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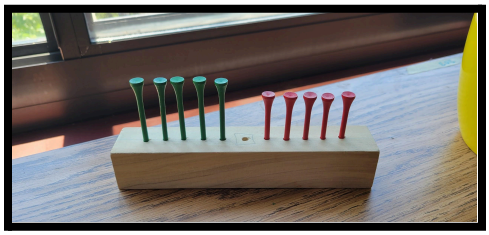
# Leap Frog

- A hopping game.

- **Activity:** Use peg puzzles to illustrate the computational thinking skills of algorithms, **decomposition**, pattern recognition, and **abstraction**. Apply your knowledge of functions, data organization, and possibly sequences.

- **Above and Beyond:**
  - Write a flowchart to solve the problem.
  - Write a computer program to solve and give the output to the Peg Puzzle for any input.
  - Determine the recursive and explicit rules for solving the puzzle, and test your ideas.



**Think -Puzzle- Explore**
**Engage:** Write out your thoughts on paper or a whiteboard.
Take a moment: think -

What do you recall about sequences?
How do you organize data?
What does perseverance look like when solving problems?

After your teacher has explained the "rules" of the game, in your own words describe the rules of the game. Be sure all group members understand the rules.
*Ok- now solve the puzzle!*

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*Feeling challenged?*

*Discuss what those challenges are and how you will persevere!*

- How can you make this problem simpler or easier to understand? (Decomposition)

While solving your peg puzzle, complete the table below:

| PAIRS OF FROGS | MOVES |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

- Can you identify a pattern in the table above? Identify / Explain what you recognize.
  (There may be more than one way of thinking this through, and, more than one way to express the pattern.) **Divergent Thinking**

- Determine a ***recursive rule*** for the peg puzzle. and show the use of the rule for $a_1$ $a_2$, $a_3$, $a_4$, $a_5$ **(Abstraction)**

- Apply the recursive rule or function to determine the number moves for 2 different inputs not in the table. Show your work**.**

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**Identify the Challenge**

- If I were to ask you to apply your rule to determine the number of moves for 100 pairs of pegs, or 300 pairs, what would you find challenging?

**Visualize the Data**

- Graph the results( last page)
    - Is the data representing the number of leaps a DISCRETE or CONTINUOUS data set? Explain.
    - What type of function do you think represents the data? Linear or quadratic? How do you know?
- How does the visualization and formula or function help you overcome the challenge?

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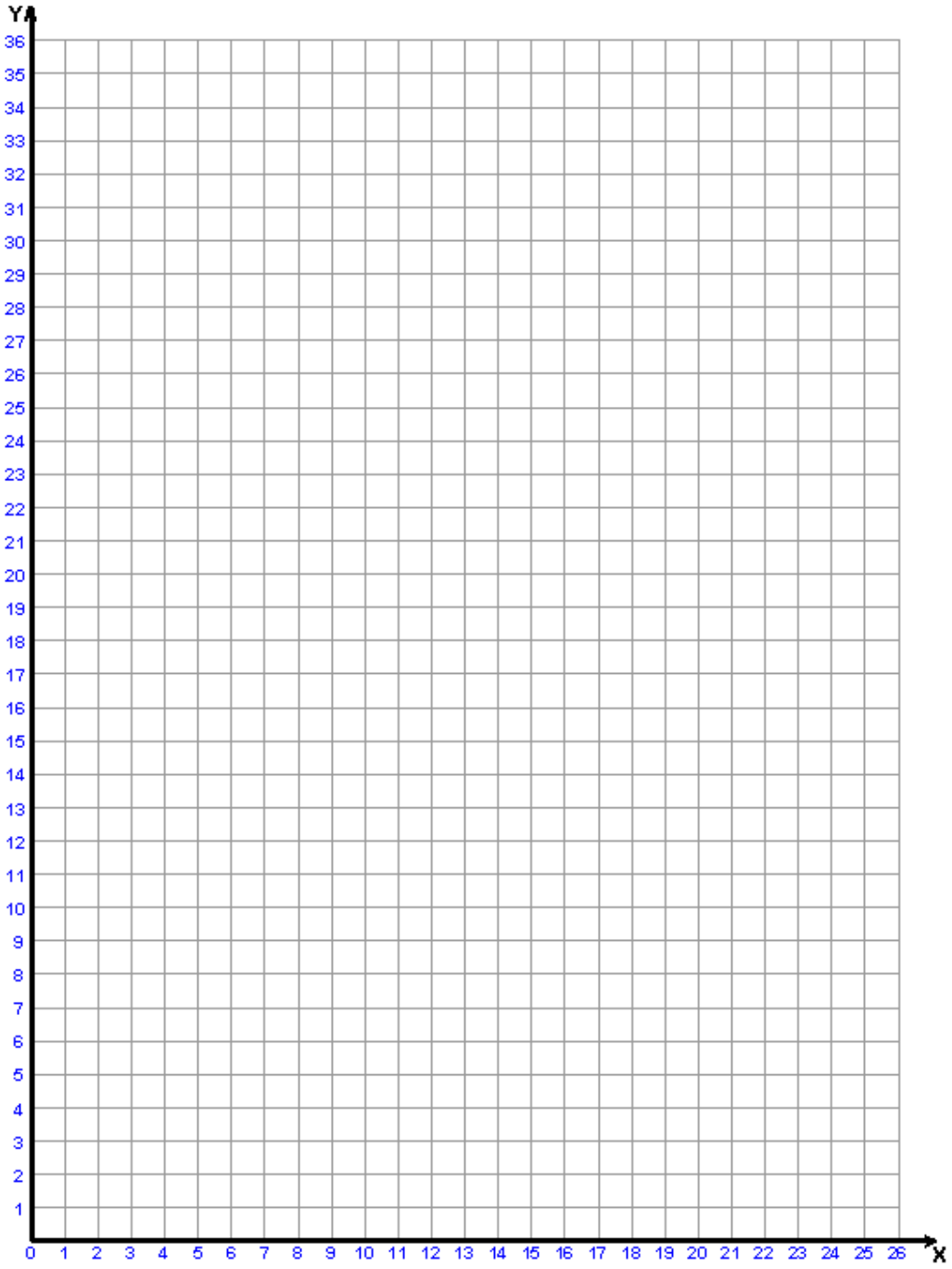

# Extend:

Write or explain a formula, or rule, for the pattern above.
Let n = number of pairs and M = number of moves. **(Abstraction)**
*An explicit rule is NOT recursive. It only needs the value of n, the number of pairs. It is like a function from algebra 1. Your formula would be all in terms of n.*

**Show your calculations.**

**Yet, abstraction comes in when we begin to use symbols to represent quantity or actions between those quantities.**

Write an algorithm for successfully moving the pegs in the least number of moves. You may diagram your thinking with illustrations. Be sure that your steps are clearly labeled. Do this on a separate sheet.

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# **Reflect :** 3-2-1 Reflection

Name 3 things you learned.

Name 2 connections you made.

Name 1 challenge that remains.

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