

MA222 - A Homework Project

1 (A) The terminal velocity of a person is approximately 120 miles per hour. Suppose that air resistance is proportional to velocity and set up a differential equation describing the height of someone who jumps from a platform 100 feet in the air. (onto an air mattress at height zero)

(B) Show how to use Laplace transforms to solve the initial value problem.

2 In an episode of a television series, one of the characters jumps out of a shuttle traveling through the center of a cylindrical space station. The station is rotating to maintain an acceleration of 9.80 meters per second for people standing on the sides of the cylinder (inside the station). These sides are rotating at 60 miles per hour. The air rotates along with the cylinder, so that the speed of the air is proportional to the distance from the center.

(A) What is the radius of the cylinder? What is the speed of the air as a function of distance from the center of the cylinder?

(B) The terminal velocity of a person is approximately 120 miles per hour. The character jumps out of the shuttle at 10 feet per second. Set up an initial value problem describing his position at time t seconds after leaping from the shuttle. Set up the differential equations using the functions $r(t)$ and $\theta(t)$, polar coordinates, rather than using Cartesian coordinates.

(C) Show how to use Laplace transforms to solve the initial value problem.