Stopping Distance Activity

Background: This activity involves observing the effect of original car speed upon the skid distance. The simulation involves a toy car rolling down a hill, hitting a box, and skidding to a stop. The height from which the car is released can be modified. The speed of the car at the bottom of the hill (prior to contact with the box) is reported. The distance that the car (and box) skid before stopping can be measured. Before answering the questions, it would be useful to first run the simulation for each of the provided heights and to record the corresponding pre-collision car speed and the stopping distance. The background grid on the simulation screen can be used to determine the stopping distance. Each square on the grid is 10 cm in length along its edge.

Data:

Initial Height (cm)	Pre-Collision Speed (m/s)	Skid Distance (cm)
10.0		
20.0		
30.0		
40.0		
50.0		
60.0		
70.0		
80.0		

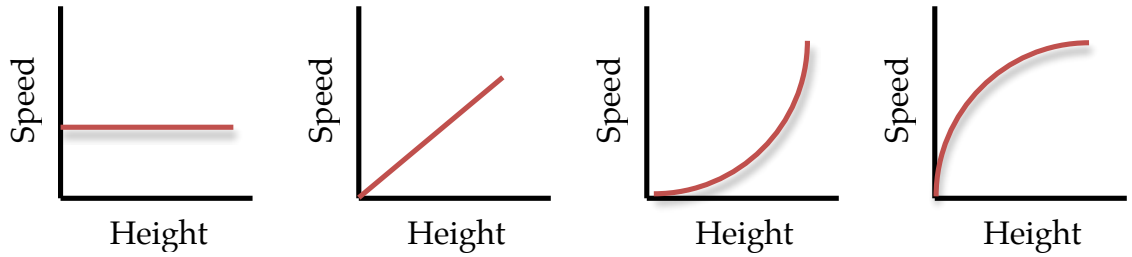
Use the collected data to answer the following questions.

Questions:

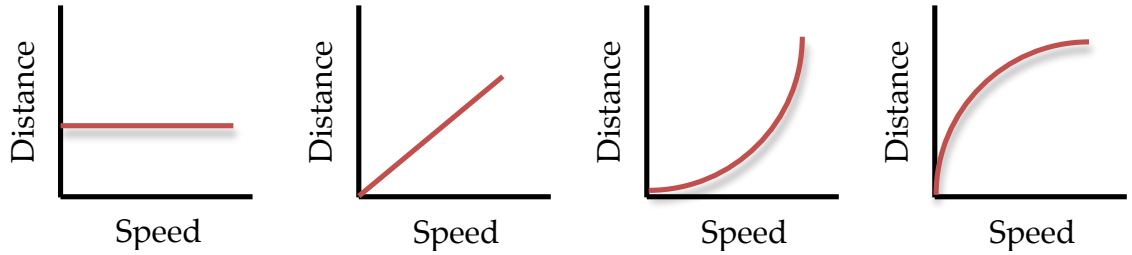
1. As the release height of the car increases, the speed of the car _____.
   a. increases
   b. decreases
   c. does not change

2. As the release height of the car increases, the skid distance of the car (and box) _____.
   a. increases
   b. decreases
   c. does not change

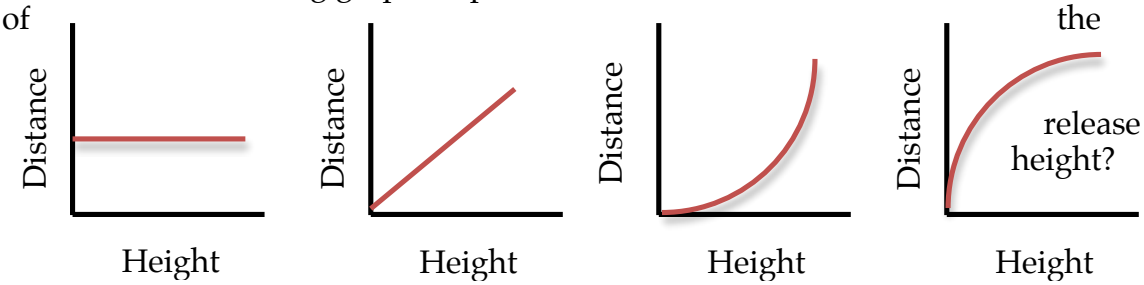
3. Which of the following graphs represents the speed of the car as a function of the release height?



4. Which of the following graphs represents the skid distance of the car as a function of the speed at the bottom of the hill?



5. Which of the following graphs represents the skid distance of the car as a function of the release height?



6. Which one of these statements describes the relationship between the initial release height and the speed at the bottom of the hill?
   a. As the release height doubles, the speed quadruples.
   b. As the release height doubles, the speed also doubles.
   c. As the release height doubles, the speed becomes one-half the value.
   d. As the release height doubles, the speed increases by less than a factor of 2.

7. Which one of these statements describes the relationship between the initial release height and the skid distance of the car?
   a. As the release height doubles, the distance quadruples.
   b. As the release height doubles, the distance also doubles.
   c. As the release height doubles, the distance becomes one-half the value.
   d. As the release height doubles, the distance increases by less than a factor of 2.

8. Which one of these statements describes the relationship between the speed of the car at the bottom of the hill and the skid distance of the car?
   a. As the speed doubles, the distance quadruples.
   b. As the speed doubles, the distance also doubles.
   c. As the speed doubles, the distance becomes one-half the value.
   d. As the speed doubles, the distance increases by less than a factor of 2.

9. If the car were released from a height of 35.0 cm, then one might predict the speed of the car at the bottom of the hill to be approximately _____.
   a. 2.15 m/s b. 2.28 m/s
   c. 2.37 m/s d. 2.70 m/s

10. If the car were released from a height of 100.0 cm, then one might predict the speed of the car at the bottom of the hill to be approximately _____.
    a. 3.65 m/s b. 3.83 m/s
    c. 5.42 m/s d. 12.1 m/s

11. If the car were released from a height of 52.5 cm, then one might predict that the car (and box) would skid a distance of approximately _____.
    a. 57 m b. 63 m
    c. 66 m d. 69 m

12. If the car were released from a height of 140.0 cm, then one might predict that the car (and box) would skid a distance of approximately _____.
    a. 144 m b. 168 m
    c. 180 m d. 192 m

13. Which two release heights would result in a 2:1 ratio in car speeds at the bottom of the hill?
    a. 10 cm and 15 cm b. 15 cm and 30 cm
    c. 15 cm and 45 cm d. 15 cm and 60 cm

14. Which two release heights would result in a 2:1 ratio in skid distance?
    a. 10 cm and 15 cm b. 15 cm and 30 cm
    c. 15 cm and 45 cm d. 15 cm and 60 cm

15. What release height would cause the car to skid two times further than it did when released from a height of 60.0 cm?
    a. 30.0 cm b. 90.0 cm
    c. 120.0 cm d. 240.0 cm