**Car-Bot Driving Test**

**Goals**
1. Students will investigate the relationship between distance, rate, and time.
2. Students will apply this relationship to a real-life driving scenario.

**Objectives**
1. Students will learn the commands of the robot by completing an instructive worksheet.
2. Students will run trials with the robot to determine equations representing the relationship between distance traveled and time, and degrees rotated and time.
3. Students will use the equations they found to program their robots to run a driving course.

**Previous Knowledge**
1. Students have used graphing calculators to create regressions using the STAT function.
2. Students have basic understanding of linear functions.
3. Students have been introduced to the D=RT relationship.

**Materials**
1. TI-Robot
2. TI-84 + Silver Edition or TI-83 calculator for the robot
3. TI-84 + Silver Edition or TI-83 calculator creating regressions
4. Tape for driving course
5. Large protractor for “Trial” worksheet
6. Small protractor for measuring course
7. Tape measures or yardsticks
8. “Driving Your Car-bot” worksheet
9. “Trial” worksheet
10. “Driving Test” worksheet

**Motivation**
1. Pass out the “Driving Test” worksheet and explain the scenario.
2. Instruct students that they will have to do some research and experimenting in order to pass their car-bot driving test.
3. They will be using their knowledge of linear functions in order to program their car-bots to run the driving course.

**Procedure**
1. Use website: http://classtools.net/main_area/fruit_machine.htm to choose partners for the activity.
2. Pass out worksheet materials for each student.
3. Read the first worksheet, “Driving Your Car-bot” as a class. Instruct groups to answer the four questions, A-D. Then review them as a class.
4. Hand out one robot with accompanying calculator to each group.
5. Instruct them to begin the second “Trial” worksheet to determine the formulas for your driving test.
6. Circulate the room to assess and assist students while they’re completing the worksheet.
7. Call the class together once students have completed the worksheet to review the answers and process involved in determining equations.
8. Review the “Driving Test” scenario and instruct students to begin coding their car-bot to run the course.
9. While students are working, stand near the driving course to mark students’ attempt check sheet.
10. Once all groups are ready for their final test, call the class together to watch each group’s test run.
11. Students that finish early and are waiting can work on the extension worksheet.

**Conclusion**
1. After students have completed the driving test, discuss the activity and how it relates to linear functions.
2. Summarize the activities of the lesson:
   i. Learned the commands of the robot.
   ii. Collected data to create functions that represent how each robot turns and moves.
   iii. Measure the course and apply functions to program robots to drive the course.
2. Consider the following questions:
   i. What does your slope represent in the equation relating distance traveled and time? (speed)
   ii. What does your slope represent in the equation relating degrees rotated and time? (degrees per second)
   iii. In our regressions, the many calculators gave us a y-intercept. Why did we eliminate the y-intercept in our equations?
   iv. When collecting data we told our robots to move both wheels. When driving the course, we could have told the robot to only move one wheel and keep the other still. Would this have affected the ability to run the course? How?
3. Use the extension worksheet as a conclusion for the activity as well.

**Extension**
1. Instruct students that have finished early and are waiting for the final car-bot test to begin work on the extension worksheet.
2. The extension worksheet can be used as homework.

**Assessment**
1. Students understanding of how to use the robots can be assessed by answering the questions on the first worksheet “Driving Your Car-bot”
2. Students ability to perform linear regressions and apply linear functions to real-world applications (DRT) can be assessed by their answers to the “Trial” worksheet.
3. The driving tests can be used as a final gauge of student understanding of linear functions and their applications.
4. The extension worksheet will be an indicator of students’ conceptual understanding of linear functions and how they relate to other real world application.
Standards
ISBE Content Goals
10.B.3 – Formulate questions (e.g. relationships between car age, and mileage, average incomes and years of schooling), devise and conduct experiments or simulations, gather data, draw conclusions and communicate results to an audience using traditional methods and contemporary technologies.
8.B.3 – Use graphing technology and algebraic methods to analyze and predict linear relationships and make generalizations form linear patterns.
7.B.4 – Estimate and measure the magnitude and directions of physical quantities (e.g. velocity, force, slope) using rulers, protractors and other scientific instruments including timers, calculators and computers.

NCTM Content
Algebra – Students use the algebraic concept of linear functions to program code for the robots.
Geometry – Students use the geometric concepts angle and distance measurements to understand the course the robot must be programmed to run.
Measurement – Students must physically measure the motion of the robots and the driving course using a protractor and tape measure to collect the data necessary to program the robot.

NCTM Process
Problem Solving – Students are led through a problem solving process when completing steps and answering questions to achieve the goal of programming their robot to complete the driving course.
Communication – Students must communicate their thinking in groups when completing worksheets, measuring robot motion and driving course, and programming the robot.
Connections – Students connect the concept of linear functions to model the motion of the robot (application of distance = rate * time).