**Harold’s Physics of Projectiles**

**Cheat Sheet**

26 September 2024

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| **The Classic Cannonball Problem** | | |
| Diagram | Image result for physics parabolic ball problem  2  1  2 | |
| **G**ivens | Degrees inclined from the horizontal | |
| **U**nknowns | **Horizontal (x-axis)** | **Vertical (y-axis)** |
| ❶ How far is it at time *t*?  ❹ How far will it land? () | ❷ How high is it at time *t*?  ❺ How high will it go? () |
| ❸ When will it land? ()  0 | |
| Observations | Notes:   * Subscripts are dimensions, time, or both. Examples:   + is the velocity in the x direction.   + is the initial horizontal position, or horizontal position at time = 0 s.   + is the initial velocity in the y direction (vertical) * Horizontal and vertical dimensions are orthogonal (independent from one another). * Assume no wind resistance (drag). If we factor in wind resistance, then differential calculus is needed. * The cannonball will reach its highest point exactly halfway through its journey. [ and | |
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| , , | |
| **E**quations |  |  |
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We are now ready to solve for all 5 unknowns in the order 1, 2, 3, 4, 5.

First, determine the distance formulas.

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|  | **Horizontal (x-axis)** | **Vertical (y-axis)** |
| **S**olve |  |  |
|  |  |
| **S**ubstitute |  |  |
| Box Answer | Distance travelled | ❷  Height travelled |

Next, determine time.

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|  | **Horizontal (x-axis)** | **Vertical (y-axis)** |
| **S**olve |  |  |
| **S**ubstitute |  | |
| Box Answer | Time the cannonball was in the air | |

Finally, determine the farthest distances.

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|  | **Horizontal (x-axis)** | **Vertical (y-axis)** |
| **S**olve |  |  |
| **S**ubstitute |  |  |
| Box Answer | ❹  Farthest distance the cannonball travelled | ❺  Highest distance the cannonball travelled |