Name: _____

Date: _____

Section: _____

Astron 104 Laboratory #3
Celestial Coordinates

Introduction

The first way astronomers developed to chart where stars were in the night sky was with a pair of angles called the **right ascension** and **declination**, which are equivalent to the geographic longitude and latitude on Earth.

All exercises below are accessed via the *Virtual Astronomy Lab*. To find them:

1. Go to the *Start Menu*
2. Click on *All Programs*
3. Click on *Virtual Astronomy*
4. Click on *Start Virtual Astronomy Lab*
5. Click on *Unit 7: Celestial Coordinates*

Exercise 1-Using Celestial Coordinates [25 points]

Select *Using Celestial Coordinates* from the list of exercises.

This first exercise shows how **right ascension** and **declination** are used to locate a star on a rectangular grid. The axes for this grid are marked out in degrees (often symbolized by °), with the **right ascension** plotted along the horizontal (x) axis, and the **declination** plotted along the vertical (y) axis. Each axis covers 180°, corresponding to one half of the sky as viewed from a point on the equator.

1. There are twenty stars at the right hand border of the window. If you click on any one of these stars using the left mouse button, the readout at the bottom of the screen will display that star's true **right ascension** and **declination**, both expressed in degrees.
2. Drag the star to the correct position given by the **right ascension** and **declination**. Do this by holding down the left mouse button while you drag the star.

3. If the star is in the correct location it will remain in place, otherwise it will return to the right side of the window and you can try again.

List the coordinates (Right Ascension and Declination) of ths stars in this Exercise **[15 pts.]**:

Star	**Right Ascension**	**Declination**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

1. Give the coordinates of the star that is the furthest to the North of those in your list [**5 pts**].

2. Give the coordinates of the star that is the furthest to the South of those in your list [**5 pts**].

Excercise 2-Expressing the Right Ascension in Hours:Minutes Format [25 points]

While we can express **right ascension** in degrees, it is often more convenient to write it in terms of a time. Since the Earth rotates once every 24 hours, the stars appear to move across the sky at the same rate: 360° per 24 hours, or 15° per hour. We can then express the right ascension as a time instead of an angle, according to:

$$\text{right ascension in degrees} = \text{right ascension in hours} \times 15$$

We also find that it's easier to write times in terms of hours and minutes. We know that:

$$1\,\text{hour} = 60\,\text{minutes}$$

so

$$1\text{minute of right ascension} = \frac{15^\circ}{60} = 0.25\,\text{degrees}$$

Select *Degrees to hours:minutes* from the list of exercises.

1. Using the options at the right side of the window, select one of the three choices for the type of problem:
   (a) degrees to hours:minutes
   (b) hours:minutes to degrees
   (c) Random problem
2. After calculating your answer, enter it and then select "Check your answer" to have the computer compare your answer with the correct one.
3. Do one of each type of problem. Record your questions and answers below.

Number	Question	Answer
1.		
2.		
3.		

Exercise 3-Plotting the Stars using the Hours:Minutes Format [25 points]

This third exercise repeats the first, but with the right ascension expressed in the hours:minutes format rather than in degrees.

Select *Celestial Coordinates using hours:minutes* from the list of exercises. Follow the same instructions used for Exercise 1, with the exception that the right ascension axis is now calibrated in hours, rather than degrees.

List the coordinates (Right Ascension and Declination) of ths stars in this Exercise **[15 pts.]**:

Star	**Right Ascension**	**Declination**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
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17.		
18.		
19.		
20.		

1. Give the coordinates of the star that is the furthest to the North of those in your list [**5 pts**].

2. Give the coordinates of the star that is the furthest to the South of those in your list [**5 pts**].

Exercise 4-Plotting the Stars on the Celestial Sphere [25 points]

Since the surface of the celestial sphere is curved, the flat rectangular grids you have been using are not an accurate representation of the coordinates of the sphere. For example, the two celestial poles (with Declinations $\pm 90^\circ$) appear on the rectangular grid as the entire top and bottom lines of the grid — this is just like how it's hard to make an accurate flat map of the Earth. This exercise gives a perspective which shows the sky as a sphere.

Select *The Celestial Sphere* from the list of exercises. Then follow the same instructions used for Exercise 1.

List the coordinates (Right Ascension and Declination) of ths stars in this Exercise [**15 pts.**]:

Star	**Right Ascension**	**Declination**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

1. Give the coordinates of the star that is the furthest to the North of those in your list [**5 pts**].

2. Give the coordinates of the star that is the furthest to the South of those in your list [**5 pts**].

Calculations: