1. No, the acceleration will not remain the same. When a curve is more gentle, it means that the radius is larger. With a larger radius, the acceleration will decrease because Centripetal acceleration is always inversely proportional to radius. $a_R = \frac{v^2}{r}$. Velocity in this case is constant.
2. The RPM of the ferris wheel would be **~10.9**. We can determine this because in order for something to be weightless, the centripetal acceleration must be gravity.

   $a_R = \frac{v^2}{r} \rightarrow g = \frac{v^2}{0.5d} \rightarrow v = \quad \sim 8.57\ m/s$

   $v = \frac{C}{T} \rightarrow v = \frac{\pi d}{T} \rightarrow T = \quad \sim 5.49\ rounds/T$

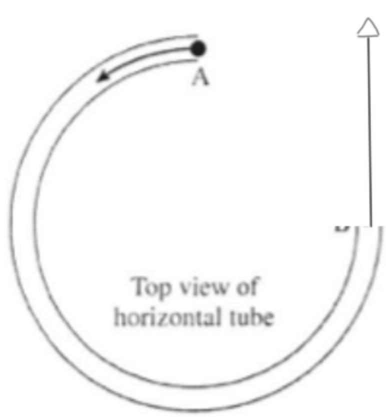
   $T = \frac{1}{f} \rightarrow f = \quad \sim 0.181\ rounds/s$

   f stands for revolutions per second. If 60 seconds make up 1 minute:

   $f \times \frac{60\ s}{1\ m} = \quad \sim 10.9\ rounds/min$

   FBD:

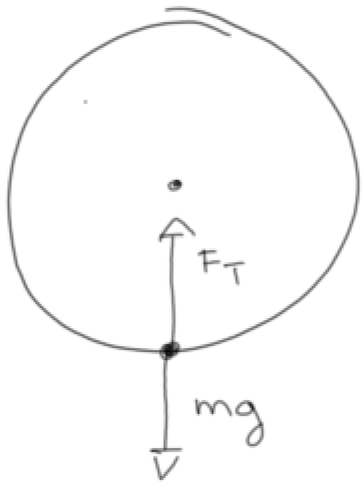
3.



4. This question uses $\Sigma F_R = ma_R$

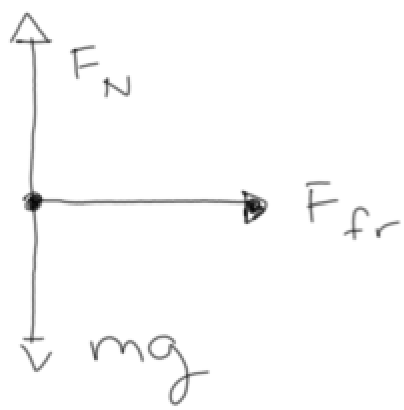
   3 > 1 =4 > 2

5. When the ball is at the lowest point, the tension must be greater than its own weight.



The force of tension must be greater than the mass because the string needs to hold not only it's weight but when moving, needs to be able to pull it up. The net force must be greater than 0.

6. Using the equations, $\Sigma F = ma_R$ and $a_R = \frac{v^2}{r}$, we can simplify the equation to $\Sigma F = m\frac{v^2}{r}$. By plugging in the values ($\Sigma F = 75N,\ m = 0.45kg,\ r = 1.3m$) we can determine **the maximum velocity is** $14.71\ m/s^2$.
7. **FBD:**



Using the three equations $F_{fr} \leq \mu_s F_N$, $a_R = \frac{v^2}{r}$, $F_N = ma$ and $\Sigma F = ma_R$, we can simplify the equation to $\Sigma F = m\frac{v^2}{r}$. Because friction is the force pulling it in, $F_{fr} = \Sigma F$. From here we can substitute and simplify:

$\mu_s F_N \geq \frac{v^2 m}{r}$

$r(\mu_s F_N) \geq v^2 m$

$\frac{u_s F_N r}{m} \geq v^2$

$\frac{u_s mgr}{m} \geq v^2$

Because we are finding the max, ≤ becomes =.

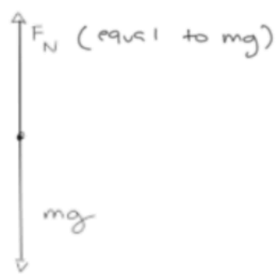
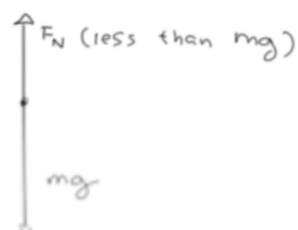
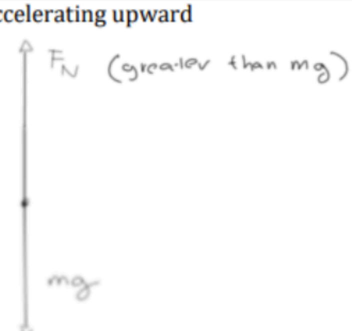
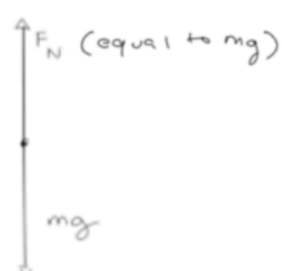
Final Answer: $v = \sqrt{u_s gr}$

