Draw a Bolt: Hex Head, Threaded Shaft, and Side-View Proportion

Original tasks 1, 2 / complete keys

Task 1

Using L = 80 mm, draw a side-view bolt with shaft diameter 20 mm, head length 48 mm, head width 72 mm, thread pitch 4 mm, and threaded length 56 mm. State the expected number of thread marks.

Answer: The expected number of thread marks is 56 divided by 4, which equals 14. The drawing should show a shaft rectangle 80 mm by 20 mm, a head rectangle 48 mm by 72 mm centered on the same centerline, chamfer lines at the head corners, and 14 evenly spaced thread marks over 56 mm.

Reason: Head length is 0.6L and head width is 0.9L, matching the lesson ratios. Thread mark count follows threaded length divided by pitch.

Check: Measure head width (72 mm) against shaft diameter (20 mm); count thread marks and confirm 14; check that threaded length plus unthreaded tip equals shaft length.

Task 2

A student draws a bolt with L = 120 mm, shaft diameter 30 mm, head length 72 mm, head width 108 mm, pitch 6 mm, and threaded length 84 mm. How many thread marks should appear, and what simple proportion check confirms the head is correct?

Answer: Thread marks: 84 divided by 6 equals 14. The head check: head length 72 mm is 0.6 times 120 mm, and head width 108 mm is 0.9 times 120 mm, so the head proportions match the lesson convention.

Reason: The ratios are applied directly to L. The thread count uses the threaded length only, not the full shaft.

Check: Multiply L by 0.6 and 0.9 to verify head dimensions; divide threaded length by pitch to verify mark count.

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Original tasks 3, 4 / complete keys

Task 3

Draw a side-view bolt with L = 60 mm, shaft diameter 15 mm, head length 36 mm, head width 54 mm, pitch 3 mm, and threaded length 42 mm. Describe where the unthreaded section is and how many thread marks you expect.

Answer: The unthreaded section is the remaining 18 mm near the tip, since 60 minus 42 equals 18. Thread marks: 42 divided by 3 equals 14. The head is 36 mm by 54 mm, centered on the shaft centerline, with chamfer lines.

Reason: The threaded length is subtracted from the shaft length to locate the unthreaded tip. The mark count uses threaded length divided by pitch.

Check: Confirm 42 plus 18 equals 60; count 14 marks; measure head width 54 mm against shaft diameter 15 mm.

Task 4

A drawing uses L = 90 mm, shaft diameter 22.5 mm, head length 54 mm, head width 81 mm, pitch 4.5 mm, and threaded length 63 mm. Calculate the thread mark count and explain one way to check even spacing without counting every mark.

Answer: Thread marks: 63 divided by 4.5 equals 14. To check even spacing without counting every mark, measure the distance across a group of five intervals; it should equal five times the pitch, or 22.5 mm. Repeat for another group of five intervals and compare.

Reason: Grouping intervals reduces counting errors. The expected group length is a simple multiplication of pitch by the number of intervals.

Check: Measure two separate five-interval groups and confirm both are 22.5 mm; then count total marks to confirm 14.

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Source rubric / reflection

- [ ] Shaft length and diameter are clearly marked and consistent with the chosen L.
- [ ] Hex head is drawn as a side-view rectangle with chamfer lines, wider than the shaft and shorter than the shaft length.
- [ ] Thread marks are evenly spaced and the count matches threaded length divided by pitch.
- [ ] Final outline is clear, construction lines are removed or light, and the centerline is visible.
- [ ] Any lettering follows the x-height convention; alternative legible styles are accepted.

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