Introductory Astronomy   NAME:

Homework 2: The Sky: Homeworks and solutions are posted on the course web site. Homeworks are **NOT** handed in and **NOT** marked. But many homework problems (~ 50–$70\,\%$) will turn up on tests.

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001 qmult 00007 1 4 1 easy deducto-memory: reading-homework-self-testing done 2
1. Did you complete reading-homework-self-testing for the Introductory Astronomy Lecture (IAL) by the weekly due date?

   a) YYYessss!   b) Jawohl!   c) Da!   d) Sí, sí.   e) OMG no!

   SUGGESTED ANSWER: (a),(b),(c),(d)

   Wrong answers:
   e) As Lurch would say AAAARGH.

   Redaction: Jeffery, 2008jan01

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002 qmult 00100 1 1 4 easy memory: old astronomy
2. Much of astronomy lore about what is seen on the sky is at least vaguely well known and dates back:

   a) days.   b) months.   c) decades.   d) millennia.   e) millions of years.

   SUGGESTED ANSWER: (d)

   Wrong answers:
   e) Note as known to humans anyway.

   Redaction: Jeffery, 2008jan01

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002 qmult 00210 2 1 3 moderate memory: parallax definition
3. Parallax is:

   a) the westward motion of a planet.
   b) the change in angular position of an object due to the subjective nature of observations.
   c) the change in angular 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 change in angular position of an object due to the change in position of the observer. Parallax is **NEVER** detected for astro-bodies 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 determining the distances to stars and galaxies.

   Redaction: Jeffery, 2001jan01

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002 qmult 00212 2 4 2 moderate deducto-memory: parallax of astro-bodies
4. "Let's play *Jeopardy*! For $100, the answer is: This condition of astro-bodies means that they show no parallax to unaided-eye observations for any movements about the Earth's surface."

   What is their _____, Alex?

   a) closeness relative to the size of the Earth   b) remoteness relative to the size of the Earth
   c) spherical nature   d) reflectivity   e) sensitivity

   SUGGESTED ANSWER: (b)

   Wrong answers:
   a) Exactly wrong.

   Redaction: Jeffery, 2001jan01

002 qmult 00222 2 5 1 moderate thinking: celestial sphere described
5. 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 00224 1 1 2 easy memory: celestial sphere rational
6. Thinking of the celestial sphere as an actual giant sphere centered on the Earth with stars pasted on it
makes some sense if like some of the ancient Greek cosmologists, you believe the Earth is at the center
of the cosmos and is:

   a) ovoid.   b) round.   c) square.   d) sediment at the bottom of the cosmic vortex.
   e) the top of a pillar.

SUGGESTED ANSWER: (b)

Wrong answers:
   d) Democritus thought this it seems. Which just goes to show you can't right all the time.

Redaction: Jeffery, 2008jan01

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002 qmult 00226 1 4 5 easy deducto-memory: Aristotelian cosmology
7. "Let's play *Jeopardy*! For $100, the answer is: The cosmology handed down from Greco-Roman
Antiquity (c.800 BCE–c.500 CE) to Medieval Islamic, Medieval European, and early modern European
cultures as a sort of philosophical dogma. It offered a qualitative explanation of the motion of the
celestial bodies. The stars were pasted on a giant remote celestial sphere. The other bodies rotated

by varying rates on inward nested invisible celestial spheres with unaligned axes connecting them and compounding their rotations. The behavior of spheres very roughly accounted for the complex motions of the other bodies, in particular, apparent retrograde motion. The motions were driven by gods in the ancient conception and angels in the Medieval and Early modern European conception. The ancient cosmology was completely superceded by the work of Copernicus (1473–1543), Galileo (1564–1642), Kepler (1571–1630), Newton (1643–1727), and others."

What is _____, Alex?

a) Babylonian cosmology   b) Thalean cosmology   c) Parmidean cosmology
d) Democritean cosmology   e) Aristotelian cosmology

SUGGESTED ANSWER: (e)

Wrong answers:
 d) Democritus goofed by not making his Earth spherical.

Redaction: Jeffery, 2008jan01

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002 qmult 00230 1 4 3 easy deducto-memory: celestial poles
8. "Let's play *Jeopardy*! For $100, the answer is: They are the extensions of the Earth's axis out to the celestial sphere."

