At the north pole, Polaris is near zenith.
d) At the north pole, Polaris is near zenith.
e) A nonsense answer.

Redaction: Jeffery, 2001jan01

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002 qmult 02600 3 4 2 tough deducto-memory: Polaris on 49 parallel

15. The altitude of Polaris is 49°. (Recall altitude in astronomy is angle measured straight up from the horizon.) You are:

a) on the equator. b) perhaps on the border of Canada. c) at the latitude of Las Vegas. d) near the north pole. e) in the southern hemisphere.

SUGGESTED ANSWER: (b)

Wrong answers:
d) Polaris is nearly at zenith there.

Redaction: Jeffery, 2001jan01

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002 qmult 02700 2 4 1 moderate deducto-memory: Vegas latitude
16. Las Vegas is at about:

a) 36° north latitude. b) 36° north longitude. c) 36° south latitude. d) 72° north latitude. e) 49° north latitude.

SUGGESTED ANSWER: (a)

Wrong answers:
b) There is no north longitude.

Redaction: Jeffery, 2001jan01

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002 qmult 02800 1 4 3 easy deducto-memory: Sun motion
17. Every day the Sun moves west in the sky. Relative to the fixed stars it is:

a) not moving. b) moving mainly west. c) moving mainly east. d) moving mainly north. e) oblique.

SUGGESTED ANSWER: (c)

Wrong answers:
a) It does move relative to the fixed stars. That is why the night time stars change with the season.
e) A nonsense answer.

Redaction: Jeffery, 2001jan01

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002 qmult 02810 1 1 4 easy memory: ecliptic defined
18. The ecliptic is:

a) the path of Pluto on the sky.
b) a sphere (centered on the Earth) on which all the celestial bodies are located.
c) an imaginary sphere (centered on the Sun) on which all the celestial bodies are located.
d) the path of the Sun on the sky.
e) the cause of eclipses.

SUGGESTED ANSWER: (d)

Wrong answers:
e) Eclipses are so called because they happen when the Moon is on the Ecliptic.

Redaction: Jeffery, 2001jan01

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002 qmult 02900 2 4 5 moderate deducto-memory: equinox defined

19. An equinox is:

a) the path of the Earth on the sky.
b) a sphere (centered on the Earth) on which all the celestial bodies are located.
c) an imaginary sphere (centered on the Sun) on which all the celestial bodies are located.
d) the path of the Sun on the sky.
e) a point where the ecliptic crosses the celestial equator.

SUGGESTED ANSWER: (e)

Wrong answers:
d) That's the ecliptic.

Redaction: Jeffery, 2001jan01

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002 qmult 03000 1 4 1 easy deducto-memory: summer tilt

20. In the summer of the northern hemisphere:

a) the northern hemisphere day side is tilted toward the Sun.
b) the northern hemisphere day side is tilted away from the Sun.
c) the southern hemisphere day side is tilted toward the Sun
d) the Earth is nearest the Sun.
e) the Earth is at 0.7 astronomical units from the Sun.

SUGGESTED ANSWER: (a)

Wrong answers:
b) The Sun would then be comparatively low on the horizon in the northern hemisphere: viz. it is winter in the northern hemisphere.
c) Same as (b)
d) Actually the Sun is at perihelion (nearest point to the Sun) in the 1st week in January and at aphelion (fartherest point from the Sun in early July (Se-23). Thus, the eccentricity of the Earth's orbit ($e = 0.0167$) doesn't dominate the seasons caused by the axial tilt.
e) Since the Earth's eccentricity is 0.0167, the Earth at perihelion is 0.983 AU from the Sun.

Redaction: Jeffery, 2001jan01

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002 qmult 03020 2 1 1 moderate memory: Sun rise direction

21. Does the Sun rise north or south of east in the summer in northern latitudes?

a) North. b) South. c) Neither. It rises due east always. d) Yes. e) No.

SUGGESTED ANSWER: (a)

Wrong answers:
b) The Sun does this from autumn to spring equinox.
c) The Sun only rises due east when at the equinoxes.
d) A nonsense answer.
e) A nonsense answer.

Redaction: Jeffery, 2001jan01

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002 qmult 03100 3 4 2 tough deducto-memory: gnomon shadow

22. Say you are in the northern hemisphere and have a gnomon (a stick set in the ground and set perpendicular to the ground). It is the winter solstice and noon. It is sunny and clear.

    a) The shadow of the gnomon points due **SOUTH**.
    b) The gnomon has its shortest shadow for that day, but it has its **LONGEST** noon shadow of the year.
    c) The gnomon shadow points due **EAST** and it is the longest it can be for that day.
    d) The gnomon has no shadow.
    e) The gnomon has its shortest shadow for that day and it has its **SHORTEST** noon shadow of the year.

SUGGESTED ANSWER: (b) A lot of facts have to be put together.

Wrong answers:
d) Now Gnomon may not see his shadow, but he does have one.

Redaction: Jeffery, 2001jan01

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002 qmult 03200 3 4 5 tough deducto-memory: Venus transiting Sun

23. Venus is in inferior conjunction. But it is not transiting the Sun (i.e., crossing the face of the Sun). Why not?

    a) It is behind the Sun relative to Earth.
    b) It is in retrograde motion.
    c) It never transits the Sun.
    d) The tilt of the orbit of Venus from the ecliptic means that Venus is usually **WEST** of the Sun during inferior conjunction. This must be the case in the present example.
    e) The tilt of the orbit of Venus from the ecliptic means that Venus is usually **ABOVE OR BELOW** the Sun at conjunctions (using the ecliptic plane to establish up and down). Venus must be above or below in the present example.

