Name: …………………………………. Date: ………………..

Thinking with models _ Quadratic equations

Investigation Task: Water Droplets Assessment Criterion: B and C

Criterion B: Investigating the patterns.

Level	Descriptor (According to Task)	Sample Response (According to Task)
0	The student does not select or apply appropriate mathematical techniques. No meaningful pattern or rule is identified.	The student does not create a correct table or factorize the quadratic equation. No explanation about when the water droplet reaches the ground is given.
1–2	The student applies basic techniques to explore the quadratic situation but identifies only simple or incomplete patterns. A general rule is unclear or incorrect. Verification is not shown.	"I made a table of values and saw that the height becomes zero, but I am not sure why. I did not use factorization correctly to explain the pattern."
3–4	The student selects appropriate techniques to identify a pattern in the quadratic equation. A general rule is stated but not clearly connected to the findings. Verification is attempted but incomplete.	"By factorizing ((t-1)(t-4)), I found that the droplet reaches the ground at (t=1) and (t=4). This shows a pattern, but I did not fully explain why it works for all quadratics."
5–6	The student selects and applies correct problem-solving techniques to discover patterns. Patterns are described as general rules consistent with the findings. Solutions are verified with mostly correct justification.	"Factorizing the quadratic equation helps find the values of (t) when the height is zero. This works because when one factor is zero, the whole expression becomes zero. Substituting the values back into the equation verifies the solutions."
7–8	The student selects and applies efficient mathematical techniques to discover complex patterns. Patterns are clearly	"For (h(t)=(t-a)(t-b)), the height is zero when (t=a) or (t=b). In the water droplet context, these values represent when the droplet reaches the ground. I verified this by substituting both values into the

	described as accurate general rules. The rules are fully verified and justified using correct reasoning and clear communication.	original quadratic equation, which confirms the general rule and justifies the pattern.”

Criterion C: Communicating

Level	Task Descriptor (According to Context)	Sample Response (According to Task)
0	The student does not communicate mathematical ideas related to the water-droplet situation. Mathematical language and representations are absent or incorrect.	Work is missing or shows unrelated numbers and statements with no reference to the quadratic equation or the water-droplet context.
1–2	The student uses limited or incorrect mathematical language. A simple representation (table or equation) is shown but is unclear or poorly labeled. Reasoning is incomplete and information is disorganized.	“The droplet goes down and then up. I made a table but did not label time or height, and I did not explain what the numbers mean.”
3–4	The student uses some appropriate mathematical language and notation. One or more representations are used, but links between them are unclear. Reasoning is partially explained and organization is inconsistent.	“I used the equation ((t-1)(t-4)) and made a table. The table shows the height is zero, but I did not clearly explain how the factors relate to the table or the water droplet.”
5–6	The student uses mostly correct mathematical language, symbols, and terminology. Appropriate representations (table and equation) are used and connected. Reasoning is generally clear and logically ordered.	“The quadratic equation (h(t)=(t-1)(t-4)) models the height of the water droplet. The table of values shows that the height is zero at (t=1) and (t=4), which matches the solutions found by factorization.”
7–8	The student consistently uses precise mathematical language, notation, and terminology. Multiple representations are used	“Using the quadratic model (h(t)=(t-1)(t-4)), I identified the roots (t=1) and (t=4), which represent the times when the water droplet reaches the

	effectively and the student moves fluently between them. Reasoning is complete, coherent, concise, and logically structured.	ground. The table of values confirms these results, and substitution verifies the solutions. My explanation clearly links the algebraic and numerical representations in a logical sequence.”