Finding the Mass of a Car

You have been given the following challenge: Determine the mass of a car using objects commonly found around the house.

Some materials you may consider using (not required of course) are:

- Measuring tape
- Bathroom scales
- Position markers (bean bags, stones, etc.)
- Reference weights
- String
- Stopwatch
- Vernier caliper
- …

There are a few rules in the challenge:

1. You are not allowed to start the car, although you do have access to the keys.
2. You cannot use any of the on-board instruments, such as the speedometer.
3. You are not allowed to damage the car.
4. Lab partners may team up to perform the lab together (teams of no more than six though), but partners must write their own lab reports.

Questions to help you think through this challenge:

1. Explain the difference between weight and mass.
2. What is the unit of measurement of a) mass and b) weight?
3. What is the measurement unit on a bathroom scale?
4. If you stand on a scale and bounce up and down, does the display change? Does your mass change?
5. From the previous questions, what does a bathroom scale actually measure?
6. List any simple kinematics and force equations that you have learned that includes mass as a parameter.
7. If you want to solve for mass in the previous equation(s), what other quantities must be determined?
8. Using the available materials, how can you measure these quantities?
9. In reality, there will be multiple sources of friction present (the car tires on the pavement and the axle and bearing, to name a few). How can you measure the total frictional force present?