How to Practice Drawing Machinery: Gears and Housings Form Study

Original tasks 1, 2, 3 / complete keys

Task 1

Draw a gear with 10 teeth using a hypothetical outer radius of 25 mm and root radius of 20 mm. State the angular step and show one tooth profile repeated around the center.

Answer: Angular step is 360 divided by 10, which equals 36 degrees per tooth. The plate shows 10 teeth spaced at 36 degrees, with outer radius 25 mm and root radius 20 mm labeled as hypothetical examples.

Reason: Dividing the full circle by the tooth count gives equal spacing; repeating one profile at that step creates a consistent gear form.

Check: Measure the angle between adjacent tooth centerlines; each should be 36 degrees within your drawing accuracy. Confirm every centerline passes through the gear center.

Task 2

Place two gear centers 60 mm apart on a horizontal line. Draw shaft axes to a housing outline and measure the left and right center-to-edge distances. If the left is 15 mm and the right is 18 mm, what is the difference?

Answer: The difference is 18 minus 15, which equals 3 mm. The plate notes a 3 mm offset between the two center-to-edge distances.

Reason: Subtracting the smaller measured distance from the larger gives the offset; consistent units keep the comparison valid.

Check: Re-measure both distances with the same ruler and subtract again; the result should match 3 mm within your measurement accuracy.

Task 3

Draw a rounded housing around a gear with a hypothetical outer radius of 30 mm. Mark a light direction from the upper right and shade the housing with light, mid, and dark tones. Describe where each tone goes.

Answer: Light tone goes on the upper-right curve facing the light; mid tone goes on the front flat area; dark tone goes on the lower-left edge away from the light. The light-direction arrow points upper right.

Reason: Tone placement follows the chosen light direction so the housing reads as a solid volume rather than a flat shape.

Check: Squint at the plate: the upper-right should appear lightest and the lower-left darkest. If reversed, move the tones to match the arrow.

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Original tasks 4 / complete keys

Task 4

Draw a gear with 12 teeth and a housing outline. Label the tooth count, angular step, and one hypothetical radius. Then list two checks you would perform before calling the plate complete.

Answer: Angular step is 360 divided by 12, which equals 30 degrees per tooth. Labels include 12 teeth, 30 degrees per tooth, and a hypothetical outer radius such as 28 mm. Checks: confirm each tooth centerline passes through the gear center, and confirm the housing clearance is visible around the outer circle.

Reason: The arithmetic gives equal tooth spacing; the checks target symmetry and clearance, which are the main form-study goals.

Check: Measure one angular step and compare to 30 degrees; measure clearance at two opposite points around the gear and confirm both are visible and roughly equal if intended.

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Source rubric / reflection

- [ ] Gear center and shaft axis are clearly marked and aligned.
- [ ] Tooth count and angular step are stated and arithmetically correct.
- [ ] Housing outline encloses the gear with visible clearance.
- [ ] Shaft alignment is measured and any offset is noted.
- [ ] Metal shading follows a stated light direction with three readable tones.
- [ ] Labels use consistent x-height from baseline to midline; letter style may vary.
- [ ] All numerical values are labeled as hypothetical examples and units are consistent.

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