PROJECTILE TARGET CHALLENGE

Designing launch vectors to reach a raised target

Name: _____	Period: _____	Date: _____

INVESTIGATION QUESTION **Which launch-velocity vectors can place the projectile on the target platform?**

TIME 30 minutes	SIMULATION BuildPhysics > Projectile target challenge	UNIT 1 Kinematics

Learning targets

- Use displacement components and a chosen flight time to design a launch vector.
- Test and refine multiple solutions that reach the same target.
- Explain why different velocity-component pairs can produce successful trajectories.

Model before you measure

Measure from the projectile center to the target landing point. Choose a flight time, then calculate the needed components.	**Design equations** $v_x = \Delta x/t$ $v_{y0} = (\Delta y + \frac{1}{2}gt^2)/t$ $g = 9.8\ m/s^2$

Targeting tip: Aim initially for the center of the target platform. A successful landing may occur anywhere on its upper surface.

Pre-lab planning | 5 minutes

1. Use Measure Displacement with components visible. Record the horizontal and vertical displacement from launch center to target center.

Measured Δx (m)	Measured Δy (m)	Launch x_0 (m)	Launch y_0 (m)	Target x (m)	Target y (m)

2. Why can the same target be reached using more than one flight time?

_____

PART A Calculate and test three launch designs

Design trials | 12 minutes

Use your measured Δx and Δy. For each chosen time, calculate v_x and v_{y0} before running the simulation.

Design	Chosen t (s)	Calculated v_x (m/s)	Calculated v_{y0} (m/s)	Actual landing x (m)	Success?	Adjustment made
1	1.00					
2	1.30					
3	1.60					

☐ Select the Challenge projectile and enter the calculated v_x and v_{y0}.

☐ Reset, run the full flight, and record the landing location.

☐ If the projectile misses, make one small component adjustment and record it rather than guessing randomly.

Sketch and label each tested trajectory.

PART B Refine, compare, and explain

Successful solutions | 5 minutes

Solution	v_x (m/s)	v_{y0} (m/s)	Measured flight time (s)	Maximum y (m)	Landing x (m)
A					
B					

Analysis | 7 minutes

3. Compare the two successful solutions. Which had the longer flight time and why?

4. How did increasing the chosen flight time affect the required v_x?

5. How did the vertical component affect maximum height?

6. Identify one systematic reason a calculated launch might land slightly away from the target center in the simulation.

7. Design a fourth solution using a different chosen time. Show the component calculations.

Claim-Evidence-Reasoning conclusion

Evaluate this statement: “There is only one possible launch velocity that can land a projectile on a particular platform.”

CLAIM	Accept, reject, or revise the statement.
EVIDENCE	Cite at least two measurements or graph features.
REASONING	Connect your evidence to the kinematics model.

Exit ticket

State the two equations you would use to design v_x and v_{y0} for a known Δx, Δy, and chosen flight time.