Guided Investigation: Mirror & Spin Lab — Even/Odd Functions

Discover symmetry by exploring an interactive applet.

Name: _____ **Class:** _____ **Date:**
_____

Purpose & Learning Goals

- Use the Mirror (y-axis reflection) and Spin (180° about the origin) overlays to **detect patterns** in graphs.

- **Form a conjecture** about when a function matches the Mirror overlay versus the Spin overlay.

- **Test, refine, and justify** your conjecture using examples and non-examples.

Materials

- Computer with the *Mirror & Spin Lab* applet open (no login or submission needed).

- This investigation sheet and a pen/pencil.

Ground Rules

- The goal is **discovery**. Avoid using outside definitions; rely on **what you observe**.

- Record **clear evidence** (screenshots not required). Use the tables below.

- If the applet shows an expression error, adjust your input (e.g., use `|x|` for absolute value; `ln(x)` for natural log; `^` for powers).

Part A — Orientation (5–8 min)

1. In the applet, ensure **Mirror** is checked and **Spin** is unchecked. Try the presets `x^2`, `|x|`, `cos(x)`.

   - What happens when the Mirror overlay *matches exactly* the blue graph? Describe in your own words:

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2. Now uncheck **Mirror** and check **Spin**. Try `x`, `x^3`, `sin(x)`.

   - What happens when the Spin overlay *matches exactly*? Describe:

Part B — Collect Evidence (10–12 min)

Use the table to log at least **8 functions**: aim for at least 3 that match Mirror, 3 that match Spin, and 2 that match neither. Use the applet's classification panel only to *check* your thinking.

Function $f(x)$	Overlay Match	What you noticed (shape, symmetry, values at $\pm x$, etc.)
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____
_____	Mirror / Spin / Neither	_____

Part C — Make a Conjecture (6–8 min)

1. Based on your table, write a **first draft** rule for when a function matches the Mirror overlay:

2. Write a **first draft** rule for when a function matches the Spin overlay:

3. Without calculating, what *relationship* might hold between the y-values at x and $-x$ when the Mirror overlay matches? When the Spin overlay matches?

Part D — Stress Test Your Conjecture (10–15 min)

Use the applet's **Transform** chips to modify functions and see what happens.

D1. Vertical/Horizontal Shifts

- Start with a function that matched Mirror. Try $f(x) + c$ and $f(x - h)$. Which (if any) changes kept the match? Which broke it? Why might that be?

Observations:

D2. Multiply by -1 and by x

- Pick a function that matched Mirror. Try $-f(x)$ and $x \cdot f(x)$. What happens to the overlay match?

- Repeat with a function that matched Spin.

Observations:

D3. Stretching

- Try $k \cdot f(x)$ and $f(kx)$ with $k > 0$. Which transformations preserve each kind of match?

Observations:

D4. Edge Cases

- Explore 0 (the zero function), $|x|$, $\ln(x)$, $\sqrt{x}$. Note any domain issues and how they affect matching.

Observations:

Part E — Refine & Justify (8–10 min)

1. **Refined Conjecture (Mirror):**

2. **Refined Conjecture (Spin):**

3. **Evidence set.** List two functions that *support* each conjecture and one *counterexample* for each (explain why it fails).

Conjecture	Example/Counterexample	Why this supports or refutes
Mirror	Example: _____	_____
Mirror	Example: _____	_____
Mirror	Counterexample: _____	_____
Spin	Example: _____	_____
Spin	Example: _____	_____
Spin	Counterexample: _____	_____

Numeric Spot-Checks (optional)

Pick 3 values of x and compare $f(x)$, $f(-x)$, and $-f(x)$ for a function of your choice.

x	$f(x)$	$f(-x)$	$-f(x)$
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Reflection (3–5 min)

- What **visual cue** most reliably told you that a function matched Mirror? Spin?

- Which transformation most *surprised* you in how it affected matching, and why?

- If you had to explain your findings to a friend using only pictures, how would you do it?

(Teacher) Success Criteria — Investigating Patterns

Focus on reasoning and use of evidence.

- **Systematic exploration:** a varied set of examples/non-examples (Mirror, Spin, Neither) recorded.

- **Conjecturing:** clear, testable statements in students' own words.

- **Testing & refinement:** transformations and edge cases are used to probe limits.

- **Justification:** examples and counterexamples linked explicitly to the conjecture.

- **Clarity:** reasoning communicated with correct use of the applet's observations.

Reminder: You do not submit anything online for this activity. Use the applet to explore and this sheet to capture your thinking.