**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 problem212 |
| **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 |