Name: ___________________________
Partner(s): ________________________
1101 or 3310: ______
Desk # _____________
Date: _____________

The Sun, Michelangelo, Sistine Chapel

The Apparent Motion of the Sun in Vancouver

Purpose

- Explain how you can find your latitude by looking up at the night sky.
- Explain the local coordinate system and what altitude and azimuth are.
- Describe the path of the Sun as seen from Vancouver on the solstices and equinoxes.
- Explain the trace of the analemma.

Equipment

- Starry Night College
- Plastic hemispheres
- Non-permanent markers

Preconceptions

- Where does the Sun rise?
- Where does the Sun set?

Latitude of a location: Before we start looking at the Sun, let's learn how to find the latitude of your location by looking at the night sky. To do so, sailors use a sextant as shown on the right.

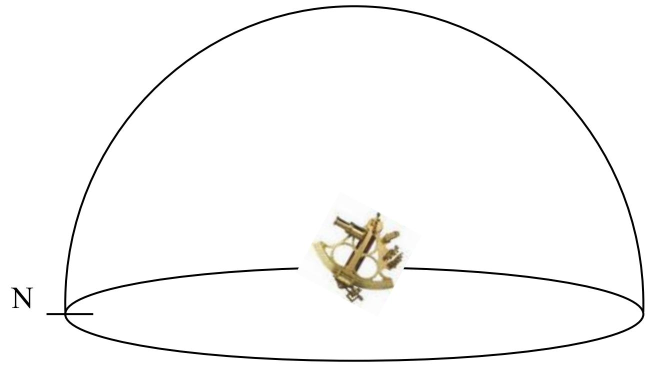
Question 1:

a) Travel to the following locations and measure the angular distance between Polaris (P) and North (N) on the horizon using the Hand/Measure Tool.

b) After selecting the location, record the Latitude of the place by clicking Location > Latitude / Longitude.

Location	Angular distance PN (round to the nearest degree)	Latitude of the place (round to the nearest minutes)
Vancouver, Canada		
Quito, Ecuado		
Reykjavik, Iceland		
Mexico City, Mexico		

c) On a local view of the celestial sphere, draw and explain how to find the latitude of a place:



d) Now travel to Santiago, in Chile. Find Polaris. What do you notice?

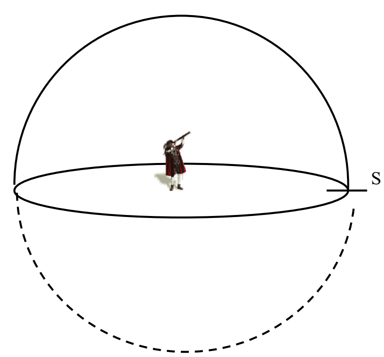
e) Go to SETTINGS > GUIDES AND LINES and select the Equatorial Coordinates and Show Grid, and find a bright star (magnitude less than 7) that could define the South Celestial Pole (SCP).

f) In which constellation is the South Celestial Pole?

g) For the following locations, find the altitude of the SCP.

Location	Altitude of the South Celestial Pole (round to the nearest degree).	Latitude of the place (round to the nearest minutes).
Santiago, Chile		
Pretoria, South Africa		
Sydney, Australia		
Sao Paulo, Brazil		

h) In the diagram to the right, you're an observer in the Southern Hemisphere. Draw the two celestial poles.



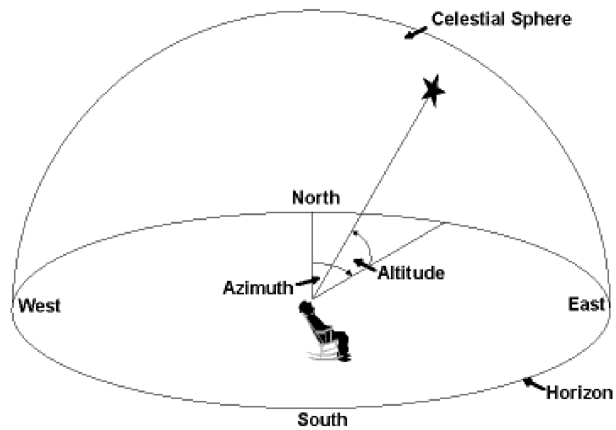
i) On a local view of the celestial sphere, draw and explain how to find the latitude of a place in the Southern Hemisphere.