What are _____, Alex?

a) zenith and nadir   b) horizon and nadir   c) the north and south celestial poles (NCP and SCP)   d) the celestial equator and the eliptic   e) the ecliptic pole and the celestial axis

SUGGESTED ANSWER: (c)

Wrong answers:
 e) Well the NCP and SCP together constitute the celestial axis, ecliptic pole is wrong.

Redaction: Jeffery, 2001jan01

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002 qmult 00240 2 1 2 moderate memory: zenith and nadir
9. 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) This is not the best meaning for zenith 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 00250 2 4 3 moderate deducto-memory: Polaris position
Extra keywords: a look-up question
10. 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 (NCP) in J2000 equatorial coordinates? **Note:** J2000 equatorial coordinates are just the preferred modern reference equatorial coordinates for the celestial sphere: they are the equatorial coordinate values for the reference year, year 2000. All the student needs to know is that declination is like latitude and the angle from the 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:** See Wikipedia: Polaris.

 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 uses the J2000 coordinates (I think) from Wikipedia: Polaris. There could be a difficulty if people have a mental block on sexagesimal arithmetic:

```
      90 00 00    changes to    89 59 60
    - 89 15 51                - 89 15 51

      --------                   --------
       ?  ?  ?                   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 00251 1 1 3 easy memory: Polaris located
11. Polaris is easily located using the pointer stars of:

a) the Very Tiny Dippler   b) the Little Dipper.   c) the Big Dipper.   d) the Big Tipper.
e) Cassiopea.

SUGGESTED ANSWER: (c)

Wrong answers:
a) A nonsense answer.

Fortran-95 Code

Redaction: Jeffery, 2008jan01

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002 qmult 00256 3 4 3 tough deducto-memory: Polaris in Vegas
12. 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 00258 3 4 2 tough deducto-memory: Polaris on 49th parallel
13. 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 00280 2 4 2 moderate deducto-memory: circumpolar stars

14. 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.

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

   Redaction: Jeffery, 2001jan01

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002 qmult 00282 1 4 4 easy deducto-memory: point-like stars
15. 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:
   a) This is just untrue.
   b) One would have to have lived in a rabbit hole.
   c) This is a red herring.
   e) Color is irrelevant to shape (at least to first order).

   Redaction: Jeffery, 2001jan01

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002 qmult 00300 1 1 3 easy memory: three astronomical location systems
16. Three astonomical location methods are by using modern constellations, horizontal coordinates, and:

   a) Cartesian coordinates.   b) polar coordinates.   c) equatorial coordinates.
   d) vertical coordinates.   e) miscellaneous coordinates.

   SUGGESTED ANSWER: (c)

   Wrong answers:
   a) A nonsense answer.

   Redaction: Jeffery, 2008jan01

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002 qmult 00310 1 1 2 easy memory: horizontal coordinates
17. In horizontal coordinates, the center is _____. The coordinates are altitude and _____. Special features are zenith, nadir, and the _____.

   a) the Earth's center; compass angle; longitude   b) where you are; azimuth; meridian
   c) the Earth's center; compass angle; latitude   d) the Earth's center; azimuth; longitude
   e) where you were; azimuff; meringue

   SUGGESTED ANSWER: (b)

   Wrong answers:
   e) Seems fine to me.

   Redaction: Jeffery, 2008jan01

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002 qmult 00320 2 4 3 moderate deducto-memory: transit the meridian
18. What does "to transit the meridian" mean? It means that an object:

a) passes through the zenith.
b) crosses the meridian of **GREENWICH** due to the rotation of the Earth.
c) crosses the meridian (i.e., the **LOCAL MERIDIAN**) due to the rotation of the Earth.
d) is in conjunction with the Sun.
e) 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 00350 1 1 4 easy memory: equatorial coordinates
19. The most standard set of astronomical coordinates are

a) longitude and latitude.   b) polar coordinates.   c) cartesian coordinates.
d) equatorial coordinates.   e) galactic coordinates.

SUGGESTED ANSWER: (d)

Wrong answers:
e) They are used, but they arn't the best answer.

Redaction: Jeffery, 2008jan01

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002 qmult 00352 1 1 2 easy memory: equatorial coordinates center
