Physics 1145 Test Preparation Homework 2

$\sum F_x = ma_x$ $\sum F_y = ma_y$ $f_S \le \mu_S N$ $f_k = \mu_k N$ g= 9.8m/s^2

$a_c = \frac{v^2}{R}$ $v = \frac{2\pi R}{T}$=ωR $\omega = 2\pi f = \frac{2\pi}{T}$ $F_G = \frac{GmM}{r^2}$ G=6.67×10^{-11} Nm^2/kg^2

The solutions must begin with Newton's 2nd law. You need to show all steps.

1. A crate sits on a ramp inclined at 30^0 above the horizontal. The crate has a mass of 55 kg.
a) Draw a complete free body diagram for the crate.
b) What is the normal force the ramp exerts on the crate?
c) If the crate does not slip, what is the frictional force on the crate?
d) What is the minimum value of the static coefficient of friction?

2. A worker is pushing a crate of mass *M* up a rough incline (coefficient of kinetic friction μ) that makes an angle θ with respect to the vertical. He applies a **horizontal** pushing force *P*.
a) Draw a complete free-body diagram.
b) The crate moves up the incline. Determine the acceleration in terms of system parameters.

3. Aircraft experience a lift force that is **perpendicular to the wings.** A small airplane is flying in a **horizontal** circle of radius *R* at constant speed *V*. The pilot achieves this by tilting the wings at some angle with respect to the horizontal.
a) Draw a fully labeled free-body diagrams for the airplane, including all information necessary to solve part b). Remember, any algebraic quantities that you use must appear in the diagram.
b) Derive an expression for the angle of tilt in terms of system parameters.

4. A "mars-stationary" satellite moves in a circular orbit around Mars and completes one circle in the same time *T* during which Mars completes one revolution around its own axis. Calculate the speed and altitude of the "mars-stationary" satellite. Mars has mass 6.42×10^{23}kg, radius 3.37×10^{6}m and rotates on its axis once every 24.8 hours.