

Part 11 Teacher Answer Key

Encoder distance plus IMU heading for an accurate L path

Guided video answers

PROMPT	EXPECTED RESPONSE / EVIDENCE
0:10 route	Drive 36 inches at heading 0, turn clockwise/right to -90, drive 24 inches holding -90, then stop.
0:21 distance	Motor encoders estimate wheel rotation and distance.
0:32 direction	IMU yaw measures robot heading.
0:43 two arguments	Distance sets travel; heading supplies feedback to correct drift while traveling.
0:54 leg 1	Hold heading 0 degrees.
1:05 absolute target	-90 is a measured heading target, not an unmeasured amount of turn time.
1:16 leg 2	Hold heading -90 degrees.
1:28 equal power	No. Motor, wheel, load, floor, and traction differences can curve the robot.
1:40 correction	Calculate target - current yaw and apply opposite signed adjustments to left and right powers.
1:49 telemetry	Target/actual encoder positions, target/current yaw, heading error, correction, elapsed time, and exit reason.
1:57 course entry	Only after STOP is pressed, DISABLED is visibly confirmed, and the safety captain authorizes entry.

Strong exit response

Encoders report wheel rotation, not the chassis's exact direction. Unequal motors or traction can produce the correct counts while the robot curves. The IMU supplies heading error during each straight leg; the program adds correction to one side and subtracts it from the other so the chassis returns toward the target heading.

Technical checks

- Top-level route order must be 36 at 0, turn to -90, 24 at -90, then explicit stop.
- RUN_TO_POSITION establishes encoder targets; heading hold modifies left/right commands without discarding the distance target.
- Normalize heading error to -180 through +180.
- Cap heading correction and give every segment a timeout.
- Telemetry should distinguish completion, timeout, STOP, and teacher-called abort.

Part 11 Safety and Assessment

Evaluate planning, feedback, evidence, and approach discipline

POWERING ON SAFETY GATE
1. Confirm the Driver Station shows DISABLED . Place and square the robot before the test.
2. Remove hands, tools, cables, tape measures, and loose objects.
3. Check the full route or turn sweep, side boundaries, and stopping buffer.
4. Call POWERING ON! loudly, then pause while everyone steps behind the boundary.
5. Visually confirm that no one is holding, touching, or reaching toward the robot.
6. Only then authorize INIT and START. Keep the operator ready to press STOP.
7. After the run, press STOP and visibly confirm DISABLED before anyone approaches.

Performance rubric

SKILL	MEETS EXPECTATION	RETEACH IF...
Route model	States all distances/headings and draws the full sweep and buffers.	Plans only the centerline and ignores chassis width.
Sensor roles	Encoders = travel estimate; IMU = heading; tape = external evidence.	Claims any one sensor proves every part of the route.
Correction	Uses signed heading error to adjust sides oppositely.	Adds the same correction to both sides.
Abort	Stops on intrusion, wrong motion, loose part, missing telemetry, oscillation, stall, or timeout.	Waits for a dangerous or obviously failed motion to finish.
Measurement	Records failed runs and enters only after DISABLED confirmation.	Deletes failures or measures while enabled.

Likely diagnoses

- Both legs consistently long/short: isolate straight distance calibration before blaming the corner.
- Final position displaced sideways with correct distances: inspect turn heading and straight-leg heading hold.
- Wide trial spread: check start placement, battery/state, loose hardware, floor, traction, and timeouts before tuning constants.