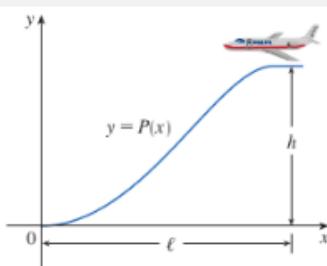


Applied Project

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.