The Fast and the Curious

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Alison Espinosa, EdD Alison.Espinosa@slcschools.org
Andy Glaze, PhD Andrew.Glaze@slcschools.org

Shared resources folder:

Knowles Academy:

Entry Document:

Team,
In the upcoming weeks we are going to compete in a car race. I'll provide the battery-operated cars. You may be worried that I'm setting you up to lose. I might give you an exceptionally slow car and pool my personal resources to secure the fastest car for myself. To make this race fair, I'm changing the rules a bit. Rather than trying to beat my car across the finish line, your goal will be to tie my car. That is, **you want your car to cross the finish line at the same time as mine.** This means you will be competing against me, but not each other.

Even with this new rule, I'm a bit nervous that I'm going to beat all of you. To give you the best fighting chance in this race, your team must demonstrate that your car placement will result in a tie by preparing the following information:

- Your car's velocity
- A graphic representation of your car's position versus time
- An equation that models your car's position as a function of time.
- Your car's placement, in relation to the finish line, when we begin our race
- A name for your car.

Once I am satisfied that you have accurately determined the information listed above, each team will have two chances to tie my car. Throughout this unit you will document and save your work in your team portfolio. A more formal summary of the items and important assignments that you must include in your portfolio is forthcoming.

Good luck,

Dr. Espinosa

Thought catcher space:

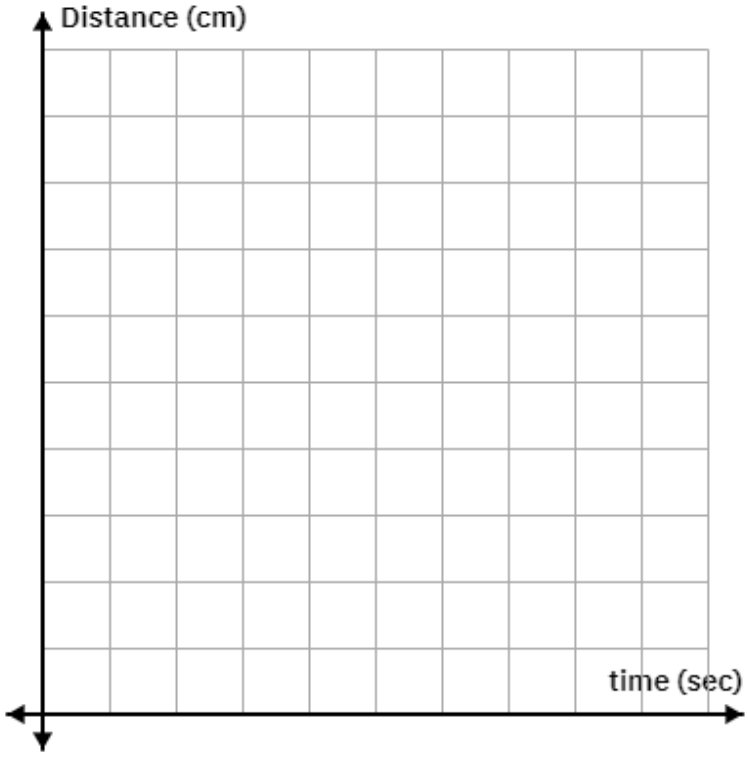
Know	Need to Know	Next Steps

Pace Car Data Collection: Benchmark Activity #1

(italicized text denotes items that we likely won't get to today)

The pace car data is provided in the table below. Represent it graphically on the axes to the right.

Time traveling (seconds)	Distance from origin line (cm)
2	48.5
4	86.9
6	131.7
8	172.6
10	211.2



Pace Car Questions:

1. Approximately how fast is the pace car traveling? Alternatively, what is the pace car's velocity?

2. Explain how you can use the table or graph to determine the pace car's velocity.

3. *Does the pace car speed up or slow down? Explain how you know.*

4. *Create an equation that models the distance the pace car is from the origin line, as a function of time.*

5. *How far will the pace car travel in 20 seconds?*

6. *How long will it take the pace car to travel five meters?*

Name: _____ Date: _____ Period: _____

Other team members: _____ Group letter : _____

Team Task: Benchmark Activity #2 *(italicized text denotes items that we likely won't get to today)*

Goal – Today we will learn about our team cars by:

- Measuring length and collecting data.
- Connecting representations of data in tables, graphs, and equations.
- Analyzing and discussing patterns represented in tables, graphs, and equations

Materials – Every team should have:

- A tape measure
- Dune buggy (your car!)
- A stopwatch (today we will use your phone)
- At least 6 pieces of masking tape (about 1" each)

