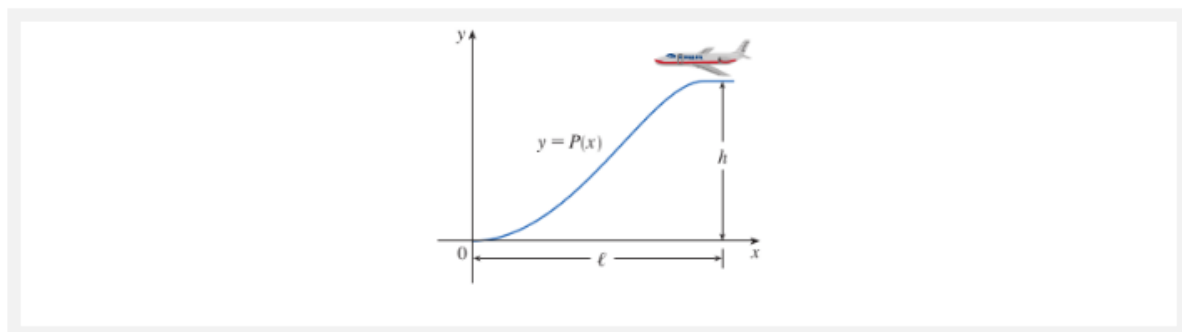


## Applied Project

## Where Should a Pilot Start Descent?


An approach path for an aircraft landing is shown in the [figure](#) and satisfies the following conditions:

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



- 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.
- Use conditions (ii) and (iii) to show that

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

- 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?
-  Graph the approach path if the conditions stated in [Problem 3](#) are satisfied.