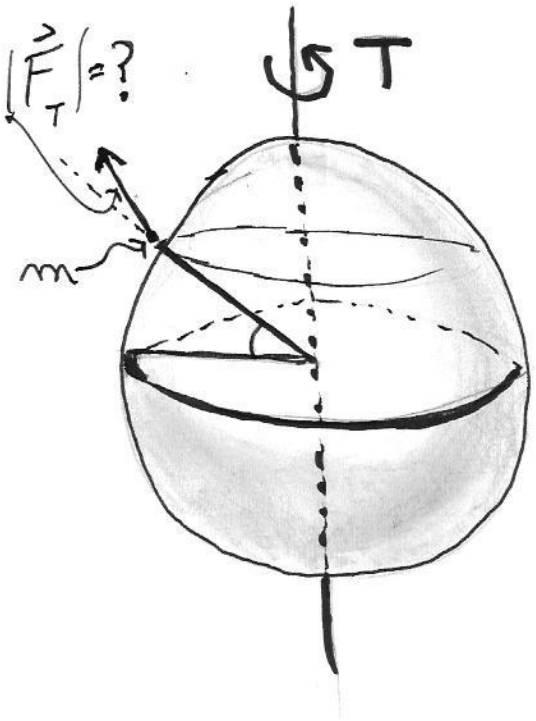
Physics 4A Exam 1 Winter 2013 Name_____

1. (25 points) Over level horizontal ground, a projectile is launched with a given initial speed, $V_i$, and initial launch angle, $\theta_i$. **Find the magnitude of its tangential acceleration at a time equal to one quarter of its full time of flight.**

2. (25 points) A research balloon of given total mass M is descending vertically with a given downward acceleration *a* (*a* < *g*). **How much mass, *m'*(*m'*<M), must be released to give the balloon an upward acceleration of the same magnitude *a*?** In this problem there is an upward force on the balloon, *that never changes*, but it is not in your final answer. But for doing the problem, you can just refer to this upward force as $F_{A;}$ the exact nature of the upward force is irrelevant.

3. (25 points) Refer to the diagram. **Find the magnitude of the tension force on the mass M that is supported at a latitude θ above the equator of a rotating planet of radius R and rotational period of T.** Let the gravity field at the surface be *g* radially inward toward the center of the planet.



4. (25 points) Refer to the diagram. **Find the acceleration magnitude of block $M_1$ relative to block $M_2$.** There is no friction between $M_2$ and the table it rests on but there is slipping between $M_1$ and $M_2$ with a given coefficient of kinetic friction $\mu_k$ between the two surfaces. The given applied force $F_A$ is acting to the left on $M_1$.