Complete Natural Symmetry: Drawing the Missing Half of Leaves and Flowers

Original tasks 1, 2 / complete keys

Task 1

A half-flower outline has a petal tip 16 mm from the mirror axis at 25 mm along the axis, and a petal notch 9 mm from the axis at 10 mm along the axis. Transfer both points to the blank half and give the expected distances.

Answer: The matching petal tip is 16 mm from the axis at 25 mm along the axis. The matching notch is 9 mm from the axis at 10 mm along the axis. Check sums: 16 + 16 = 32 mm and 9 + 9 = 18 mm.

Reason: Each point is mirrored by keeping the same position along the axis and placing the partner at the same perpendicular distance on the opposite side. The sum check confirms twice the single distance.

Check: Measure each transferred point perpendicular to the axis. Confirm equal distances and that each pair sums to twice one distance.

Task 2

A half-leaf has three points measured from the axis: 11 mm, 7 mm, and 13 mm. The corresponding positions along the axis are 5 mm, 15 mm, and 22 mm. State the three matching distances and one arithmetic check.

Answer: The matching distances are 11 mm, 7 mm, and 13 mm at the same positions along the axis. One check is 11 + 11 = 22 mm, which equals twice 11 mm.

Reason: Bilateral symmetry preserves perpendicular distance and position along the axis. The arithmetic check tests whether a pair sums to twice its single distance.

Check: Measure all three pairs. Each pair should have equal distances, and each sum should equal twice the single distance.

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Original tasks 3, 4 / complete keys

Task 3

A half-flower has a vein endpoint 6 mm from the axis and another endpoint 15 mm from the axis. The vein meets the axis at a 40-degree angle on the given half. Describe how to place the matching vein on the blank half and give one distance check.

Answer: Place the matching vein endpoints at 6 mm and 15 mm from the axis on the opposite side, and make the vein meet the axis at 40 degrees on that side. Check: 6 + 6 = 12 mm and 15 + 15 = 30 mm.

Reason: Endpoints mirror by equal perpendicular distance, and the angle at the axis mirrors to the same angle on the other side. The distance sums confirm the transfer.

Check: Measure both endpoints perpendicular to the axis and compare the meeting angle on each side. Confirm the sums equal twice the single distances.

Task 4

A completed half-leaf has a point 18 mm from the axis, but its partner on the blank side measures 15 mm from the axis. The position along the axis is the same. Identify the error and state the corrected distance.

Answer: The partner is 3 mm too close to the axis. The corrected distance is 18 mm from the axis on the blank side. Check: 18 + 18 = 36 mm.

Reason: Matching points must have equal perpendicular distances. The difference is 18 minus 15 equals 3 mm, so the partner must move 3 mm farther from the axis.

Check: Re-measure the corrected point perpendicular to the axis and confirm both distances are 18 mm and the sum is 36 mm.

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Source rubric / reflection

- [ ] The mirror axis is a single straight line and is clearly identified.
- [ ] At least three matching point pairs are measured perpendicular to the axis.
- [ ] Each matching pair has equal distances from the axis within the pencil width.
- [ ] The completed outline connects transferred points smoothly without guessing long curves.
- [ ] Internal details such as veins or petal creases have mirrored endpoints or angles.
- [ ] Units are consistent throughout and numerical values are labelled as hypothetical examples.
- [ ] Valid alternatives in line style or stroke order are accepted if the distance rule is met.

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