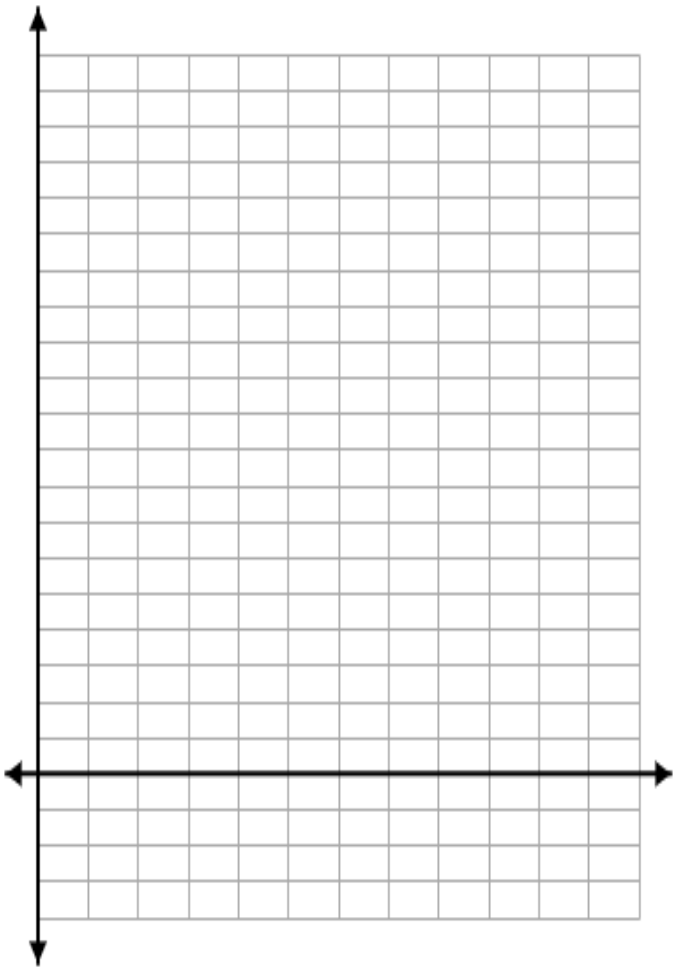
Procedure:

1. Find a clear 2-meter area and mark the origin line on the floor with a piece of masking tape. Label the origin line.
2. Decide whether you will place tape on the floor in 1 or 2 second increments. Fill in the time column (below) based on your decision. All team members should do this on their paper.
3. **Follow the directions on the blue slip of paper** to determine where to start your car in relation to the origin line and the direction that it should travel. Place a piece of tape on the ground at the starting point and label it. Note that your blue slip of paper indicates your group letter. Write your letter on the top of this page. All group members should do this.
4. The **car wrangler** should hold the car in the air above the start line and turn the car on. The front tires of the car should be hovering over the start line. DO NOT hold the car in place on the floor while it is turned on.
5. The **timer** should count down to when they start the stopwatch so that the wrangler releases the car when the stopwatch begins. The timer should count out loud in the agreed upon time increment.
6. The **taper(s)** should place a piece of tape beside the front tire of the car when indicated by the timer. Mark at least five locations.
7. Once at least five locations have been taped, the **car wrangler** should measure in centimeters the distance of each piece of tape from the ORIGIN LINE (not the start line).
8. The **recorder** should record these measurements in the trial #1 column of the table below.
9. *Complete steps 4-7 again, but this time the **recorder** should record these measurements in the trial #2 column.*
10. *All team members should average the distances from trial #1 and trial #2 and record the average distance on their own paper.*

	Trial #1	***Trial #2***	***Average***
Time (in seconds)	**Distance from Origin (cm)**	***Distance from Origin (cm)***	***Distance from origin (cm)***

To graph:

1. *Label each axis. We want the independent variable on the horizontal axis, and the dependent variable on the vertical axis. One axis should show time, and the other axis should show average distance. Remember, the independent variable is the one over which you had direct control. Include units in your label.*
2. *Mark the scale of the graph along both axes. Scale appropriately to use most of the graph space so that your points aren't bunched all together.*
3. *Plot the data. Give your graph a title.*
4. *Sketch the "line of best fit."*
5. *Answer the questions on the right.*



Questions:

1. *What is your car's (estimated) velocity?*

2. *Where does your best-fit line cross the vertical axis? Why do you think it crosses at this point?*

3. *When we have our race, will you need to put your car in front or behind the pace car? How do you know?*

4. *Create an equation that (roughly) models your line of best fit.*

Benchmark Activity #3:

5. When we race, I'm going to start my car **200 cm** from the finish line. Where should you start your car?

Teacher note: This calculation occurs in a 3rd activity where students analyze multiple representations of their car and the pace car during a race. During this activity we redefine the origin line as the pace car starting point. You could analyze the graphic representations to introduce systems

Procedure #3 Group A

Your car should start **20 cm** from the origin line and travel **away** from the origin line.

Procedure #3 Group B

Your car should start **10 cm** from the origin line and travel **away** from the origin line.

Procedure #3 Group C

Your car should start **180 cm** from the origin line and travel **toward** the origin line.

Procedure #3 Group D

Your car should start **240 cm** from the origin line and travel **toward** the origin line.

Procedure #3 Group E

Your car should start **70 cm** from the origin line and travel **away** from the origin line.

Procedure #3 Group F

Your car should start **55 cm** from the origin line and travel **away** from the origin line.

Procedure #3 Group G

Your car should start **225 cm** from the origin line and travel **toward** the origin line.