Robot Leg Drawing: Joints and Segments

Original tasks 1, 2 / complete keys

Task 1

Draw a robot leg with a ball hip, hinge knee, and hinge ankle. Use upper segment 7 cm, lower segment 4 cm, foot 2 cm. Label all joints and lengths.

Answer: A side-view leg with three labeled joints: ball hip (circle with center dot and arc), hinge knee (circle with bar), hinge ankle (circle with bar). Upper segment 7 cm, lower 4 cm, foot 2 cm, all labeled. Motion arrows at knee and ankle only.

Reason: The joint types determine which symbols and arrows are used. Ball hip gets a dot-and-arc symbol and no hinge arrow. Hinge knee and ankle get bar symbols and motion arrows. Segment lengths are written beside each part.

Check: Measure each segment against the plan with a 0.5 cm tolerance. Confirm each joint symbol matches its label. Confirm arrows appear only at hinges.

Task 2

A robot leg has upper segment 8 cm and lower segment 6 cm. Draw it with a hinge hip and ball knee. Add a foot of 3 cm. Label all parts.

Answer: Side-view leg with hinge hip (circle with bar), ball knee (circle with dot and arc), and a 3 cm foot. Upper segment labeled 8 cm, lower labeled 6 cm. Motion arrow at hip only.

Reason: The hinge hip allows bending, so it gets an arrow. The ball knee allows multi-direction rotation, so it gets a dot-and-arc symbol without a hinge arrow. The foot is shorter than the lower segment.

Check: Check that the upper-to-lower ratio is 8:6, or 4:3. Measure drawn lengths within 0.5 cm. Confirm the ball knee has no hinge arrow.

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Original tasks 3, 4 / complete keys

Task 3

Draw a robot leg with three hinge joints: hip, knee, ankle. Use upper 5 cm, lower 5 cm, foot 1.5 cm. Show motion arrows at all three joints.

Answer: Side-view leg with three hinge symbols (circle with bar) at hip, knee, and ankle. Equal upper and lower segments of 5 cm, foot 1.5 cm. Motion arrows at all three hinges.

Reason: All joints are hinges, so all get bar symbols and motion arrows. Equal segment lengths make the leg symmetric in the side view. The foot is shorter than both segments.

Check: Measure both main segments to confirm they are equal within 0.5 cm. Confirm three hinge symbols and three arrows. Check foot length is about 1.5 cm.

Task 4

Design a robot leg with one ball joint and two hinge joints. Choose segment lengths that sum to 12 cm for the two main segments. Draw and label the leg.

Answer: A side-view leg with one ball joint (dot and arc) and two hinges (bars). For example, upper 7 cm and lower 5 cm, summing to 12 cm. Foot 2 cm. All joints and lengths labeled. Motion arrows at hinges only.

Reason: The sum constraint fixes the total main-segment length. Any split that sums to 12 cm is valid, such as 7 and 5 or 6 and 6. The ball joint gets its own symbol and no hinge arrow.

Check: Add the two labeled segment lengths and confirm the sum is 12 cm. Confirm one ball symbol and two hinge symbols. Confirm arrows appear only at hinges.

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Source rubric / reflection

- [ ] Three joint centers are marked and labeled by type.
- [ ] Hinge and ball symbols follow a stated, consistent convention.
- [ ] Upper and lower segments have consistent width and labeled planned lengths.
- [ ] Motion arrows appear only at hinge joints.
- [ ] Measured segment lengths are within the stated tolerance of the plan.

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