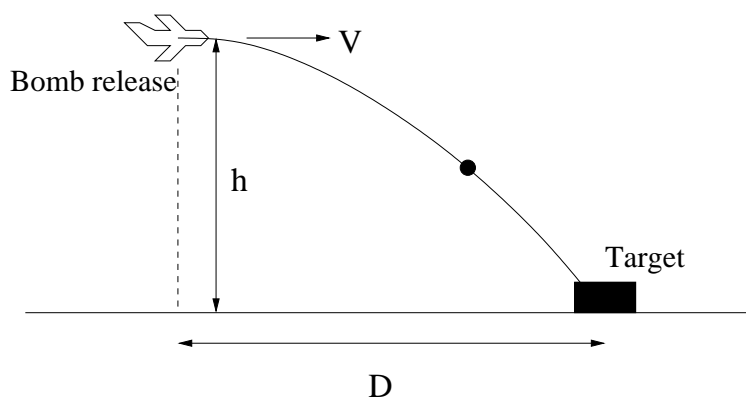


Problem 3 (15pts) Targeting:

A bomber flies horizontally with a speed  $V$  and at a height  $h$ . Ignore the air friction and assume there is no wind. The acceleration of gravity is  $g$ . (Express your answer in terms of  $V$ ,  $h$ , and  $g$ .)

- (a) How long does it take for the bomb to reach the ground?
- (b) To bomb a target, how far away from the target should the bomber release the bomb? (*ie* Find the distance  $D$  in the figure below.)
- (c) What is the speed of the bomb just before it hits the target?
- (d) What is the location of the airplane when the bomb strikes the target.



Solution:

- (a) The bomb free fell for a distance  $h$ . From  $h = \frac{1}{2}gt^2$ , we find that it takes  $t = \sqrt{\frac{2h}{g}}$  for the bomb to reach the target.
- (b) The horizontal velocity of the bomb is always  $V$ . Thus  $D = Vt = V\sqrt{\frac{2h}{g}}$ .
- (c) The vertical velocity of the bomb before striking the target is  $V_{\text{vert}} = tg = \sqrt{2hg}$ . The speed of the bomb before striking the target is  $\sqrt{V_{\text{vert}}^2 + V^2} = \sqrt{2gh + V^2}$ .
- (d) Since the bomb and the airplane have the same horizontal velocity, when bomb strikes target, the airplane is right above the target.