20. Corrections need to be made for the parallax of close astro-bodies, but usually speaking the center for the equatorial coordinates is:

a) the North Pole.   b) any place on Earth.   c) the Earth's center.   d) the equator.
e) any place on Mars.

SUGGESTED ANSWER: (b)

Wrong answers:
a) A nonsense answer.

Redaction: Jeffery, 2008jan01

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002 qmult 00360 2 4 3 moderate deducto-memory: declination defined
21. What is declination (dec or δ)?

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 vernal (or spring) 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 00410 1 1 4 easy memory: ecliptic defined
22. The ecliptic is:

a) the great circle path of Pluto on the celestial sphere.
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 great circle path of the Sun on the celestial sphere.

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 00414 1 1 5 easy memory: ecliptic plane and ecliptic pole

23. The _____ is the plane of the ecliptic (the path of the Sun on the celestial sphere) and the _____ is the perpendicular to this plane.

  a) elliptic variation; elliptic mean   b) variation; mean   c) elliptic plane; elliptic pole
  d) ecliptic plane; elliptic pole   e) ecliptic plane; ecliptic pole

SUGGESTED ANSWER: (e)

Wrong answers:
  a) A nonsense answer.

Redaction: Jeffery, 2008jan01

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002 qmult 00420 1 4 3 easy deducto-memory: Sun motion on celestial sphere

24. Every day the Sun moves west on the sky with the celestial sphere. But relative to the fixed stars on the celestial sphere 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 00432 1 4 4 easy deducto-memory: summer solstice

25. When the Sun is at the (northern hemisphere) summer solstice, it is:

  a) at the most southern point (i.e., most southern declination) of the ecliptic from the celestial equator.
  b) on the celestial equator.
  c) in the Big Dipper asterism.
  d) at the most northern point (i.e., most northern declination) of the ecliptic from the celestial equator.
  e) at zenith.

SUGGESTED ANSWER: (d)

Wrong answers:
  a) The Sun is high in the northern sky then, not low.
  b) Only at the equinoxes is the Sun on the equator.
  c) The Big Dipper is far from the Zodiac. The Sun is never there.
  e) the Sun can only be at zenith in the tropics.

Redaction: Jeffery, 2001jan01

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002 qmult 00434 2 1 1 moderate memory: Sunrise direction

26. 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 00436 1 4 1 easy deducto-memory: summer tilt

27. 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 00440 2 4 5 moderate deducto-memory: equinox defined

28. 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 00510 1 1 1 easy memory: eastward motion on celestial sphere

29. As viewed from the Earth, the Sun, the moon, all the planets, and most of the asteroids move _____ on the celestial sphere (and relative to the fixed stars) all or most of the time. Their paths are close to the ecliptic, except that the Sun path is the ecliptic by definition.

a) eastward   b) westward   c) northward   d) southward
e) outward with the expansion of the universe

SUGGESTED ANSWER: (a)

Wrong answers:

e) As Lurch would say AAAAaargh.

Redaction: Jeffery, 2008jan01

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002 qmult 00520 1 1 4 easy memory: conjunction and opposition defined

30. When two astro-bodies are aligned on the sky, they are _____ and when they are 180° apart on the sky, they are in _____.

a) conjunction; antiparallel   b) construction; opposition   c) conduction; opposition
d) conjunction; opposition   e) parallel; antiparallel

SUGGESTED ANSWER: (d)

Wrong answers:

e) Sounds reasonable for the lines from the Earth to the astro-bodies.

Redaction: Jeffery, 2008jan01

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002 qmult 00530 1 1 1 easy memory: retrograde motion
31. Retrograde motion (or in modern astro-jargon apparent retrograde motion) is when a planet moves _____ on the celestial sphere.

a) westward   b) eastward   c) northward   d) southward
e) outward with the expansion of the universe

SUGGESTED ANSWER: (a)

Wrong answers:

e) As Lurch would AAAaargh.

Redaction: Jeffery, 2008jan01

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002 qmult 00546 1 1 3 easy memory: long-period comets
32. Long-period comets have orbital periods ranging from 200 years to millions of years and sometimes to infinity (i.e., they escape the Solar System). Their orbits _____ and viewed in projection can be clockwise or counterclockwise for any viewing direction.

a) are very roughly aligned with the ecliptic plane
b) are nearly aligned with the ecliptic plane   c) have random orientations   d) are circular
e) are always open