SUGGESTED ANSWER: (e)

Wrong answers:
a) That's superior conjunction.
b) True, Venus is in retrograde motion (i.e., moving west relative to the fixed stars) at the time of inferior conjunction, but that's not answer.
c) Au contraire, but rarely. Transits of Venus occur in pairs 8 years apart. Between the last of a pair and the first of the next pair elapses altnernatively periods of 105.5 and 121.5 years (Berry's astro history p. 284). The next pair of transits (last depending on the antiquity of these electronic notes) occurs in 2004 and 2012; after that in 2117 and 2125. The transits occur when Venus is close to the two points where its orbit crosses the ecliptic at the same time as it's in inferior conjunction.
d) Venus can't be west of the Sun and in inferior conjunction at the same time: a logically inconsistent answer.

Redaction: Jeffery, 2001jan01

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002 qmult 05000 1 1 2 easy memory: constellation

24. A constellation is:

    a) a conventional grouping of **PLANETS** on the celestial sphere. b) a conventional grouping of **STARS** on the celestial sphere. c) a group of gravitationally bound **STARS**. d) the Moon at sunset. e) stars seen at sunset.

SUGGESTED ANSWER: (b)

Wrong answers:
d) C'mon. The Moon?

Redaction: Jeffery, 2001jan01

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002 qmult 05005 1 1 4 easy memory: constellation relation
Extra keywords: physci KB-24-5
25. The stars in a constellation are:

a) in orbit about the Earth. b) all about the same age. c) at about the same distance from the Earth. d) usually unrelated, except that they are close in angular position as seen from the Earth. e) members of the solar system.

SUGGESTED ANSWER: (d)

Wrong answers:
a) Geometrically, you could say they orbit the celestial axis.
e) As Lurch would say: "Aaaarh."

Redaction: Jeffery, 2001jan01

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002 qmult 05010 1 4 3 easy deducot-memory: three constellations
26. Three IAU (International Astronomical Union) official constellations are:

a) the Big Dipper, the Little Dipper, and the Tiny Dipper. b) the Big Dipper, Orion, and Callisto. c) Ursa Major (the Big Bear), Orion, and Cassiopeia. d) Ursa Major (the Big Bear), Orion, and Buffy. e) Ulysses, Euripides, and Federigo.

SUGGESTED ANSWER: (c)

Wrong answers:
a) The Big and Little Dipper are not IAU constellations, but only asterisms. Of course, they are traditional constellations. There is no Tiny Dipper.
b) Callisto is a moon of Jupiter.
d) Buffy has not yet been raised to the heavens.
e) They all should have constellations in a just world.

Redaction: Jeffery, 2001jan01

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002 qmult 05030 1 4 3 easy deducto-memory: IAU constellation
27. "Let's play *Jeopardy*! For $100, the answer is: Any traditionally recognized group of stars on the sky or one of the 88 International Astronomical Union (IAU) recognized groups of stars and its defined region on the celestial sphere."

What is _____, Alex?

a) a star cluster b) a star party c) a constellation d) an astigmatism e) Asterix

SUGGESTED ANSWER: (c)

Wrong answers:
a) A star cluster is a physical grouping of stars. The stars are close together in space and formed from the same star forming region and have nearly the same age.

b) A star party is a group of amateur astronomers who congregate to look at some astro bodies. Such affairs are usually perfectly innocent.
d) An astigmatism is an eye-focusing problem. You may be thinking of asterism which can be any traditionally recognized grouping of stars on the sky excluding the IAU constellations. In older usage asterism could be a synonym for constellation, but that usage is now disfavored at least by professional astronomers.
e) Asterix is a Gaul: see `http://easyweb.easynet.co.uk/~leifc/`.

Redaction: Jeffery, 2001jan01

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002 qmult 05200 1 4 5 easy deducto-memory: constellation sets

28. All historical cultures eventually arrived independently at the same set of constellations.

a) Yes. b) For short periods of time. c) Every other Thursday. d) No. They all started with the same set of constellations, but as time passed they varied them to arrive at very different sets. e) No.

SUGGESTED ANSWER: (e)

Wrong answers:
d) Could this be right? If all humans started from one culturally small group with constellations, could it be right? Well first off we don't know that they did start off so. Secondly, "all historical cultures" involves those that evolved later than the earliest humans and they surely didn't have the same constellations. "Historical culture" is a pretty vague term.

Redaction: Jeffery, 2001jan01

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002 qmult 05210 1 4 3 easy deducto-memory: 48 classical constellations

29. "Let's play *Jeopardy*! For $100, the answer is: He defined the 48 classical constellations (i.e., the 48 constellations passed on by the ancient Greco-Roman civilization)."

Who was _____, Alex?

a) Berossos, priest of Bel b) Aristotle c) Ptolemy d) King Ptolemy e) Cleopatra

SUGGESTED ANSWER: (c)

Wrong answers:
a) Berossos of Babylon (3rd century BC) moved to the Greek island of Kos and founded a school astronomy/astrology (No-38–39).
d) The Macedonian dynasty of Egypt had many King Ptolemys but none were astronomers to my knowledge.
e) The gender should be the give away. Actually Cleopatra in after-legend was credited with arcane wisdom and is the apocryhal author of a work on alchemy I believe.

Redaction: Jeffery, 2001jan01

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002 qmult 05300 1 4 5 easy deducto-memory: X is constellation Y

30. A modern astronomer who wished to indicate that an astro-body X was located in the patch of sky belonging IAU defined constellation Taurus would say:

a) X is on Taurus. b) X is within Taurus. c) X is superimposed on Taurus. d) X is digested by Taurus. e) X is in Taurus.

SUGGESTED ANSWER: (e)

Wrong answers:
d) Digested by Taurus?

Redaction: Jeffery, 2001jan01