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 ($\sim$ 50–70 %) will turn up on tests.

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!

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.

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.

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

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 **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.
   b) 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.
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   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.

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.

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

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

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.

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.

11. Polaris is easily located using the pointer stars of:

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

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. Three astronomical 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.

18. 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

19. 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).

20. The most standard set of astronomical coordinates are

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

21. Corrections need to be made for the parallax of close astro-bodies, but for most purposes the center for the determination the angles of the equatorial coordinates with negligible error can be assumed to be:

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

22. 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.

23. 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.

24. 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

25. Every day the Sun moves west on the sky with the celestial sphere. Relative to the fixed stars on the celestial sphere it is:

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

26. 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.

27. 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.

28. 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.

29. 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.

30. 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

31. 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

32. 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

33. 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

34. The number of officially recognized Solar System planets is:

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

35. 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.

36. The Solar System planets shine in visible light because they:

a) reflect moonlight. b) reflect earthlight. c) reflect sunlight. d) emit light powered by their internal heat. e) have a little nuclear burning.

37. 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.

38. 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.

39. 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.

40. 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.

41. A circumpolar constellation:

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

42. 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.

43. 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.

44. "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 (c.100–c.170 CE)

45. 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.

46. "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

47. 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.

48. 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.