Name: _____

Additional Information: Eccentricity + orbit review packet

- Due to the elliptical shape of orbits, when the orbiting body (planets, comets, etc.) revolves around the Sun, its distance from the Sun changes, at times being closer and other times being farther away.
- When an orbiting object is closer to the Sun (star), it speeds up. This is because the gravitational attraction with the Sun increases, causing the increase in orbital speed.
- When an orbiting object is farther from the Sun in its orbit, the gravitational attraction with the Sun decreases, causing a decrease of orbital speed.
- Earth is closer to the Sun in winter, thus having its greatest orbital speed during this time.
- Earth is farther from the Sun in summer, thus having its slowest orbital speed during this time.

Keplers 3 Laws

$E = \frac{a}{L}$

Set 1 — Eccentricity

1. Which object is located at one foci of the elliptical orbit of Mars?

   (1) the Sun
   (2) *Betelgeuse*
   (3) Earth
   (4) Jupiter

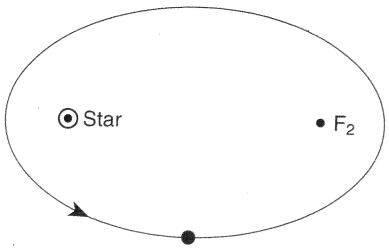
   1 _____

2. Which planet has the most eccentric orbit?

   (1) Mercury
   (2) Venus
   (3) Neptune
   (4) Saturn

   2 _____

3. The diagram below shows the elliptical orbit of a planet revolving around a star. The star and F_2 are the foci of this ellipse. What is the approximate eccentricity of this ellipse?



   (1) 0.22
   (2) 0.47
   (3) 0.68
   (4) 1.47

   3 _____

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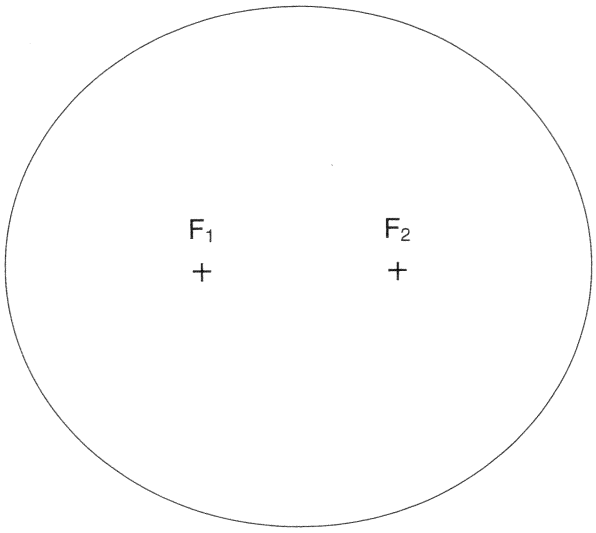
Base your answers to questions 4 and 5 on the diagram below of the ellipse.



4. *a*) Write out the eccentricity equation.

b) From the given ellipse, subsitute the correct values into the equation.

c) Calculate the eccentricity of the ellipse.

5. State how the eccentricity of the given ellipse compares to the eccentricity of the orbit of Mars.

_____

_____

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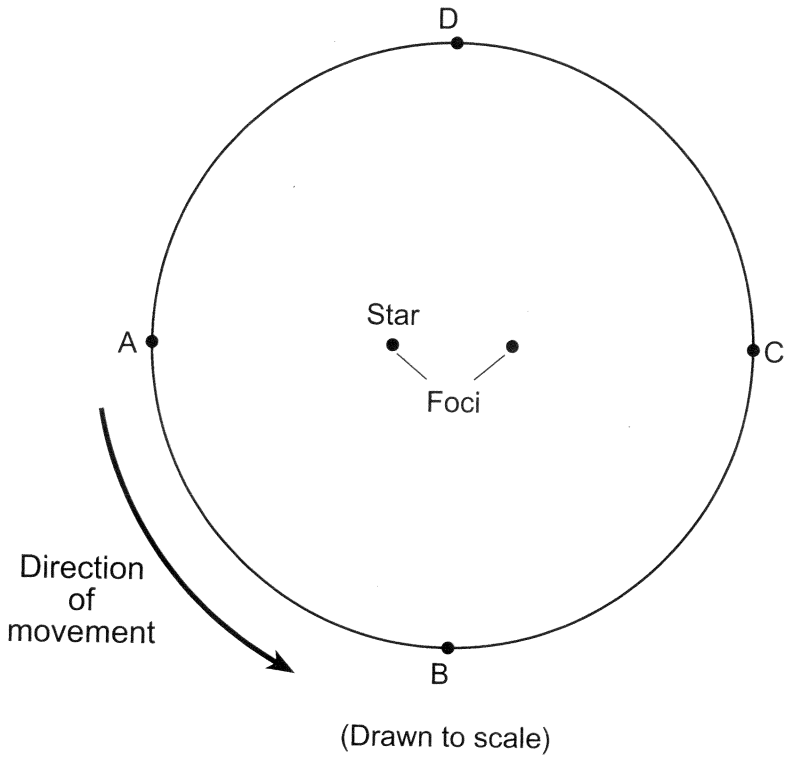
Base your answers to questions 6 through 8 on the diagram below, which represents the elliptical orbit of a planet traveling around a star. Points *A*, *B*, *C*, and *D* are four positions of this planet in its orbit.



