

Unit 1: Forces and Motion
Chapter 2: Mathematical Models

Vocabulary Terms

Scientific model
dependent variable
average speed
gravity

Physical models
independent variable
instantaneous speed
free fall

Conceptual models
position
acceleration

Graphical model
slope
deceleration

$$\text{Acceleration} = \frac{\text{final speed} - \text{beginning speed}}{\text{change in time}}$$

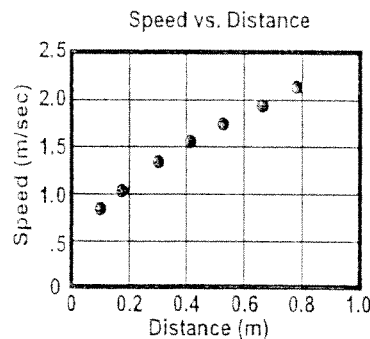
$$\text{final speed} = \text{beginning speed} + (\text{acceleration} \times \text{time})$$

$$\text{Change in time} = \frac{\text{final speed} - \text{beginning speed}}{\text{acceleration}}$$

1. A mathematical, physical, or conceptual description of how variables are related is often referred to as a _____.
2. The variable which is plotted on the x-axis of a graph is called the _____ variable.
3. The speed you have at a specific point in your journey is best called _____.
4. The ratio of a line's rise to its run is called the _____.
5. The distance an object traveled and the time it took to do so over a whole journey is _____.
6. An object that is changing its speed over time is said to be experiencing _____.
7. The force of attraction experienced between objects that have mass is called _____.
8. When constructing a graph, the x-axis is most closely related to:
 - a. the dependent variable.
 - b. the vertical axis.
 - c. the independent variable.
 - d. the slope.

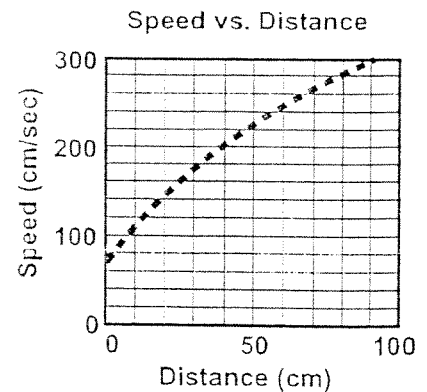
9. On this graph, the dependent variable is:

- a. distance.
- b. speed.
- c. acceleration.
- d. the slope of the speed vs. distance curve.



