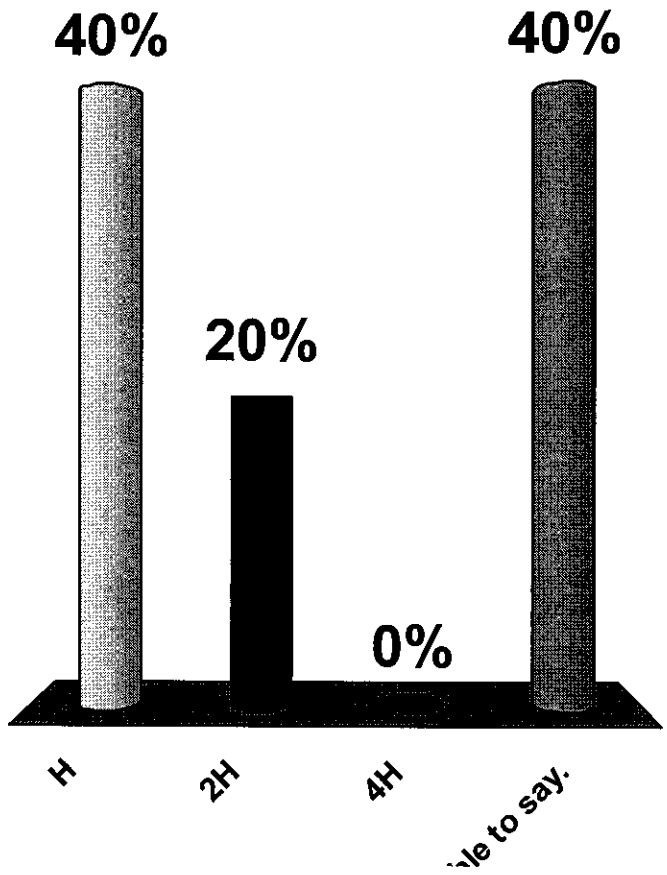
A projectile launched at 45° above the horizontal flat ground and which reaches a maximum height, H, will travel a horizontal distance

1. H
2. 2H
3. ✔ 4H
4. Impossible to say.



Qualitative Approach

- **If acceleration, g, were zero then at 45° the height h, and distance, d, would be the same at any time t.**
- **Because of –g, y(t) falls below the 45° line, so that y(t) is always less than x(t); i.e. H(t) < D(t)**
- **Thus at top x(T) > y(T) = H, and by time 2T, when projectile hits ground, D(2T) = 2x(T)> 2y(T) > 2H.**
- **Then only answers #3 and #4 are possible.**
- **But we know the problem can be solved, so that answer #4 is not in fact possible. By elimination, the correct answer must be #3.**

Note: This checks with previous query:

$$H=10*5^2/2 =125, \text{ and}$$
$$D = 500 = 4*125 = 4*H.$$

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Detailed Quantitative Solution

- **Let time to top be $T = v_{oy}/g$**
  (….from $0 = v_{oy} - gT = v_y(t)$ at top)
- **Then $H = gT^2/2 = g*(v_{oy}/g)^2/2 = v_{oy}^2/2g$**
- **But $D = v_{ox}*(2T) = v_{ox}*2*(v_{oy}/g)) = 2v_{ox}v_{oy}/g$**
  (And use $v_{ox} = v_{oy}$ (from 45° angle) to get☺
- **$= 2*(v_{oy}^2/g) = 4*(v_{oy}^2/2g) = 4*H$.**
- **And answer 3 is indeed correct.**