SUGGESTED ANSWER: (c)

Does the concept of clockwise or counterclockwise make sense without a specified orbital plane and viewing angle? It depends a bit on how one is thinking, I think. But if one does specify a direction, the orbits viewed in projection will be clockwise or counterclockwise.

Wrong answers:

e) Some of them have open orbits: i.e., they escape the Solar System.

Redaction: Jeffery, 2008jan01

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002 qmult 00580 1 1 2 easy memory: number Solar System planets
Extra keywords: physci
33. The number of officially recognized Solar System planets is:

a) 9.   b) 8.   c) 6.   d) 2.   e) 1.

SUGGESTED ANSWER: (b)

Wrong answers:

a) Poor Pluto. Once it was a planet, the 9th planet. But now it has be degraded. It's an ex-planet, but a faded glory lingers.
c) This is the number of planets known since prehistory: Uranus, Neptune, and Pluto are modern discoveries.
e) As Lurch would say: "Aaaarh."

Redaction: Jeffery, 2001jan01

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002 qmult 00582 1 1 5 easy memory: name 3 planets
Extra keywords: physci
34. Name three planets.

a) The Moon, Pluto, Mars.   b) The Moon, Jupiter, Saturn.
c) Ganymede, Uranus, Neptune.   d) Ganymede, Toronto, Orion.
e) Mercury, Uranus, Earth.

SUGGESTED ANSWER: (e)

General knowledge should say which one has to be right; which ones have to be wrong.

Wrong answers:
d) Toronto is not a planet.

Redaction: Jeffery, 2001jan01

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002 qmult 00584 1 1 2 easy memory: planets shine by reflected light
Extra keywords: physci KB-604
35. The Solar System planets shine in visible light because they:

a) reflect moonlight.   b) reflect sunlight.   c) reflect earthlight.   d) emit light powered by their internal heat.   e) are planets.

SUGGESTED ANSWER: (b)

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

Redaction: Jeffery, 2001jan01

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002 qmult 00586 1 1 5 easy memory: 8-year Venus cycle
36. Sometime circa 1650 BCE, the ancient Babylonian astronomers discovered the Venus cycle. Their record of this is called (by moderns) the *Venus Tablet of Ammisaduqa*: King Ammisaduqa was Hammurabi's grandson. The Venus cycle is just a result of the synodic period of Venus being about 583.92 days and the Earth's orbital period being about 365.25 days (a Julian year). The synodic period is the time for the planet to return to the same position in the sky relative to the Sun. Five synodic periods is 2919.60 days and 8 Julian years is 2922.00 days. These times are nearly equal. So 8 years from any day, Venus will be back where it was on that day relative to the Sun (because 8 years is 5 synodic periods) and relative to the fixed stars (because the Sun comes back to the same position relative to the fixed stars every year). It is now easy to predict Venus' position approximately to the past or future from 8 years of observations. A lot of ancient astronomical prediction skill comes down to using approximate cycles like the Venus cycle. It's not rocket science.

If Venus is nearly in same place relative to the Sun every 8 years, where is it relative to the fixed stars at the same intervals?

a) Far off the ecliptic.   b) 30° farther east on the ecliptic every Venus cycle period.
c) 30° farther west on the ecliptic every Venus cycle period.   d) It's unpredictable.
e) Nearly the same place.

SUGGESTED ANSWER: (e)

I've given the answer in the preamble—tricky. Anyway after a year the Sun is back at about the same place on the celestial sphere. If Venus is back where it was relative to the Sun after 8 years, it's also back where it was relative to the fixed stars.

Wrong answers:
a) A nonsense answer.

Redaction: Jeffery, 2008jan01

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002 qmult 00600 1 1 2 easy memory: constellation traditionally defined
37. A constellation by the traditional definition 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

002 qmult 00602 1 1 2 easy memory: naked eye stars

38. The constellations are made up of naked eye stars. The number of naked eye stars visible under typical good observing conditions is estimated to be:

a) about 100.   b) about 5600.   c) exactly 5600.   d) in the millions.   e) infinite.

SUGGESTED ANSWER: (b) This the number from Wikipedia: Naked eye in astronomy.

Wrong answers:
  e) Probably uncountable, but not infinite.

Redaction: Jeffery, 2008jan01

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002 qmult 00620 2 1 2 moderate memory: asterism defined

39. What is an asterism?

  a) A group of gravitationally bound stars moving about their common center of mass in orbits that are very roughly elliptical. Because of the many-body nature of the system, the orbits cannot be true ellipses. There are too many perturbing gravitational effects and usually no true absolutely dominant massive star located near the center of mass.
