Physics 1145 Homework #6: Newton's 2nd law

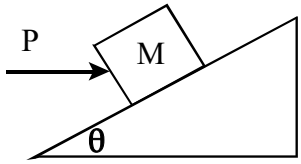
For each problem, begin by drawing a fully labeled free-body diagram.

1. A student of mass 75 kg stands on a bathroom scale in an elevator. Find the reading on the scale. i.e. the normal force exerted on the student, if the elevator
a) moves upwards at constant speed of 5 m/s .
b) moves downwards at constant speed of 5 m/s.
c) moves upwards and speeds up at a rate of 2 m/s^2.
d) moves upwards and slows down at a rate of 2 m/s^2.

2. A fisherman pulls a fish of mass 3kg vertically out of the water. The fishing line breaks when the tension exceeds 36N. What is the largest acceleration with which he can lift the fish?

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.

4. A box of mass M is pushed by a horizontal pushing force up a frictionless incline that makes an angle θ with the horizontal. The box moves at **constant speed.** Find the magnitude P of the pushing force.



5. A child of mass 30kg is sliding down a slide that is inclined by 30º. The coefficient of kinetic friction between child and slide is 0.2 Find the magnitude of the normal force, the magnitude of the force of friction, and the child's acceleration.

6. A crate of mass 100kg is at rest on a ramp that makes an angle of 15º with the horizontal. How big is the force of static friction acting on the box?