Name _____ Hour _____

Applications of F=ma

1. **To Find an Object's Weight**

F = ma becomes   Fg = mg or   **w = mg**   Weight takes the place of the force (Fg)!
        <u>mass</u> - *the amount of matter measured in* _____

         <u>weight</u>- *the force due to* _____ *on a mass measured in* _____

Ex: If Sam weighs 165 lbs., calculate his weight in Newtons on earth. *(- 735 N)*

2. **Use with One-Dimensional Motion equations**

        We can use F=ma to find forces, accelerations, etc, using our 1-D equations.

Ex: A 1,600 **lb**. car is traveling at 32 m/s and comes to a stop in a distance of 50 meters. Calculate the breaking force that was needed to stop the car. (-7,447 N)

Why is the force negative? _____

3. **When there are 2 accelerations in the y-direction:**
We can use F = ma if there are other accelerations acting <u>in the vertical direction </u>besides the acceleration due to gravity. (Like in an elevator, rollercoaster)
        The equation F=ma becomes   **F = m (-9.8 m/s^2 + a)**
                                            a = the other acceleration in m/s^2

Ex: You (mass = 75 kg) feel a force of -355 N when you start riding downward in an elevator (that point where you feel lighter). What is the additional acceleration of the elevator? (a= 5.07 m/sec^2)

4. **To find g forces**
G forces are the numbers that tell you how many times your weight you are experiencing. Sitting here, filling out this very exciting worksheet you are experiencing 1 g or one times your weight.
One g = weight at rest.   (1 g = m x g)

At the bottom of a rollercoaster you feel heavier. You can be experiencing 2 to 4 g's or 2 to 4 times your body weight. Humans typically black out at 7 to 8 g's.

At the top of those hills near the end of the rollercoaster you feel lighter as you fly up out of your seat. This means you are experiencing what people often refer to as negative g's even though **they do not come out negative in our calculations**. In our calculations they come out as <u>decimals</u>. If you experience half of your body weight, that will be 0.5 in our calculations. If you feel 1/3rd of your normal weight, it will come out as 0.33 in our calculations.

Name _____ Hour _____

- Explain what it means to feel 2 g's. _____
- Explain what it means to feel 0.5 g's. _____
- Calculate one g for you. **(One g is the same as your weight in Newtons**, so answers will vary.)

- If you weigh -600 N, how many Newton's would 3 g's be for you? _____ 0.5 g's?_____

Formula for the number of g's experienced:

$$\# \text{ of g's} = \frac{|\text{total force experienced}|}{1\text{ g}}$$ *(Those are absolute value signs.)*

1 g = m x gravity

Problems:

1. You (mass 50 kg) and your friend (mass 60 kg) experience -1,200 N of force at the bottom of the hill on the Wild Thing. How many g's is this for you and for your friend? *(ans. 2.45 g's for you and 2.04 g's for your friend-* **Remember, no negatives)**

2. Jeff Gordon (170 lbs) initially traveling at 98 **mph** hits a wall with his car and comes to a complete stop in 0.70 seconds. Find the number of g's Jeff Gordon would experience in the crash. *(6.4 g's)* (**1. Convert lb and mph 2. Find a 3. Find Force 4. Find # of g's**)

3. You (154 lbs) are riding in an elevator. It accelerates upward at -1.2 m/s^2 and then it decelerates at the top at 0.9 m/s^2. Find your weight **in Newtons,** and **how many** g's you are experiencing: **SHOW YOUR WORK!**

   a. **When you are at rest before the elevator moves.** (-686 N, 1 g)

   W = _____, g's = _____

   b. **When you accelerate on the way up.** (-770, 1.12 g's) **(Hint:** use F = m (-9.8 m/s^2 + a) to get the force experienced, then solve for # of g's.)

   W = _____, g's = _____

   c. **When you are decelerating at the top.** *(-623 N, 0.91 g)*

   W = _____, g's = _____