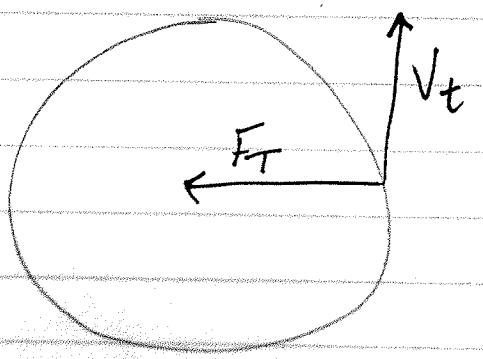
# Circular Motion and Universal Gravitation Review Sheet Key

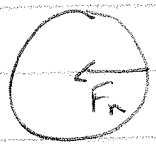
1. a. Tension from the string creates a centripetal force that keeps the ball moving in a circular pattern. Even though the ball is staying at a constant speed, it is repeatedly changing directions, therefore considered to be accelerating. If the string were to break, causing the force of tension to disappear, the inertia of the ball would keep it moving in a straight path.

b.

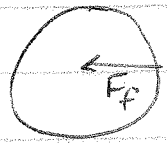



c. The EF is directed towards the center of the circular motion.

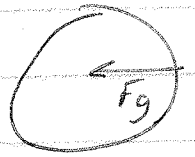
2. Inertia will cause all moving objects to continue in motion in the same direction they are moving UNLESS some form of force acts upon the object to change its motion from its straight-line path. The inward force during circular motion must be present for objects to move in circles.

3. a. 

Clothes in a spin cycle in your washing machine.

b. 

A car turning the corner.

c. 

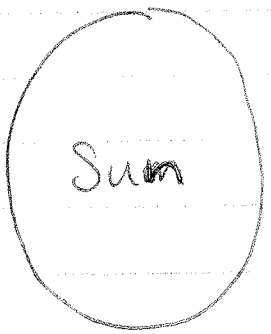
The moon orbiting the earth.

4. a. The force of gravitation is a mutual force between all particles. This mean that the force of the earth and ISS are the same onto each other.

b. If the mass of the ISS is increased, the the $F_g$ would increase. If it was decreas the the $F_g$ would decrease

$$F_g = \frac{G m_1 m_2}{r^2}$$

There is a direct relationship between mass and $F_g$.

5. 


(c) Forces are equal because of Newton's 3rd Law

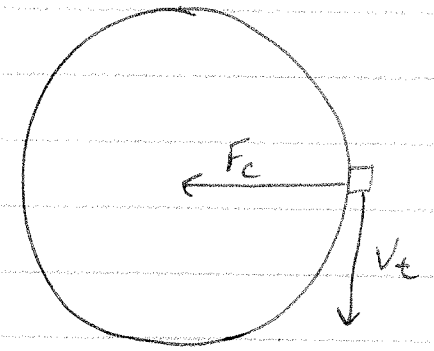
Planet 1

(b) ↖ greater $F_g$ because it is closer to the sun.

Planet 2

(a) ↖ higher $V_t$ because it travels further in the same time frame.

6.




7. You would weigh slightly more in the basement since the distance between you and the center mass of the earth is closer.

8. SKIP

9. a. SKIP

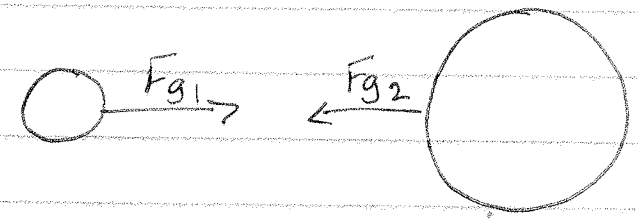
b. $F_c = \frac{m V_t^2}{r}$

$$F_c = \frac{(115\,kg)(5.0\,m/s)^2}{14m} \qquad F_c = 205\,N$$

10. $$450\,N = \frac{(3500\,kg)(V_t^2)}{250\,m} \qquad V_t = 5.7\,m/s$$

11. Disagree. The ISS only has a force of gravity acting upon it, therefore it is in freefall. The astronauts are also experiencing freefall. Since there is no air resistance in space, both the astronauts and ISS are falling at the same rate which makes them appear to be floating.

12. a.




The forces are equal because of Newton's 3rd Law. The accelerations are not. Since the mass of one star is 2x the mass of the other, the smaller star will experience a greater acceleration.

13. No, since earth has a much larger mass than the skydiver, it has a much smaller acceleration than "g".

14. a. When the distance between 2 masses decreases the $F_g$ between them will increase.

b. As the mass of an object increases, the $F_g$ will increase.

$$F_g = \frac{G m_1 m_2}{r^2}$$