The Local Coordinate System: Go back to Vancouver. Go to SETTINGS > GUIDES AND LINES and select the Horizon Coordinates and Show Grid. Horizon Coordinates is also called Local Coordinates.

The **altitude** of a celestial object is the angle measured upwards from the observer's horizon. Thus, an object on the horizon has an altitude of 0° and one directly overhead has an altitude of 90°. Negative values for the altitude mean that the object is below the horizon. Altitude is also frequently referred to as elevation.

The **azimuth** of a celestial object is the angle measured clockwise around the observer's horizon from north. An object due north has an azimuth of 0°, one due east 90°, south 180° and west 270°.

In this activity, always round off azimuth and altitude to the nearest degree.



Question 2: Find the azimuth of the following compass points.

N	E	S	W	NE
ESE	SE	SW	NW	WNW

Motion of the Sun as seen from Vancouver: Use a plastic hemisphere to represent the sky in Vancouver, i.e. what you can see from your backyard. Draw N, S, E, W, Z (zenith), P (Polaris) and the local meridian joining N, Z and S.

Set the date to March 21. Check off the box of “Automatic Daylight Saving Time” under “Location > Latitude / Longitude”. Right Click on the Sun and follow it by playing the time from sunrise to sunset. Note the position of the Sun at sunrise, culmination and sunset. Draw the daily path of the Sun on the plastic hemisphere.
(Help: Culmination is the highest altitude that a celestial object attains above the horizon. An object culminates as it crosses the local meridian.) (Check on the box of “Show Meridian”.)

Draw the daily path of the Sun on the same plastic hemisphere on June 21, Sept 21 and Dec 21.

**Ask your instructor to check your work:

Instructor’s initials: _________

Question 3:

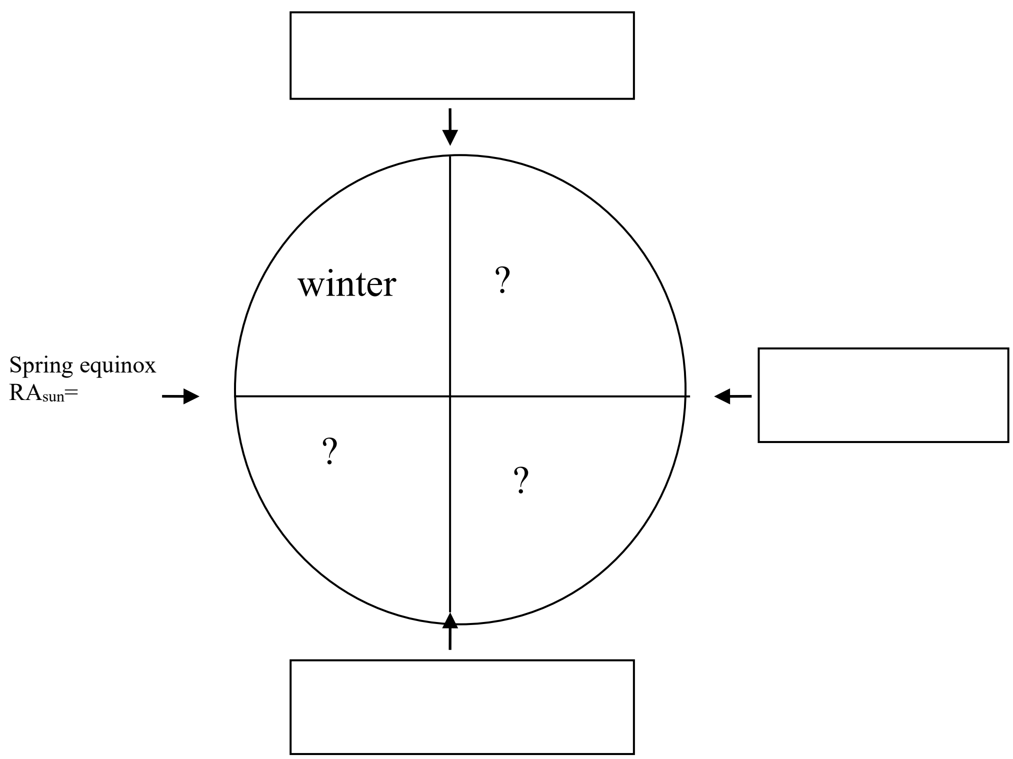
a) What is the date of the summer solstice (longest daylight)? _____________

