brief review of Kepler's Laws lab

Qs on MP?

-volunteers to show work

HW Quiz @ 2:55 p.m.

1. The two images below show the area swept out by the same planet during two separate time spans. If the first picture represents the area swept out during a time of "A" days and the second represents the area swept out during a time of "B" days, which of the following statements is true about A and B?

A. A > B

B. A = B

C. A < B

D. The relationship between A and B cannot be determined

2. Earth travels fastest in January and slowest in July. What is the most likely explanation for this?

- A. Earth is nearest the Sun in July and farthest away in January.
- B. Earth is nearest the Sun in January and farthest away in July.
- C. Earth is nearest the Sun in April and farthest away in October.
- D. Earth is nearest the Sun in October and farthest away in April.

3. Earth's orbit is a nearly circular ellipse with the Sun at one focus. How would its orbit change if Earth were twice as massive?

- A. The orbit would still be an ellipse, but the Sun would now be at the center of the ellipse.
- B. The orbit would become a much flatter, more eccentric ellipse.
- C. Earth would fly off into space, never to return.
- D. The orbit would not change at all.

4. In our solar system, the constant "*k*" in Kepler's Third Law is equal to 1 if AU and Earth years are used. Suppose astronomers found a new planet, very close to the Sun. If the average distance from the planet to the Sun were 1/4 AU, how long would the planet's period be?

- A. 1/32 of an Earth year
- B. 1/8 of an Earth year
- C. 1/4 of an Earth year
- D. 1/2 of an Earth year

$$T = 2\pi\sqrt{\frac{r^3}{GM}} \qquad 1 = \frac{T^2}{\left(\frac{1}{4}\right)^3}$$

5. Scientists discover two planets orbiting a distant star. The average distance from the star to Planet A is 4 AU, and it takes 432 Earth days for Planet A to orbit the star. If it takes 1,460 days for Planet B to complete an orbit, what is the average distance from Planet B to the star?

- A. 6 AU
- B. 8 AU
- C. 9 AU
- D. 13.5 AU

$$\frac{T^2}{r^3} = \frac{4\pi^2}{GM} \quad \text{"k"}$$

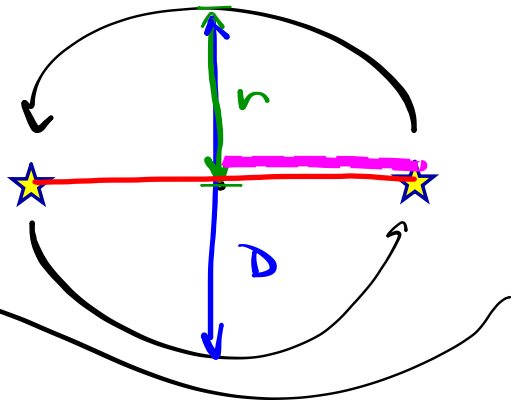
$$\frac{T_a^2}{r_a^3} = \frac{T_b^2}{r_b^3}$$

12.33

BINARY STARS

T?

$$v = \frac{2\pi r}{T}$$



$$\frac{mv^2}{r} = G\frac{m^2}{r^2}$$

$$\frac{mv^2}{\left(\frac{D}{2}\right)} = G\frac{m^2}{D^2}$$

$$m = \frac{D^2 v^2}{G\frac{D}{2}}$$

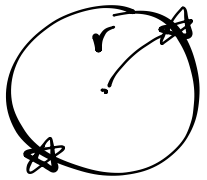
$$m = \frac{2v^2 D}{G}$$

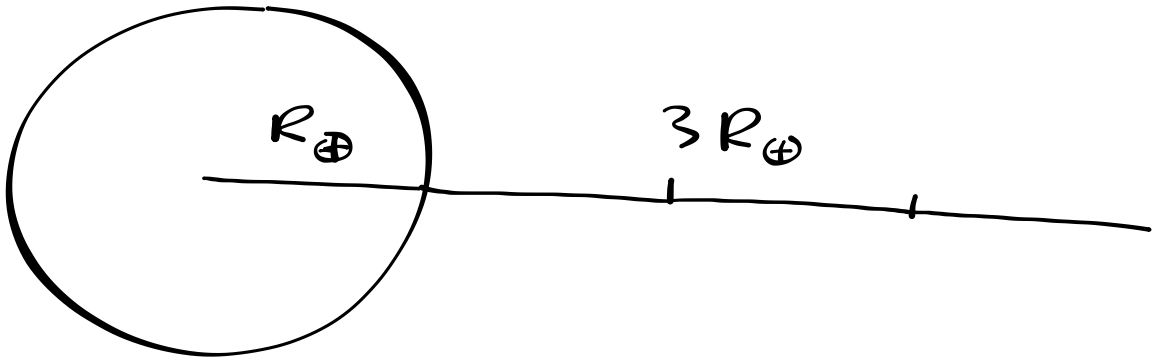
$$m = \frac{2D}{G}\frac{\pi^2 D^2}{T^2}$$

$$m = \frac{2\pi^2 D^3}{GT^2}$$

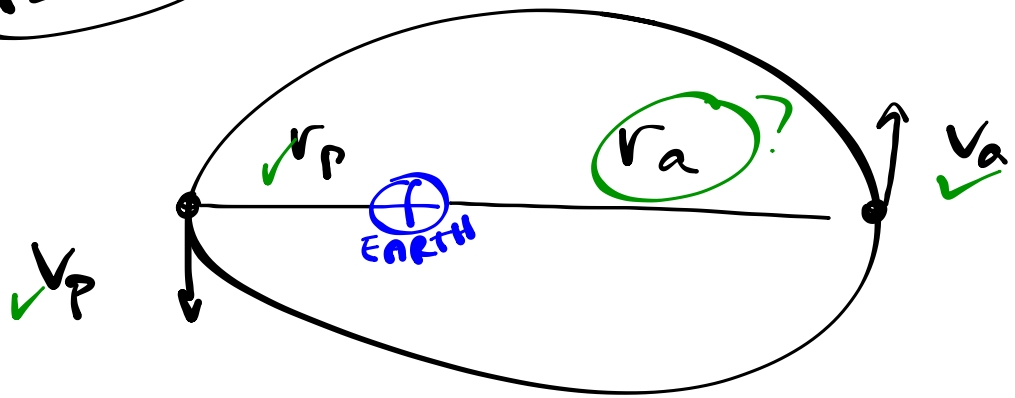
$$v = \frac{2\pi r}{T}$$

$$v = \frac{2\pi D}{2T}$$




$R_\oplus$
$3R_\oplus$

12.40



$$K_a + U_{ga} = K_p + U_{gp}$$

$$\frac{1}{2}mv_a^2 + \frac{-GMm}{r_a} = \frac{1}{2}mv_p^2 + \frac{-GMm}{r_p}$$