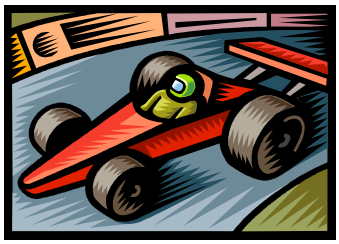

On Your Mark, Get Set, GO!!!!
Racing through FUNctions

Adapted from: TEXTEAMS Rethinking Middle School Mathematics: Algebraic Reasoning

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(With special thanks to Shannon Hernandez, from FWISD for her cars!!)

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Facilitator Notes:

Concept: Collect distance data using a motion detector and find a trend line for the data.

Overview: Participants will use data collection devices with motion detectors to collect distance data for small hand-held vehicles that travel at a constant rate. They will obtain scatter plots of the vehicle's distance from the motion detector over elapsed time while traveling away and toward the motion detector and sitting still. Using this data, participants will find trend lines that describe the vehicle's distance from the motion detector in relation to time.

TEKS focus: 8.4, 8.5A, 8.12B
A.1A-E, A.2B-D, A.3A-B, A.5C, A.6A-G

Materials: Hand held vehicles (1 per group), CBRs, calculators, large sheets of graph paper, markers, meter sticks, (optional: aluminum foil and masking tape – for a better target if necessary)

To begin – throw out an overarching question such as…
In your lifetime, when will a motion detector be important for you?

(Students might have a hard time with this, so I always say, "Ma'am, can you step out of the car please? Do you know how fast you were going?" In my most obnoxious tone ☺ This usually draws a discussion on speeding tickets which leads into our activity today. Other applications that might come up are pitchers in baseball clock their throws; Walk the graph activity they might have done previously)

How do motion detectors work for DPS? How might we reinact something similar here in our classroom?

Complete Worksheet #1

Notes: The aluminum foil is used to create a bigger target. You can omit the foil if the vehicle is large enough. Do not collect data until the vehicle is up to speed. We want a linear scatter plot – so the rate must be constant. Be sure to ask the students "Did this vehicle travel at a constant rate? How can you tell?" (To get them to focus on the linearity!!)

- The cars we are using have been tested and give a relatively linear pattern – if that is not the case, have them repeat the sample. If it continually speeds up, and the pattern is NOT linear, use it as a teachable moment – asking questions such as "Why does it look like this?" "What is happening to your car that is not happening in the other instances?""What would have to change to make it look more like a line?"

Motion detectors have a range of detection. Do not try to collect data out of that range.

As this activity is geared toward the middle grades, words like "starting point" and "car's rate" are used instead of "y-intercept" and "slope." The more formal vocabulary should be included when doing this activity with Algebra students (per their TEKS).

Have students share their strategies on how they arrived at their rule. Ask "Will everyone's rule in this class be the same? Why?" Ah! Cheating is useless ☺!!

Another calculator application that you might opt to use in the higher grades on this activity is a linear regression. You could include it by having them do a linear regression and then ask questions such as "Is the regression line and your trend line the same?" "Explain the differences." "Which one is better? Why?"

Complete Worksheet #2

Notes: You may want to ask them "Where did the police car start?" so they make the connection to the y-intercept to help them determine their rule.

You might also ask them "Where was your car at 3 seconds when the police car met you?" to help them figure out how far they had to go in 3 seconds – which will lead them to the rate.

Have the students share their methods for finding the rule. "Did the police car have to travel faster or slower than your car?" "How is this shown on the graph?" "How is this shown in your rule?"

Complete Worksheet #3

Take polls as to who will win (polls, NOT bets ☺) – depending on how many are racing, you may have to do some heats and a final race to find the winner!

Extensions

1. This activity only discussed when the car was going AWAY from the motion detector. Start the car about 15 feet from the motion detector traveling toward the motion detector. (The aluminum should now be at the front of the car).
    - Write a rule to describe the car's distance from the motion detector in relation to elapsed time.
    - What changed in the rule? Why did it change?

2. Heading away from the motion detector is a positive slope. Returning to the motion detector is a negative slope. You can also show a zero slope by sitting the car about 5 feet from the motion detector and let it sit still for 3 seconds. This will result in a horizontal line.
    - Write a rule to describe the car's distance from the motion detector in relation to elapsed time.
    - What changed in the rule? Why did it change?
    - Can we graph a vertical line on our calculators? What would the car have to do if it is possible?

3. Repeat the activity collecting distance data in meters instead of feet. Compare rates in meters per second vs. feet per second.

4. Instead of cars, have a person walk or crawl away and toward the motion detector at a constant rate. Find trend lines to fit the scatterplot of the walk.

Assessment Connections:

1. Transfer the data for a scatter plot of an unknown vehicle's data that you have prepared in advance to participants' calculators. Have them find a trend line. Ask them to discuss the distance of the vehicle from the motion detector and how it relates to the trend line.

2. Algebra Assessments (http://www.tenet.edu/teks/math/clarifying/algebra1/)
    - The 600 Meter Race
    - Motion Detector Problem
    - Speeding Cars

    **These activities will have to be modified for 8th grade classrooms due to vocabulary.

FYI: Middle School Assessments (http://www.tenet.edu/teks/math/clarifying/msassessments/)

**Assessment books are also available to purchase in hard copy form at http://utdirect.utexas.edu/txshop/list.WBX?component=0&application_name=MHDANACT