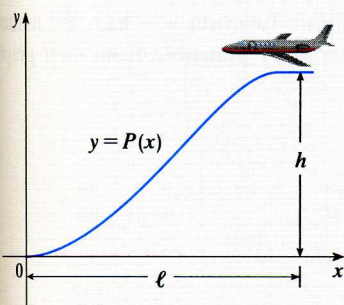


Where Should a Pilot Start Descent?



An approach path for an aircraft landing is shown in the figure and satisfies the following conditions:

- (i) The cruising altitude is h when descent starts at a horizontal distance ℓ from touchdown at the origin.
- (ii) The pilot must maintain a constant horizontal speed v throughout descent.
- (iii) The absolute value of the vertical acceleration should not exceed a constant k (which is much less than the acceleration due to gravity).

1. Find a cubic polynomial $P(x) = ax^3 + bx^2 + cx + d$ that satisfies condition (i) by imposing suitable conditions on $P(x)$ and $P'(x)$ at the start of descent and at touchdown.
2. Use conditions (ii) and (iii) to show that

$$\frac{6hv^2}{\ell^2} \leq k$$

3. Suppose that an airline decides not to allow vertical acceleration of a plane to exceed $k = 860 \text{ mi/h}^2$. If the cruising altitude of a plane is 35,000 ft and the speed is 300 mi/h, how far away from the airport should the pilot start descent?

4.  Graph the approach path if the conditions stated in Problem 3 are satisfied.