How to Draw an Ellipse on the Floor with String and Stakes

Original tasks 1, 2, 3 / complete keys

Task 1

Hypothetical example: major axis 300 cm, minor axis 180 cm. Compute focal distance and string loop length.

Answer: a = 150 cm, b = 90 cm. Focal distance = square root of (22500 minus 8100) = square root of 14400 = 120 cm. Loop length = 300 + 240 = 540 cm.

Reason: Halve each axis, square, subtract, take the square root for focal distance, then add twice the focal distance to the major axis for the loop.

Check: Verify that 120 squared plus 90 squared equals 150 squared: 14400 + 8100 = 22500, which is 150 squared.

Task 2

Hypothetical example: major axis 500 cm, minor axis 300 cm. Where do the stakes go relative to the centre, and what loop length is needed?

Answer: a = 250 cm, b = 150 cm. Focal distance = square root of (62500 minus 22500) = square root of 40000 = 200 cm. Stakes are 200 cm from the centre on the major axis. Loop length = 500 + 400 = 900 cm.

Reason: The stakes sit at the focal points, which are the focal distance from the centre, not at the axis ends.

Check: The loop path from one stake to the far major-axis endpoint and back to the other stake is 250 + 400 + 250 = 900 cm, which equals the major axis plus twice the focal distance.

Task 3

Hypothetical example: a traced point is 170 cm from stake A and 130 cm from stake B. The major axis is 300 cm. Does the point lie on the ellipse?

Answer: Yes. The sum is 170 + 130 = 300 cm, which equals the major axis.

Reason: The defining property is that the sum of distances to the two stakes equals the major axis for every point on the ellipse.

Check: Repeat at two nearby points; if each sum is 300 cm within measurement accuracy, the curve is consistent.

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Original tasks 4 / complete keys

Task 4

Hypothetical example: major axis 360 cm, minor axis 216 cm. A helper places stakes 180 cm from the centre. Is that correct?

Answer: No. a = 180 cm, b = 108 cm. Focal distance = square root of (32400 minus 11664) = square root of 20736 = 144 cm. Stakes should be 144 cm from the centre, not 180 cm.

Reason: Placing stakes at half the major axis puts them at the axis endpoints, which is a common error; the focal distance is shorter.

Check: Compute 144 squared plus 108 squared = 20736 + 11664 = 32400, which equals 180 squared, confirming the focal distance.

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Source rubric / reflection

- [ ] Calculation box shows a, b, focal distance, and loop length with consistent units.
- [ ] Stakes are placed at centre plus and minus focal distance, not at the major-axis endpoints.
- [ ] String loop length is verified flat before tracing.
- [ ] Curve is checked at four axis endpoints and at least four intermediate points using the distance-sum test.
- [ ] Final line is applied only after all checks pass; any deviation is corrected before marking.

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