6. The calculated eccentricity of this orbit is approximately

(1) 0.1 (2) 0.2 (3) 0.3 (4) 0.4 6 _____

7. The gravitational attraction between the star and the planet will be greatest at position

(1) *A* (2) *B* (3) *C* (4) *D* 7 _____

8. What planet could this orbit represent? _____

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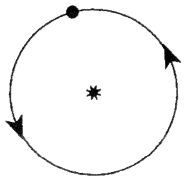
9. Which planet has the least elliptical orbit?

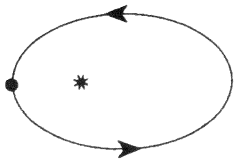
(1) Jupiter
(2) Mars
(3) Venus
(4) Saturn

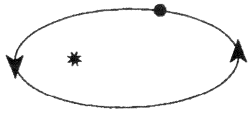
9 _____

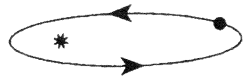
10. Which diagram shows a planet with the *least* eccentric orbit?

(Key: • = planet * = star)

(1) 

(2) 

(3) 

(4) 

10 _____

11. The actual orbits of the planets are

(1) elliptical, with Earth at one of the foci
(2) elliptical, with the Sun at one of the foci
(3) circular, with Earth at the center
(4) circular, with the Sun at the center

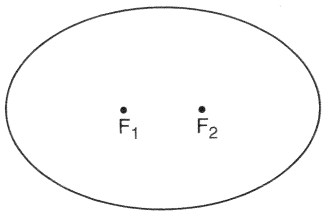
11 _____

12. Earth is farthest from the Sun during the Northern Hemisphere's summer, and Earth is closest to the Sun during the Northern Hemisphere's winter. During which season in the Northern Hemisphere is Earth's orbital velocity greatest?

(1) winter
(2) spring
(3) summer
(4) fall

12 _____

13. The diagram below is a constructed ellipse. F_1 and F_2 are the foci of the ellipse. The eccentricity of this constructed ellipse is closest to the eccentricity of the orbit of which planet?



(1) Mercury
(2) Earth
(3) Saturn
(4) Venus

13 _____

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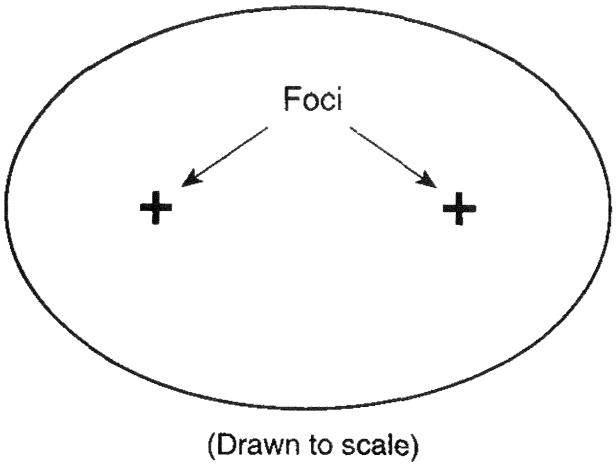
14. The accompanying diagram represents the elliptical orbit of a spacecraft around the Sun. Calculate the eccentricity of the spacecraft's orbit following the directions below:



