Motorcycle Physics Lab

Purpose:

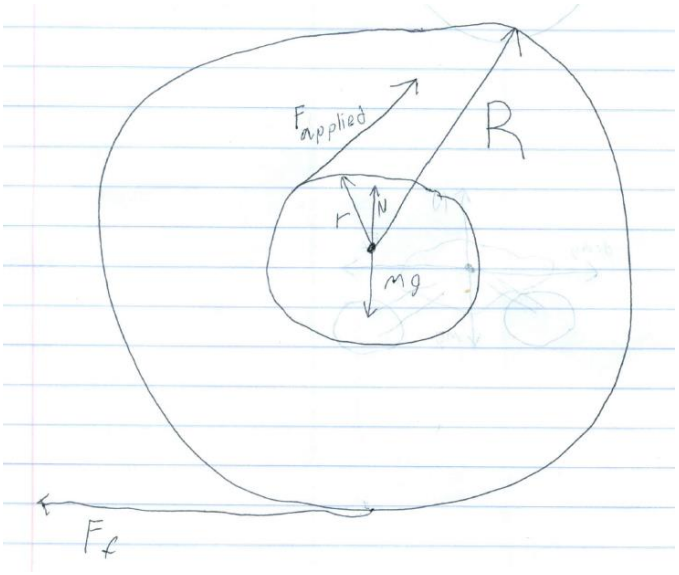
Analyze the motion of the motorcycle's different parts and determine what the forces in the motion are, and also determine what principles of physics are determined in the different types of motion motorcycles move in. Also determine what kind of difference the presence of a passenger makes in the motion of a motorcycle.

Parts of a motorcycle involved in motion:

Wheels: The force of friction the wheels make with the ground are what pushes the motorcycle forward.

Chain: As the wheel rotates around the center axis of the wheel it generates the torque required to rotate the wheel.

Wheels Physics:



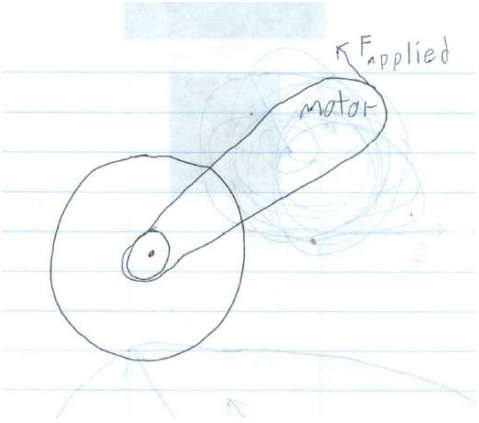
Treat the wheel as a disk- The moment of inertia of the wheel is $\frac{1}{2}mR^2$

The velocity of the bike is determined by the speed of the center of mass of the wheel, and since the rotation of the wheel is an example of rolling without slipping $V_{cm} = R\omega$

The torque applied to the wheel is what causes the rotation of the wheel, and the magnitude of this torque is given by$F_{applied} \times r$. Because the chain operates with a smaller radius than that of the wheel $F_{applied}r = F_f R$

Chain Physics:

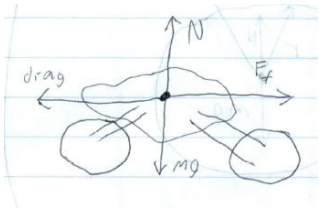
The chain applies the force to the wheel which allows it to rotate on the ground, and is turned by the motor.



Motor Physics:

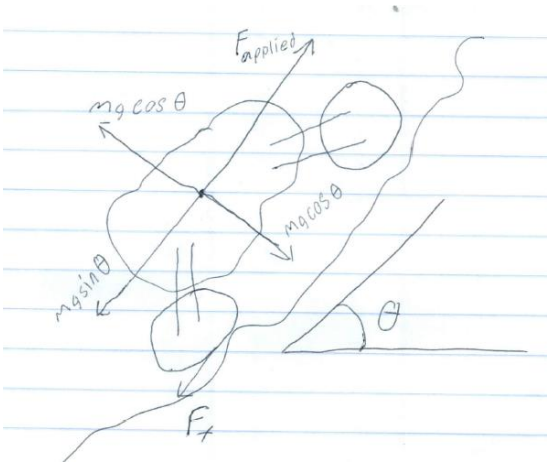
The motor produces the energy for the system through the burning of gas. The applied Force originates here and moves the entire system.

One dimensional motorcycle motion (street driving):



The rolling without slipping force of friction applied to the bike by the system is what moves the bike forward. The counteracting force to this motion is air resistance which increases as velocity increases.

Two dimensional motorcycle motion (climbing):



In this situation the bike is climbing a hill. It continues to climb until

$mgsin\theta + F_{friction} = Force_{applied}$ at this point the bike can no longer climb the hill and may even begin falling back down it.

Presence of a passenger:

When a passenger is on the bike it has the effect of shifting the center of mass more towards the rear of the bike, increasing the possibility of the bike flipping while climbing a steep hill, and increase the value of the force of friction.

Conclusion:

The physics involved in the motion of a motorcycle are complex, but when broken down can be understood easily. Also the presence of a passenger on the bike has a large effect on the motion of the bike.