Butterfly Wing Pattern Drawing: Repeat and Vary a Single Motif

Original tasks 1, 2 / complete keys

Task 1

You have a 3 by 3 grid. The motif fills two-thirds of the cell height. Your rotation rule is 90 degrees clockwise moving right, and 180 degrees in the next row. State the rotation value for each of the nine cells, starting with 0 degrees in the top-left cell.

Answer: Row 1: 0, 90, 180. Row 2: 180, 270, 0. Row 3: 0, 90, 180.

Reason: Apply the rule cell by cell: moving right adds 90 degrees; the first cell of a new row starts 180 degrees from the first cell of the previous row, then the 90-degree step continues. Count the values: 0 appears three times, 90 twice, 180 three times, 270 once. A 3 by 3 grid has only nine cells, so four rotations cannot each appear three times (4 × 3 = 12, which is more than 9). For this smaller grid the balance check is relaxed: the rule is applied consistently, and the uneven counts are expected rather than a mistake.

Check: Count the cells: nine values listed. Check that each step right adds 90 degrees and each new row starts 180 degrees from the previous row's first cell.

Task 2

A learner defines three variations: a notch, a vein, and a spot. In a 4 by 3 grid, they assign the notch to four cells, the vein to four cells, and the spot to four cells. Is this a valid variation plan under the lesson convention? Explain using counts.

Answer: Yes. Twelve cells are covered exactly once, and each of the three variations appears four times, which meets the requirement of at least three cells per variation.

Reason: The grid has 4 times 3 equals 12 cells. Four plus four plus four equals 12, so every cell has one variation. Each variation count is four, which is at least three.

Check: Add the counts: 4 + 4 + 4 = 12. Compare with the number of cells: 4 × 3 = 12. Confirm each variation count is at least 3.

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Original tasks 3, 4 / complete keys

Task 3

In a 4 by 3 grid, a learner uses rotations 0, 90, 180, and 270 degrees. They want each rotation to appear exactly three times. Is this possible with 12 cells? Show the arithmetic.

Answer: Yes. Four rotation values times three appearances equals 12 cells, which matches the grid size.

Reason: The grid has 12 cells. If each of four rotations appears three times, the total is $4 \times 3 = 12$. This uses every cell exactly once.

Check: Multiply the number of rotation values by the desired appearances: $4 \times 3 = 12$. Compare with $4 \times 3 = 12$ cells.

Task 4

A learner draws a 4 by 3 grid but makes the motif fill the whole cell height in row 1 and two-thirds height in rows 2 and 3. They define three variations and apply a consistent rotation rule. Using the lesson convention, identify the problem and state a fix.

Answer: The problem is that the motif height is not consistent: row 1 uses full height while other rows use two-thirds height. The fix is to redraw row 1 so the motif fills about two-thirds of the cell height, matching the other rows.

Reason: The convention requires the motif to fill about two-thirds of the cell height in every cell so that rotations and variations can be compared fairly. A full-height motif in row 1 breaks that checkable condition.

Check: Measure the motif height in each cell against the cell height. Confirm that every cell is about two-thirds, not full height.

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Source rubric / reflection

- [ ] The grid has equal cells and the motif fills about two-thirds of the cell height in every cell.
- [ ] A single rotation rule is stated and applied consistently across the grid.
- [ ] At least three motif variations are defined in words and each appears in at least three cells.
- [ ] The pattern reads as a repeating butterfly wing pattern and is balanced by count.
- [ ] Valid alternatives are accepted: any consistent inner-edge choice, any three defined shape or line variations, and any equal-cell grid size that fits the paper.

Reflection: What did you check, what did you change, and what will you try next?