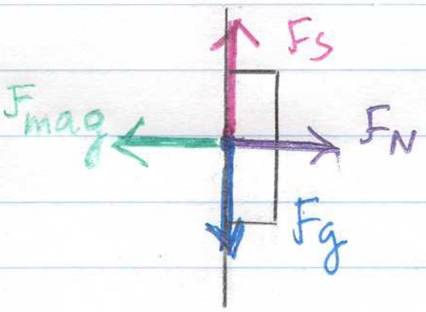
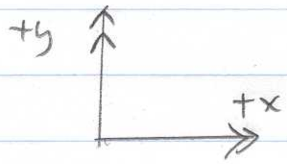
Solution to Lecture Quiz # 6:

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





$$\Sigma F_x = 0$$
$$F_N - F_{mag} = 0$$
$$\Rightarrow \boxed{F_N = F_{mag}}$$

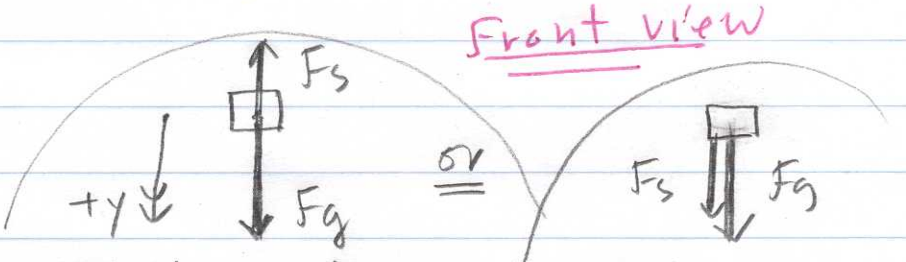
$$\Sigma F_y = 0$$
$$F_s - F_g = 0 \Rightarrow \boxed{F_s = mg}$$

Note: F_s not necessarily equal to mg.

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

At the top:

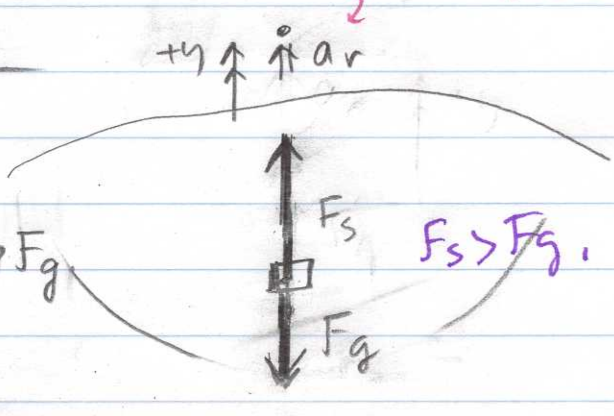
Front View:



or F_s can also be zero. It depends on how fast the disk & the magnet are rotating. All we know is that

$$\Sigma F_{net,y} = ma_r$$
$$F_g - F_s = \frac{mv^2}{R} \quad \text{or}$$
$$F_g + F_s = \frac{mv^2}{R} \quad \text{or}$$
$$F_g = \frac{mv^2}{R}$$

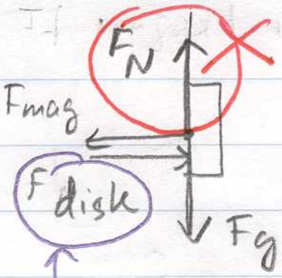
Note, $\vec{a}$ not included in FBD.



At the bottom: Since we need F_{net} towards the center, $F_s > F_g$

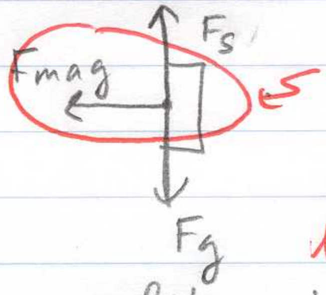
$$\Sigma F_y = ma_r$$
$$\Rightarrow F_s - F_g = mv^2/R.$$

Lec Quiz 6: Common Mistakes:

* : 

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

call this the normal force.

* . 

unbalanced force in x-direction. This implies $\Sigma F_x = ma_x \neq 0$ so magnet cannot be at rest & 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 include 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 ~~sr~~ net sideways force.

Some of you had a force labeled F_ω. What is that force? ~~In~~ There is no such thing, my friends — ~~thing is~~ Please don't invent more forces than the list we've developed in class. All the forces we will encounter ~~have~~ in this class have already been listed in class.