

Date: _____

Your Name: _____

Grade 11

Extended Response Task for Inquiry— Driver's Education

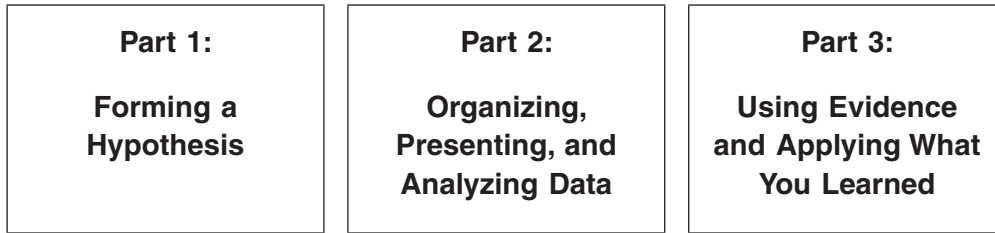
Session 3

Directions:

You will be completing an extended-response inquiry task called **Driver's Education**. Explain the reasons for all of your answers.

- Please write in complete sentences. You may include labeled drawings or diagrams and bulleted lists to help explain your answers.
- Try your best.
- Work individually.
- Do not disturb other students if you finish early.

There are three parts to this task.



Driver's Education

Josh is currently completing a driver's education class. His driving instructor notices that he has trouble stopping behind the white lines at intersections. The instructor strongly recommends that Josh review the information about stopping distances in the driver's education manual. The instructor also tells Josh he should take his driving test in a small car.

Josh isn't sure why his instructor told him to take his driving test in a small car. He is learning about moving vehicles in his physics class and decides to ask his teacher to help him understand safe stopping distances. His physics teacher is happy to help him understand the momentum, forces, acceleration, and mass involved in stopping distances.

Josh's physics teacher wants him to do some investigating on his own. She allows him to use English units of measure, because English units are used in his driver's education class. The teacher helps Josh formulate his investigation questions so he can better understand the relationships among mass, speed, and stopping distance.

Josh's investigation questions are as follows:

How does the mass of a moving vehicle affect its stopping distance?

How does the speed of a moving vehicle affect its stopping distance?

Part 1: Forming a Hypothesis

Josh identifies the following three variables to investigate:

- the mass of the vehicle being driven
- the speed at which the vehicle travels
- the stopping distance of the vehicle

- 11 a. In Josh's investigation, which variable is the dependent variable and which variables are the independent variables?
- b. Explain how the independent variables are different from the dependent variable.
- c. Why is it important to test each variable separately rather than at the same time? Explain your answer.
- 12 Form a hypothesis about the relationship between the mass of a vehicle and its stopping distance. Explain your thinking.

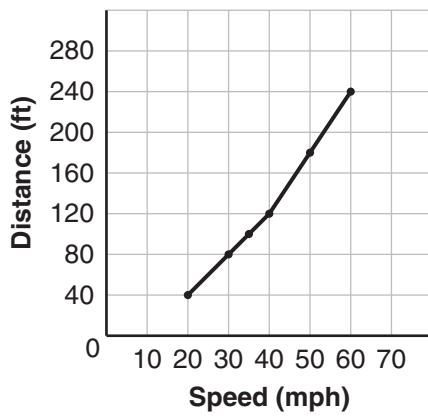
Part 2: Organizing, Presenting, and Analyzing Data

Josh practices his stopping distances at different speeds in a small car. His older brother records the data in the table shown below.

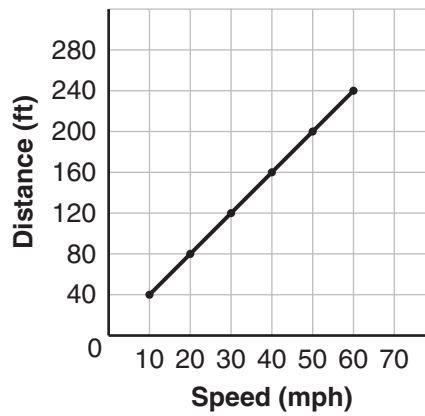
Table 1: Josh's Small Car Data

Trial	Vehicle Speed (mph)	Average Stopping Distance after Multiple Trials (ft)
A	20	40
B	30	75
C	35	95
D	40	120
E	50	175
F	60	240

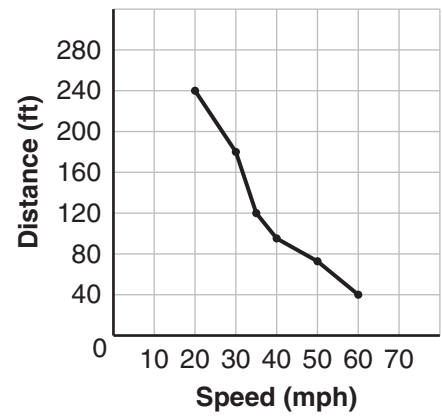
13 Which graph **best** represents Josh's stopping distance data in Table 1? Explain your answer.



Graph A



Graph B



Graph C

Josh and his friend Sam have the same kind of vehicle. Sam claims that he can stop his vehicle within 150 ft when traveling at a speed of 55 mph.

- 14 a. Use the data in Table 1 to determine Sam’s actual stopping distance at 55 mph. Do the data support Sam’s claim?

- b. Use the relationship between speed and stopping distance to explain your answer.

Josh passes his driver’s test and borrows his parent’s SUV (large vehicle). He observes that the stopping distances he uses in his small car do not stop the SUV in time. For safety purposes, Josh researches stopping distances for SUVs and small cars to better understand the differences.

Table 2: Stopping Distances of Small Cars and SUVs

Speed (mph)	Stopping Distances (ft)	
	Small Car (1,230 kg)	SUV (2,223 kg)
20	40	70
30	75	105
35	95	125
40	120	155
50	175	210
60	240	280

- 15 Based on the stopping distance data for small cars and SUVs provided in Table 2, construct an appropriate graph with all the required elements to show a comparison of the two.

- 16 Determine whether the data in Table 2 **support** or **refute** your hypothesis from question 12. Use evidence to explain how your hypothesis compares with these data.

Part 3: Using Evidence and Applying What You Learned

After he gets his driver's license, Josh drives his parent's SUV on a local road. A traffic light turns red, and he applies the brakes so he will stop before the intersection. However, the car takes longer than he expects to stop, and he ends up in the middle of the intersection. Fortunately, Josh's car is the only vehicle on the road; the light turns green, and he starts driving again.

- 17 Josh wants to find out why the SUV took longer than expected to stop at the intersection. The mass of the SUV did not change. Other factors Josh could test include the wet road surface, the rate of brake application, the inflation of the tires, and the incline of the road.
- Write a hypothesis that uses a factor other than mass to explain why the SUV took longer than expected to stop. Explain your reasoning.
 - Design an investigation car manufacturers might use to test the hypothesis you wrote in part (a). Explain your reasoning.