Draw a Scaled Ball: Wrapping Overlapping Rows Around a Sphere

Original tasks 1, 2, 3 / complete keys

Task 1

A circle has a vertical axis and one equator guide. The first scale is centered on the axis with its tip down. Describe where to place the next scale to the right so overlap is consistent.

Answer: Place it to the right with its top edge just below the equator guide, overlapping the first scale's right side slightly, tip pointing down.

Reason: Consistent overlap means each new scale covers part of the previous one in the same direction. Keeping the top edge below the guide maintains row alignment.

Check: Trace the row: both scales should share the same downward tip direction and the right scale should overlap the left.

Task 2

A ball is drawn with light from the upper left. A student shades the upper left scales dark and the lower right scales light. What is wrong and how should it be fixed?

Answer: The shading is reversed. Darken the lower right gradually and keep the upper left lighter, with thin shadows under overlapping edges.

Reason: Light from upper left means surfaces facing upper left are lit; surfaces turning away darken. Reversing this flattens the sphere.

Check: Compare shading to the light arrow: the side nearest the arrow should be lighter overall.

Task 3

On a circle of radius 5 cm, a student draws five straight horizontal rows of identical scales. Name two problems and one correction for each.

Answer: Problem one: rows are straight, not curved. Correction: redraw guides as arcs bowing with the sphere. Problem two: scales are identical everywhere. Correction: narrow and tilt scales near edges and compress rows near top and bottom.

Reason: A sphere's surface curves, so rows must bow and scales must foreshorten near edges. Identical flat rows read as a flat pattern.

Check: Trace a row: it should curve smoothly. Compare center and edge scale widths: edges should be narrower.

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Original tasks 4 / complete keys

Task 4

A student draws overlapping scales but the overlap direction reverses on the left side. Describe a check and a fix using row-by-row inspection.

Answer: Check each row from left to right, noting tip direction and which scale covers which. On the left side, redraw scales so their tips point down and each covers the scale beneath in the same direction as the rest of the ball.

Reason: Overlap direction is a global convention; reversing it locally breaks the roof-tile effect and confuses curvature.

Check: Mark one arrow per row showing overlap direction; all arrows should match.

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Source rubric / reflection

- [ ] Rows curve with the sphere rather than staying flat.
- [ ] Overlap direction is consistent across the ball.
- [ ] Scale size and spacing compress toward top, bottom, and side edges.
- [ ] Shading shows a clear light direction and spherical volume.
- [ ] Overlap shadows are present but not overpowering.
- [ ] Valid alternative scale shapes are accepted if curvature and overlap remain consistent.

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