Algebra Applications

Calculating Speed

Knowing how to calculate the speed of your BattleBot is important for many reasons. The kinetic energy of your bot is a function of the robots speed. Moreover, a robot can be too fast with respect to the drive train gearing and/or the operators ability to accurately control the bot.

This activity will demonstrate the usefulness of (algebraically) calculating an unknown. We will use a familiar formula that describes a particular relationship between distance, rate and the time of an object moving at an average speed. The formula,

Distance = Rate x Time

will be used in this activity. The formula can be re-written as:

Rate = Distance/Time

Follow these steps to calculate the average speed of a student.
1. Using a measuring tape, measure a straight, runway length, of 40 feet. The distance of 40 feet is approximately the working distance of the Battlebox. Be careful to include at least 30 feet of deceleration distance beyond the length of the runway.
2. Allow two students, using stop watches, to record the time it takes student volunteers to run/jog/walk the 40'.
3. Convert the 40' foot runway length into meters (1 foot = 0.3048m) Note: There are many useful conversion calculators on the internet. Find them and use them, they are very helpful.
4. Record the data in the table below. Use this data and the formula given to calculate the rate or speed of each student.

Student	Distance	Time	Rate
1.			
2.			
3.			
4.			

From this activity you can find the average velocity a student can run/jog/walk. Using basic algebraic techniques, you can manipulate the formula in order to solve for any of the three variables: Time, Distance, Rate.

Example: Solve for Distance or Time

$$\textbf{Rate = Distance/Time}$$

Rate * Time = (Distance/Time)*Time   (Multiply by Time)
Rate * Time = Distance   (Formula solving for Distance)

$$\textbf{Distance = Rate x Time}$$

$$\textbf{Rate = Distance/Time}$$

Rate * Time = (Distance/Time)*Time   (Multiply by Time)
(Rate * Time)/Rate = Distance/Rate   (Divide by Rate)
Time = Distance/Rate   (Formula solving for Time)

$$\textbf{Time = Distance/Rate}$$

Useful Design Exercise

The average speed of many BattleBots is within an order of magnitude of the speed of people. This exercise can provide participants with a "Feel" for the speeds and accelerations associated with BattleBots, and how various speeds can enhance or inhibit performance within the BattleBox.

An interesting and helpful robot design exercise might be to "Block off" the dimensions of the BattleBox and the various hazards and have "Human" Robots guided by audible commands from their drivers move about the box and avoid the hazards. Use your imagination and make this exercise meaningful. At least your research will yield a working map of the BattleBox, and this is helpful robot design data for hard thinking BattleBot builders.