Name: ______________________________
Period: ______________________________

UNIT: AUTONOMOUS VEHICLE

ACT-BASED MATH: MAPPING AND NAVIGATION PLANNING

Here are ACT-aligned math activities for the **Robotic Car Kit** that help students apply real-world skills in measurement, speed and distance calculations, ratio and proportion adjustments, and data interpretation related to sensor readings, motion paths, and acceleration tracking.

OBJECTIVE:

Students will plot an efficient navigation path for the robotic car.

MATERIALS NEEDED:

- Grid paper
- Robotic car
- Compass
- Measuring tape

STUDENT DIRECTIONS:

Goal:
To develop students' understanding of spatial reasoning, geometry, and coordinate planning by designing, calculating, and testing optimal paths for a robotic car across a grid-based map. This activity supports ACT Math skills such as geometry, measurement, and strategic problem-solving.

Step 1: Design a Map for the Robotic Car

- On your **grid paper**, sketch a simple map or path using labeled **Points A, B, C, D**, etc.
- The grid should have equal squares (e.g., 1 square = 1 meter or 0.5 meters).
- Include **obstacles or restricted zones** the robotic car must avoid.
- Define a **start point and an end point**, and draw at least **two possible paths** the robotic car can take.

Pro Tip: Use color-coded lines to represent alternate paths (e.g., red = direct, blue = turn-based route).

Step 2: Calculate the Shortest or Most Efficient Path

- Using a **ruler and your scale**, measure the total distance of each possible path.
- Use the **Pythagorean Theorem** if needed to calculate diagonal distances.
- Calculate turning angles with a **protractor** (e.g., 90°, 45°, or custom angles).
- Determine which path is **shortest or has the fewest movements**.

Example:

Path	Distance (m)	Turns	Notes
A → B → C	5.0	2	Right angle turns
A → D	5.0	0	Straight line
A → E → F	5.5	1	Diagonal path

MATH STRATEGY TIP:
If two paths have equal distance, choose the one with **fewer or easier turns** to minimize error in programming.

Step 3: Program the Robotic Car and Test It

- Use basic commands to program your robotic car to follow your chosen path (e.g., move forward 2m, turn right, move forward 3m).
- **Run the car** through the course. Use a **stopwatch** if comparing how long each path takes.
- Observe and record whether the car **successfully follows the planned path** or needs adjustments.

Reflection Questions:

- Did the robotic car follow your planned path accurately?
- Were the angles and distances correct?
- How would you improve your path next time?

ACT-STYLE QUESTION:

- If the robotic car must travel from Point A to Point B (5 meters apart) using two turns, what is the optimal set of moves?

    A. Move forward 5m
    B. Move forward 3m, turn right, move forward 2m
    C. Move forward 2.5m, turn 45 degrees, move forward 2.5m
    D. Move forward 2m, turn left, move forward 3m

⚡ Why These Activities and Questions Matter

By engaging in math-based activities connected to the **Robotic Car Kit**, students:

✅ Apply math concepts to real-world systems such as speed, distance, time calculations, and sensor-based adjustments.
✅ Build skills in ratio reasoning, unit conversions, interpreting graphs, and analyzing data from robotic movements.
✅ Use formulas to calculate acceleration, predict travel times, and optimize navigation paths in different driving conditions.

These hands-on, math-rich tasks mirror the ACT Math emphasis on practical problem-solving and quantitative reasoning—preparing students for test success and real-world applications in STEM careers.