8. A. **Yes**. The apple does exert a force on the Earth, just that it's extremely small and not visible to us.

   B. This is due to 2 factors. This is because from the default reference frame (on the Earth), the Earth's movement is not visible, so that is why we only see the apple accelerate. Another reason that we see the apple accelerate is because the mass of the earth is nearly 4×10^{22}times as large compared to a typical apple (~150 g). Because the mass is larger, the force is going to be greater.

9. A.

B.

The elevator is moving down with constant speed	The elevator is accelerating downward
	
The elevator is accelerating upward	**The elevator is moving upward with constant speed**
	

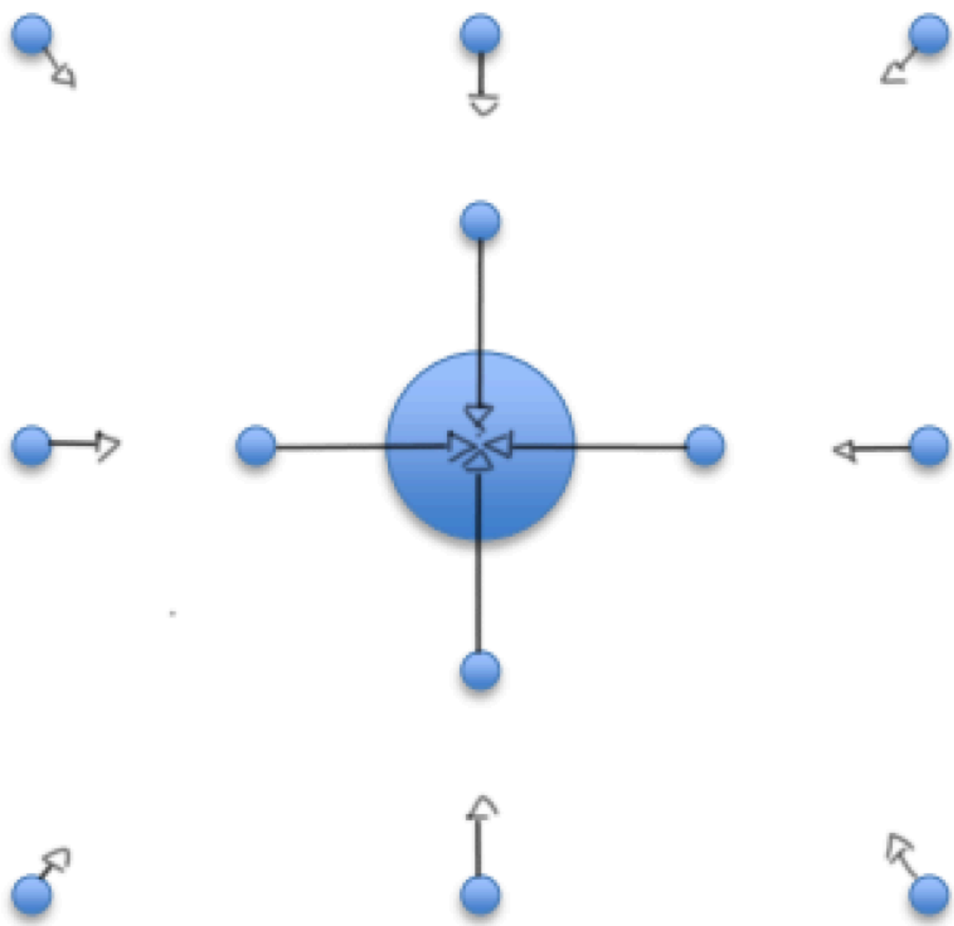
10. By using the Universal Gravitational Formula: $F = G\frac{m_1 m_2}{r^2}$, and because mass is constant and the new radius is half the radius, the equation for this situation would be $F = G\frac{m_1 m_2}{(0.5r)^2}$.

$F = G\frac{m_1 m_2}{0.25r^2}$

$F = 4G\frac{m_1 m_2}{r^2}$

We can determine the strength of gravity will be **4 times larger** compared to the previous gravity.

11.



12. By using Kepler's second law, the areas of the sectors of the circle will always remain the same. However if the distance is further, the arc of the sector will be smaller within that given period of time. Because the arc of the sector is smaller if the distance is smaller, that means if the distance is smaller (i.e the planet gets closer to the Sun), then the arc length will increase. If arc length increases, that signifies a change in velocity.