Draw Gym Equipment: Frame and Weight-Stack Construction

Original tasks 1, 2 / complete keys

Task 1

Draw a single upright frame 10 cm tall and 2 cm wide with a right-angle joint at the top connecting to a 6 cm horizontal tube. Add one pulley at the joint center with a 2 cm outer circle. Use hypothetical values and show the cable tangent to the pulley.

Answer: The upright is a vertical rectangle 10 cm by 2 cm with rounded caps. The horizontal tube is 6 cm by 2 cm, meeting the upright at a right-angle joint with a small center circle. The pulley outer circle is 2 cm diameter centered at the joint, with an axle circle at one-third radius. The cable is a line tangent to the pulley edge, with a short wrap arc where it changes direction.

Reason: The joint center is the shared reference for both tubes and the pulley. Tube widths match on both sides of the joint, and the cable touches the outer circle rather than passing through the center.

Check: Measure both tube widths at the joint; they should be equal. Confirm the cable line touches the pulley outer circle at one point and does not cross the center.

Task 2

Draw a weight stack with five plates. Each plate is 3 cm wide and 0.8 cm tall, with 2 mm gaps. Add a selector pin through the top plate. Use a vertical center line and check that all center holes align.

Answer: The stack is a vertical column of five rounded rectangles, each 3 cm by 0.8 cm, separated by 2 mm gaps. A vertical center line runs through all plates, and each plate has a center hole on that line. The selector pin is a short horizontal line entering the side of the top plate and stopping at the center rod, not crossing the center hole.

Reason: Equal plate dimensions and consistent gaps keep the stack visually regular. The center line ensures alignment of holes, and the pin is drawn as a simple horizontal line for clarity.

Check: Measure the width and height of each plate; they should match. Check that the gaps are equal and that every center hole lies on the vertical center line.

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Original tasks 3, 4 / complete keys

Task 3

Draw a frame with two uprights 12 cm tall and a top crossbar 8 cm wide. Add two pulleys, one at each top corner, each with a 2 cm outer circle. Show a cable running from the left pulley tangent to the right pulley. Label the frame height and stack height with a consistent x-height.

Answer: Two vertical uprights 12 cm by 2 cm are connected by a top crossbar 8 cm by 2 cm. At each top corner, a pulley outer circle of 2 cm diameter is centered on the joint, with an axle circle at one-third radius. The cable runs tangent to both pulley outer circles, with short wrap arcs at each pulley. Labels use a 3 mm x-height and are placed in clear spaces.

Reason: Centering each pulley on its joint keeps the construction consistent. Tangent cable lines show the cable path without crossing pulley centers. Labels are separated from frame lines to keep the drawing readable.

Check: Confirm each pulley is centered on its joint and that the cable touches both outer circles. Check that label x-heights are equal and that no label overlaps a frame line.

Task 4

Draw a machine frame 9 cm tall with a weight stack 3 cm tall. Use four plates of equal size with 2 mm gaps. Add one pulley at the top with a cable tangent to it and connected to the top plate. Check the frame-to-stack ratio and state whether it matches the three-to-one proportion.

Answer: The frame is 9 cm tall and the stack is 3 cm tall, giving a ratio of 9 to 3, or three to one, which matches the proportion check. The stack has four equal plates with 2 mm gaps and aligned center holes. The top pulley has a 2 cm outer circle and an axle circle at one-third radius. The cable is tangent to the pulley and connects to the top plate with a short vertical connector line; a separate selector pin is drawn horizontally through the side of a plate, stopping at the center rod.

Reason: The ratio is calculated directly from the stated heights. Equal plates and gaps keep the stack regular, and the tangent cable follows the pulley convention.

Check: Divide the frame height by the stack height; the result should be about three. Measure plate widths and gaps for equality, and confirm the cable touches the pulley outer circle.

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Source rubric / reflection

- [ ] Frame tubes have parallel edges and consistent width on both sides of every joint.
- [ ] Each joint has one center mark and tube edges connect cleanly to the joint circle.
- [ ] Pulley has an outer circle and an axle circle at about one-third radius.
- [ ] Cable lines are tangent to the pulley and include a short wrap arc at direction changes.
- [ ] Weight plates are equal rounded rectangles with consistent gaps and aligned center holes.
- [ ] Connector is a short vertical line joining the cable to the top plate; selector pin is a short horizontal line entering the side of a plate and stopping at the center rod.
- [ ] Labels use a consistent baseline-to-midline x-height and do not overlap frame lines.
- [ ] Frame-to-stack height ratio is checked and recorded as about three to one, with hypothetical values labeled as examples.

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