**Motion in Two Dimensions**

These are the problems that you and a team of other 2-3 students will be asked to solve during the recitation session next week. Your team can do better if you think about the approach and explanation for each of these problems BEFORE coming to class.

1. **Exit Ramp:** While driving through the Colorado Rockies, you notice emergency exits every few miles on the downhill portions of the road. These “runaway ramps” are sloped uphill and are designed to stop runaway trucks which lose their brakes, possibly due to ice, while going downhill. You are curious, so you stop at the next emergency exit where you measure that the exit rises at an angle of ____ degrees from the horizontal and is ____ m long. What is the maximum speed of a truck that can be stopped by this road, even if the frictional force of the road surface is negligible? _______. Justify your answer by showing a full solution.

2. **Which Way Is Up?** Tilted Land is flat, much like South Texas, but in Tilted Land gravity does not point straight down! Although the gravitational acceleration is 9.8 m/s², it points down at an angle of ____ degrees with respect to the ground. (In South Texas g-acceleration points straight down at an angle of 90 degrees with respect to the ground.) This circumstance causes major changes in everyday life, but people manage. If a person in Tilted Land throws a ball straight up at ____ m/s. Where does the ball hit the ground? _______. Justify your answer by showing a full solution.

3. **2001 A Space Odyssey:** A Hollywood producer has decided to film a remake of the movie 2001: A Space Odyssey. Your team has been hired as a consultant for the movie to make sure the science is correct. Part of the movie takes place on a space station very far from any gravitating body. The station is a large wheel-like structure where people live and work on the rim. In order to create “artificial gravity”, the space station rotates about its axis. It is desired that the acceleration of the objects falling to the “floor” be equal to ____ times that on the surface of Earth. However, since centripetal acceleration depends on the distance to the axis of rotation, it is not possible for the “artificial gravity” to be the same at the head and the feet of a standing person (say about 1.8 m in height). In order to minimize any possible discomfort, the difference in the “artificial gravity” should be only ____%. Your team has to calculate the diameter and the rotation rate of the space station. Your full solution will be given to the special effects department, which will build that large wheel.
**Approach**: Under this tab, list the steps taken by your team for finding each solution. You answer here the questions WHAT? and HOW?

*Approach 1.*

*Approach 2.*

*Approach 3.*

**Explanation**: Under this tab, explain why your team has chosen those approaches. You answer here the questions WHY? and WHEN?

*Explanation 1.*

*Explanation 2.*

*Explanation 3.*