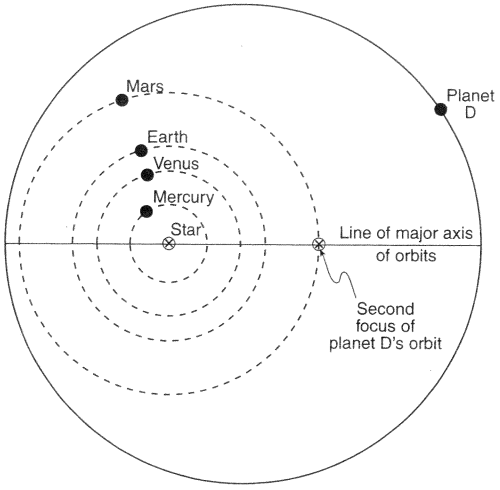
(Drawn to scale)

a) Write the equation for eccentricity.

b) Substitute measurements of the diagram into the equation.

c) Calculate the eccentricity and record your answer in decimal form.

15. Describe the eccentricity of planet *D*'s orbit relative to the eccentricities of the orbits of the planets shown in our solar system.



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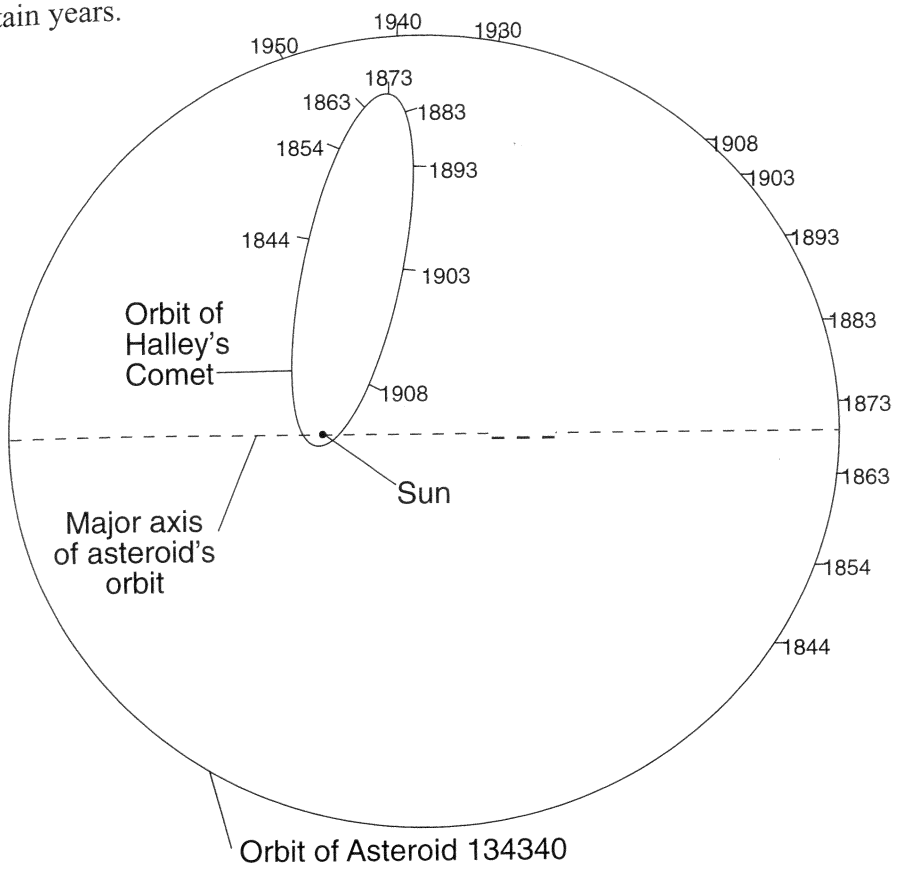
Base your answers to questions 16*a*, *b*, *c* and *d* on the diagram below. The diagram shows the positions of Halley's Comet and Asteroid 134340 at various times in their orbits. Specific orbital positions are shown for certain years.



16. *a*) The eccentricity of the asteroid's orbit is 0.250. On the orbital diagram above, mark the position of the second focus of the asteroid's orbit by placing an **X** on the major axis at the proper location.

b) Determine which was traveling faster, Halley's Comet or the asteroid, between the years 1903 and 1908. State one reason for your choice.

c) Explain why Halley's Comet is considered to be part of our solar system.

d) Of the two orbiting objects, which would have a higher eccentricity value? Explain why.

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