  b) An angular grouping of stars not officially identified as a constellation: e.g., the Big Dipper which officially is only a part of Ursa Major (the Big Bear). Usually asterism is used only for named angular groupings. In older usage asterism could be used as a synonym for constellation, but that usage is disfavored by astronomers.
  c) A telescopic lens problem that makes stars look elongated.
  d) A barbarian Gaul.
  e) The dog belonging to Nick and Nora Charles.

SUGGESTED ANSWER: (b)

Wrong answers:
  a) I think this answer is roughly true for an open cluster of stars (which is not necessarily and not usually an asterism), but I don't really know anything in particular about cluster celestial mechanics.
  c) You're thinking of astigmatism. An eye or lens problem causing unfocused convergence to an image.
  d) That's Asterix: see `http://easyweb.easynet.co.uk/~leifc/`.
  e) Asta, Asta, as in Asta la vista: the dog that secretly solved all the Thin Man cases.

Redaction: Jeffery, 2001jan01

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002 qmult 00640 2 4 3 moderate deducto-memory: circumpolar constellation defined

40. A circumpolar constellation:

a) sometimes rises and sets.   b) is a group of gravitationally bound stars.   c) never rises or sets.   d) is located at zenith.   e) is a group of stars seen at sunset.

SUGGESTED ANSWER: (c)

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. Now some students might argue that stars that are above and below the horizon will be circumpolar for someone. This is true, but that answer would be meaningless as a definition. Almost any short definition implies a host of qualifications that would make it more precise, but in common usage never need to be spoken. But what is circumpolar always depends on where the observer is.

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

Redaction: Jeffery, 2001jan01

002 qmult 00650 1 1 4 easy memory: 6 easy constellations

41. Six relatively easily found constellations in the sky seen from the Northern Hemisphere are Ursa Major (containing the Big Dipper), Ursa Minor (containing the Little Dipper and Polaris), Cassiopia (the big W in the northern sky), Orion (lord of the winter sky), Canis Major (containing Sirius, the Dog Star), and:

   a) Mensa.   b) Antinous.   c) Tucana.   d) Taurus.   e) Norma.

   SUGGESTED ANSWER: (d)

   By the way I don't imply that finding the constellation is the same as finding all of the stars in it that give it its traditional shape. That's pretty hard to do. With Canis Major, I only really know Sirius.

   Wrong answers:
   a) Yes, the organization for smart people have their own constellation.
   b) Poor old Antinous, he's an obsolete constellation—but his deification has never been rescinded—he's still a god.
   c) You have to be pretty far south to see the Toucan.
   e) Right between Ara and Lupus—you can't miss it.

   Redaction: Jeffery, 2008jan01

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002 qmult 00670 1 4 5 easy deducto-memory: cultural constellation sets

42. 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 00680 1 4 5 easy deducto-memory: 48 classical constellations

43. "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 is _____, Alex?

   a) Aristotle (384–322 BCE)   b) Berossos, priest of Bel Marduk (3rd century BCE)
   c) King Ptolemy I (c. 367–c. 283 BCE)   d) Cleopatra (69–30 BCE)
   e) Ptolemy (circa 100–175 CE)

   SUGGESTED ANSWER: (e)

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

   Redaction: Jeffery, 2001jan01

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002 qmult 00682 1 1 3 easy memory: zodiac constellations

44. The 12 zodiac constellations:

a) are all within a band of 90° right ascension.   b) are very near 90° declination.
c) straddle the ecliptic.   d) are very near −90° declination.
e) do **NOT** straddle the ecliptic.

SUGGESTED ANSWER: (c)

Actually Ophiuchus straddles the ecliptic, but he didn't make the cut with the ancient Babylonians.

Wrong answers:
 e) Exactly wrong.

Redaction: Jeffery, 2008jan01

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002 qmult 00710 1 4 3 easy deducto-memory: IAU constellation defined
45. "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://en.wikipedia.org/wiki/Asterix`.

Redaction: Jeffery, 2001jan01

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002 qmult 00730 1 4 3 easy deducot-memory: three IAU constellations
46. 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 00750 1 4 5 easy deducto-memory: X is in constellation Y
47. A modern astronomer, speaking in conventional jargon, 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