Retrograde Motion Activity

Before beginning this activity read the information located at:

Retrograde Motion, http://alpha.lasalle.edu/~smithsc/Astronomy/retrograd.html

Some helpful websites:

Ptolemaic Orbit of Mars Module,
http://nw.pima.edu/dmeeks/ast101/101sim/marsorbit.html (source: Astronomy Education at the University of Nebraska-Lincoln).

Epicycles Demo Module, http://nw.pima.edu/dmeeks/ast101/101sim/pathtracer.html
(source: Astronomy Education at the University of Nebraska-Lincoln).

Retrograde Motion of Planets,
http://www.scienceu.com/observatory/articles/retro/retro.html

Venus Fact Sheet, http://nssdc.gsfc.nasa.gov/planetary/factsheet/venusfact.html

Mars Fact Sheet, http://nssdc.gsfc.nasa.gov/planetary/factsheet/marsfact.html

Part of this activity will be done during class.

- You and your team members will act as the Sun, Venus, Earth, and Mars to demonstrate the concept of retrograde motion.
- You will need to create a layout that demonstrates the correct positions of each of these in relation to each other.
- Once you and your team members have established the correct layout, ask your instructor to check your positions, then demonstrate the concept of retrograde motion before completing the questions below.

1. What is retrograde motion?

2. Access and experiment with the Ptolemaic Orbit of Mars Module, http://nw.pima.edu/dmeeks/ast101/101sim/marsorbit.html What did Ptolemy use and how did he explain the retrograde motion of Mars?

3. In Ptolemy's model how would Mars' motion appear to a person on Earth?

4. In Ptolemy's model how would Mars' motion appear to a theoretical person on or near the Sun?

5. In Ptolemy's model how would the Sun's motion appear to a person on Mars?

6. Access and experiment with the Epicycles Demo Module, http://nw.pima.edu/dmeeks/ast101/101sim/pathtracer.html Assume that the blue dot represents Earth, the yellow dot represents the Sun, and the red dot represents Mars. Set the module to keep the blue object fixed. Explain why fixing the Earth produces a result that duplicates Ptolemy's epicycle model.

7. Now set the module to keep the yellow dot fixed. How and why does "moving" the Sun to the center of the solar system still enable us to explain apparent retrograde motion?

8. Complete the following table. Write the answers in columns C and D using two decimal places.

Planet Positions

A	B	C = 365.25/B	D = C/2
Planet	Number of days for one orbit	Number of orbits in one Earth year	Number of orbits in 6 Earth months
Venus			
Earth			
Mars			

9. From Earth's point of view, how do both Venus and Mars appear to travel across the sky in relation to the background stars as they orbit the Sun?

10. From Venus' point of view, how do both Earth and Mars appear to travel across the sky in relation to the background stars as they orbit the Sun?

11. From Mars' point of view, how do both Venus and Earth appear to travel across the sky in relation to the background stars as they orbit the Sun?

12. Draw and label a diagram of the Sun, Venus, Earth, and Mars as they would appear lined up on the same side of the Sun. No credit for this question if you use incorrect labels or leave out any of the objects.

13. Draw and label a diagram of the Sun, Venus, Earth, and Mars as they would appear exactly 6 Earth months later. Hint: you need to know how far in their orbits both Venus and Mars travel during 6 Earth months, using the information from the table above. No credit for this question if you use incorrect labels or leave out any of the objects.

14. Draw and label a diagram of the Sun, Venus, Earth, and Mars as they would appear exactly one Earth year later. Hint: you need to know how far in their orbits both Venus and Mars travel during one Earth year, again, use the information from the table above. Remember that Venus is closer to the Sun so it makes more than one, but less than two entire orbits around the Sun in the time Earth makes one; Mars is farther from the Sun so it makes less than one entire orbit around the Sun in the time Earth makes one. No credit for this question if you use incorrect labels or leave out any of the objects.