Draw a Wheel: Rim, Hub, and Spoke Layout Guide

Original tasks 1, 2 / complete keys

Task 1

Draw a wheel with rim radius 40 mm and hub radius 10 mm using 8 evenly spaced spokes. State the spoke spacing and the hub-to-rim ratio.

Answer: Spoke spacing is 360 divided by 8, which equals 45 degrees. Hub-to-rim ratio is 40:10, which simplifies to 4:1. Spoke positions are 0, 45, 90, 135, 180, 225, 270, and 315 degrees.

Reason: Even spacing divides the full circle by the spoke count. The ratio compares rim radius to hub radius in the same units.

Check: Measure two adjacent spoke angles and confirm they are close to 45 degrees. Measure rim and hub radii and confirm the ratio is close to 4:1.

Task 2

Draw a wheel with rim diameter 100 mm and hub diameter 30 mm using 12 evenly spaced spokes. State the radii, spoke spacing, and ratio.

Answer: Rim radius is 50 mm and hub radius is 15 mm. Spoke spacing is 360 divided by 12, which equals 30 degrees. Ratio is 50:15, which simplifies to 10:3, about 3.33:1.

Reason: Diameter to radius conversion divides by 2. Even spacing divides 360 by the spoke count. The ratio uses radii in the same unit.

Check: Measure the drawn diameters and halve them to confirm radii. Measure adjacent spoke angles and confirm they are close to 30 degrees.

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Original tasks 3, 4 / complete keys

Task 3

Draw a wheel with rim radius 60 mm and hub radius 20 mm using paired spokes: two spokes 10 degrees apart, with pair centers repeated every 60 degrees for 12 total spokes. State the pair spacing and check that 12 spokes fit the pattern.

Answer: Pair spacing is 10 degrees. To get exactly 12 total spokes with pair centers repeated every 60 degrees, use 6 repeat positions spaced 60 degrees apart, each holding a pair 10 degrees apart: 6 pairs times 2 spokes equals 12 spokes. Mark pair centers at 0, 60, 120, 180, 240, and 300 degrees, and place each pair's two spokes at plus 5 degrees and minus 5 degrees from its center. Count the drawn spokes to confirm the total is 12.

Reason: Paired layouts require an explicit repeat rule. Counting spokes against the repeat interval prevents accidental over- or under-drawing.

Check: Count the drawn spokes and confirm the total is 12. Measure one pair separation and confirm it is close to 10 degrees. Measure the angle between adjacent pair centers and confirm it is close to 60 degrees.

Task 4

Draw a wheel with rim radius 45 mm and hub radius 18 mm using 9 evenly spaced spokes. State the spoke spacing and ratio, and note whether the hub ratio falls within the accepted alternative range of 1:2.5 to 1:3.5.

Answer: Spoke spacing is 360 divided by 9, which equals 40 degrees. Hub-to-rim ratio is 18:45, which simplifies to 1:2.5. This equals the lower bound of the accepted hub-to-rim range 1:2.5 to 1:3.5, so it is valid if stated.

Reason: Even spacing divides 360 by 9. The ratio simplifies by dividing both values by 9. The accepted range is a stated convention, not a universal standard.

Check: Measure adjacent spoke angles and confirm they are close to 40 degrees. Measure radii and confirm the simplified ratio is close to 5:2.

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Source rubric / reflection

- [ ] Rim and hub share a single center point; concentricity is checked by measurement.
- [ ] Hub-to-rim ratio is stated and verified by arithmetic.
- [ ] Spoke count and spacing convention are stated; spacing equals 360 divided by count for even layouts.
- [ ] Spokes connect hub edge to rim edge without unintended center crossing.
- [ ] Labels follow the defined convention and do not obscure the construction.
- [ ] Units are consistent and every numerical value is labeled as a hypothetical example where applicable.
- [ ] Valid alternatives are accepted when the chosen convention is stated and checkable.

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