Solution to Lecture Quiz # 6:

1) when magnet is at rest, we must have $\Sigma F_x = 0$ and $\Sigma F_y = 0$.

\[ \Sigma F_x = 0 \]
\[ \Sigma F_y = 0 \]
\[ F_N - F_{mag} = 0 \]
\[ \Rightarrow F_N = F_{mag} \]

$F_s - F_g = 0 \Rightarrow F_s = mg$

Note: $F_s$ not necessarily equal to $mg$.

2) when magnet is rotating along with the disk at a constant rate $\omega$, (i.e. its tangential speed $\nu$ is constant since $\nu = \Omega \omega$.)

At the top:

Front View:

\[ \frac{F_g - F_s}{R} = \frac{m\nu^2}{R} \]
\[ \frac{F_g + F_s}{R} = \frac{m\nu^2}{R} \]

\[ F_g = \frac{m\nu^2}{R} \]

or $F_s$ can also be zero. It depends on how fast the disk & the magnet are rotating. All we know is that $\Sigma F_{net+x} = m\nu R$

Note: $\omega$ not included in FBD.

At the bottom: since we need Fnet towards the center, $F_s > F_g$.

\[ \Sigma F_y = m\nu R \]
\[ \Rightarrow F_s - F_g = m\nu^2/R \]
Lec Quiz 6: Common Mistakes:

* wrong because normal force is always 1 to the surface of contact.

\[ F_N \]

\[ F_{mag} \]

\[ F_{disk} \]

\[ F_g \]

Call this the normal force.

* unbalanced force in x-direction.

This implies \( EF_x = \text{max} \neq 0 \) so magnet cannot be at rest and must be accelerating thru the disk.

(In reality, it's \( F_N \) that stops it from doing that.

So look at correct free body diagram on previous page.

Part 2

* Several people have included accelerations and/or velocity as a force on their free body diagram. Please, please, don't do that. Centripetal acceleration is NOT a force.

* Also note that if the disk & magnet are rotating at a constant rate, there cannot be any tangential acceleration, so there can be no net sideways force.

Some of you had a force labeled \( F_w \). What is that force? There is no such thing, my friends — please don't invent more forces than the ones we've developed in class. All the forces we will encounter have in this class have already been listed in class.