b) What is the date of the winter solstice (shortest daylight)? _____________

c) When is the length of day equal to the length of night (equinox)? _____________

d) Draw Z and P (Polaris) on the following diagram representing the sky in Vancouver. Draw and label the path of the Sun on each equinox and each solstice.

e) Complete the ecliptic wheel below with the name of the equinox/solstice and the right ascension RA of the Sun on these days. Replace each ? by the name of a season. (You may want to check out the information at SKYGUIDE > UNIT A: Earth, Moon and Sun > A5: The Celestial Sphere > 7: Equinoxes & 8: The Solstices.)



f) What is the right ascension of the sun on the fall equinox? _____________

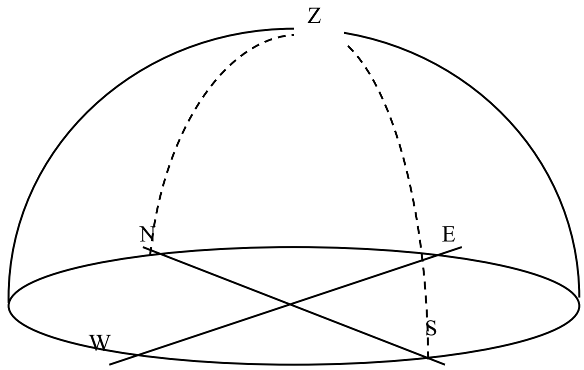
g) What is the declination of the sun on the fall equinox? _______________

h) Does the Sun ever reach the Zenith in Vancouver? ________________

i) Explain why the weather is warmer in Vancouver in June than in December? (Find two reasons).

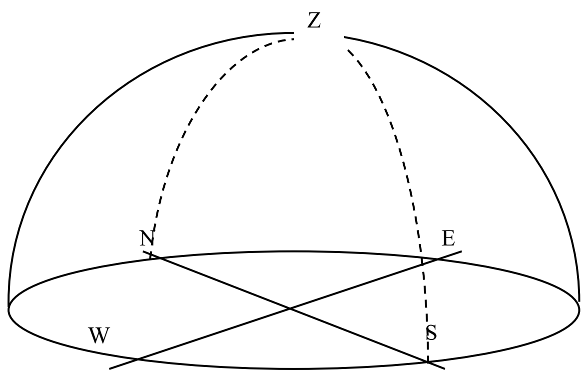
Question 4: Analemma. Say you record the position of the Sun every day at noon in Vancouver.

a) On the following diagram, draw the change in the positions of the Sun that <u>you expect to</u> record (based on what you learn in Question 3 & 4). It might help to draw it on the plastic hemisphere too.



Since the orbit of the Earth is not a perfect circle, the Sun follows an 8 figure. Go to SKYGUIDE > UNIT A: Earth, Moon and Sun > A9: Analemma. Click on "Introduction" and set the location to Vancouver and the time to noon. Uncheck the box of "Automatic Daylight Saving Time" under "Location > Latitude / Longitude". Watch the changes of the Sun's position at noon in the course of a year. Note that the time step is set as 1 day.

b) Draw the analemma. Indicate the date of the highest and lowest positions of the Sun.



Conclusion: Write a 3 to 5-line (complete sentences) conclusion about this lab.

Clean and return your hemisphere.