Physics 1135 Homework for Recitation 5: Newton's 1st and 2nd law

1. Apparent weight. A superhero of mass 75 kg stands on a bathroom scale in an elevator. Find the reading on the scale if the elevator
a) moves upwards at constant speed of 3 m/s .
b) moves downwards at constant speed of 3 m/s.
c) moves upwards and speeds up at a rate of 3 m/s^2.
d) moves upwards and slows down at a rate of 3 m/s^2.

2. A fisherman is using a very light fishing line that breaks when the tension exceeds 20N. He lifts a fish vertically out of the water with an upwards acceleration of 2 m/s^2. What is the largest mass of the fish for which the line will hold?

3. A magic medallion is suspended from a string inside a compartment of Hogwarts Express which is running straight westwards on horizontal tracks.
a) Draw a free-free body diagram for the medallion if the train is moving at constant speed.
b) Draw a free-body diagram for the medallion if the train is accelerating at a constant rate. Indicate acceleration and the direction of the net force.
c) Calculate the angle the string makes with the vertical if the train accelerates at a constant rate from rest to 20 m/s in 10 seconds.
d) If the mass of the medallion is doubled, how will the angle change?

4. A hot air balloon of total mass M (including passengers and luggage) is moving with a downward acceleration of magnitude a. As it approaches a mountain, the captain needs to accelerate upwards. He decides to throw enough ballast over board to achieve an upward acceleration of magnitude $a/2$. What fraction of the initial mass does he have to drop? Assume the upward lift force exerted by the air on the balloon does not change because of the decrease in mass.