

Astronomy 350: Worksheet 1 - Positional Astronomy

- 1. Why is the sidereal day shorter than the solar day?
- 2. What is the difference between a sidereal month and a synodic month? Between a sidereal year and a tropical year?
- 3. What is apparent solar time and what is the difference between this and mean solar time?
- 4. What are the fall and spring equinoxes and the winter and summer solstices in terms of the Earth's orbit around the Sun?
- 5. What are declination and right ascension? How are they similar and different to latitude and longitude on Earth?
- 6. How and why do the Sun's celestial coordinates change over the course of a year?
- 7. At the North Pole, where is the Celestial equator in the sky and the North Celestial Pole? Describe the motions of the stars here. Do the same for the equator.
- 8. Describe the Sun's paths through the local sky on the equinoxes and solstices for latitude 40°N . Do the same for the North Pole, South Pole and equator.
- 9. What is special about the tropics of Cancer and Capricorn? Describe the Sun's path on the solstices at these latitudes. Do the same for the Arctic and Antarctic circles.
- 10. Briefly describe how you would use the Sun or stars to determine your latitude and longitude.
- 11. Describe why the following statements do or do not make sense: a) the apparent solar time was noon, but the Sun was just setting. b) my mean solar clock said it was 2.00pm but a friend who lives east of here had a mean solar clock that said it was 2.11pm. c) when the standard time is 3.00pm in Baltimore, it is 3.15pm in Washington DC. d) Last night I saw Jupiter at an altitude of 45° in the south. e) The latitude of stars in Orion's belt is about 5° f) today the Sun is at an altitude of 10° on the celestial sphere. g) Los Angeles is west of New York by about 3 hours of right ascension h) the summer solstice is east of the vernal equinox by about 6 hours of right ascension.
- 12. The time from one spring equinox to the next is a) sidereal day b) tropical year c) synodic month.

- 13. Your wristwatch tells you a) apparent solar time b) universal time c) standard time
- 14. A star that is located 30° north of the celestial equator has a) declination= 30° b) right ascension of 30° c) latitude= 30° .
- 15. A star's path through the night sky depends on your latitude and the star's a) declination b) right ascension c) both.
- 16. At 50°N , the celestial equator crosses the meridian at altitude a) 50° in the south b) 50° in the north and c) 40° in the south.
- 17. At the North Pole on the summer solstice, the Sun a) remains stationary in the sky b) reaches zenith at noon c) circles the horizon at an altitude 23.5° .
- 18. If you know a star's declination, you can determine your latitude if you also a) measure its altitude when it crosses the meridian b) measure its right ascension c) know the universal time.
- 19. If you measure the Sun's position in your local sky, you can determine your longitude if you also a) measure its altitude when it crosses the meridian b) know its right ascension c) know the universal time.
- 20. If the Earth did not precess would there be any difference between the sidereal and tropical year?
- 21. Answer the following for a latitude of about 40°N :
 - a) Where is the North Celestial Pole in your sky?
 - b) Describe the location of the meridian in your sky. Specify three distinct points on it. Is there a meridian at the North Pole?
 - c) Describe the location of the celestial equator in your sky. Specify three distinct points along it.
 - d) Does the Sun ever appear at your zenith? If not, why not?
 - e) What range of declinations makes a star circumpolar in your sky? What range of declinations for stars makes it impossible to see in your sky?
- 22. It's Feb 15 and your sundial tells you the apparent solar time is 3.30pm. What is the mean solar time?
- 23. It is 4pm on the spring equinox. What is the local sidereal time?
- 24. The local sidereal time is 19.30. When will Vega (RA= 18^h35^m). When will Vega cross your meridian?

- You observe a star that has an hour angle of 3 hours when the local sidereal time is 8:15. What is the star's RA?
- 25. The Orion Nebula has a declination of about -5.5° and $RA=5^h25^m$. If you are at latitude $40^\circ N$ and the local sidereal time is 7:00, approx where does the Orion Nebula appear in your sky?