

Part 10 Teacher Answer Key

Built-in IMU orientation, yaw feedback, and a controlled right turn

Guided video answers

PROMPT	EXPECTED RESPONSE / EVIDENCE
0:10 IMU vs encoders	The IMU reports robot orientation/heading; encoders primarily estimate wheel rotation and travel.
0:20 sensor location	The universal IMU is built into the REV Control Hub used here.
0:31 FRONT	The team defines a consistent robot front and uses it for code, setup, and field measurements.
0:43 rigid mount	The sensor must rotate with the chassis; a loose Hub makes yaw unrelated to the robot body.
0:55 installation directions	REV logo facing direction and USB port facing direction.
1:05 still at initialization	Motion or tilt can corrupt the starting reference and make results unreliable.
1:15 resetYaw()	Makes the robot's current aligned heading zero degrees.
1:25 right-turn sign	For the verified orientation in the sample, clockwise/right is negative yaw.
1:37 error	$-90 - (-70) = -20$ degrees, so continue clockwise.
1:47 proportional slowing	Smaller power near the target reduces overshoot and helps the robot settle.
1:56 tolerance	Real sensors and motion vary; an acceptable band is more reliable than waiting for exact equality.

Practice table

TARGET	CURRENT	ERROR	ACTION
-90	0	-90	Clockwise/right
-90	-70	-20	Continue clockwise
-90	-89	-1	Stop: within +/-2 degrees
-90	-95	+5	Correct counterclockwise

Strong exit response

The program compares the **target** with the **current** yaw to calculate signed **error**. The error sign selects turn direction and its magnitude scales power. When absolute error is inside the **tolerance**, it stops. A **timeout**, STOP request, and explicit final zero-power command can also end motion.

Technical checks

- Use the SDK universal IMU API with RevHubOrientationOnRobot, not the legacy BNO055 initialization pattern.
- Verify the actual logo/USB orientation on the physical robot before selecting enum values.
- Normalize angular error to -180 through +180 so the controller chooses the shortest signed correction.
- Sample constants: target -90, gain 0.015, max power 0.35, minimum useful power 0.12, tolerance 2 degrees, timeout 4 seconds.
- Accept measured variation. Diagnose sign/orientation errors before increasing gain.

Part 10 Safety and Assessment

What the teacher should observe during the practical

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...
Orientation	Names robot front, logo direction, and USB direction; code matches installation.	Uses camera view or field side as front without a team convention.
Yaw	Explains zero, negative right turn, and signed error after physical sign check.	Memorizes -90 without verifying orientation/sign.
Feedback	Connects error magnitude to turn power and tolerance to completion.	Treats the command as timed open-loop motion.
Safety	Runs call-and-clear and waits for visible DISABLED before approach.	Touches the robot during or immediately after motion.
Evidence	Records target, current, final error, and exit reason.	Calls the test successful only because it looked close.