10. Use the graph to predict the speed of the car when the car is at 60 cm.

- a. 220 cm/sec
- b. 230 cm/sec
- c. 240 cm/sec
- d. 250 cm/sec

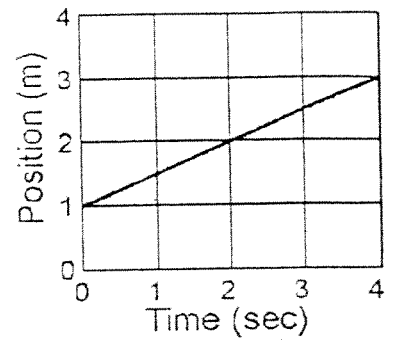


11. The slope of a distance vs. time graph is equal to:

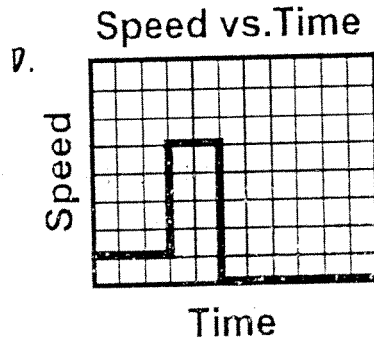
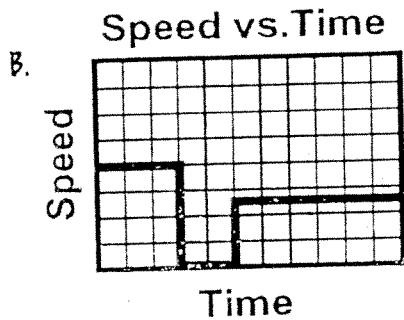
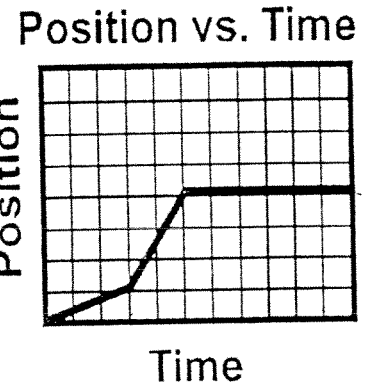
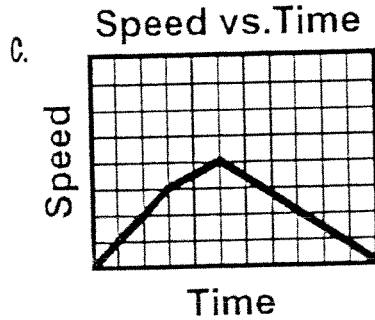
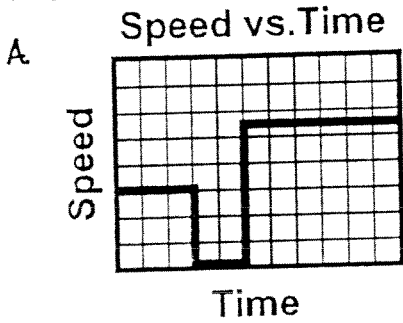
- a. distance.
- b. speed.
- c. acceleration.
- d. none of these.

12. Calculate the speed of the object from the position vs. time graph shown to the right.

- a. 0.5 m/sec
- b. 0.75 m/sec
- c. 2 m/sec
- d. 3 m/sec



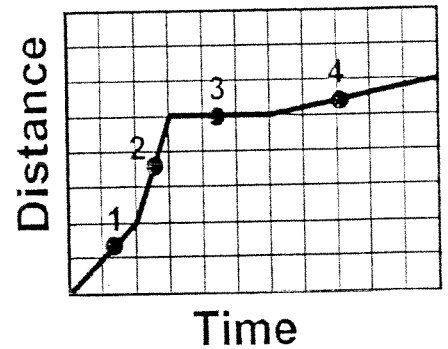
13. Match the position vs. time graph with the correct speed vs. time graph.



14. A bicycle rider would NOT be accelerating if her:
- a. direction and speed were unchanged.
 - b. direction changed and speed was constant.
 - c. speed increased and direction was unchanged.
 - d. speed decreased.

15. At which of the following points on the graph is the speed the greatest?

- a. Point 1
- b. Point 2
- c. Point 3
- d. Point 4



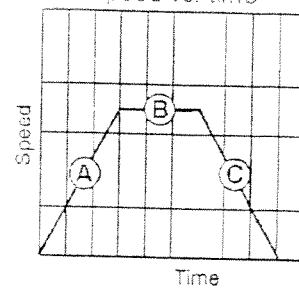
16. A rocket sled accelerates from 10 m/sec to 50 m/sec in 2 seconds. What is the acceleration of the sled?

- a. 10 m/sec²
- b. 25 m/sec²
- c. 40 m/sec²
- d. 20 m/sec²

Speed vs. time

17. In this speed vs. time graph, the object at point C:

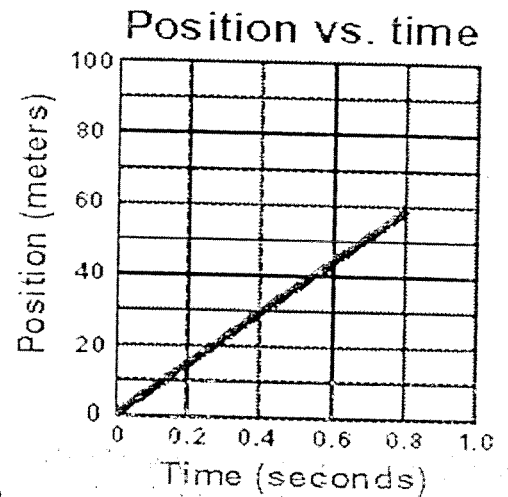
- a. has positive acceleration.
- b. has zero acceleration.
- c. has negative acceleration.
- d. is moving at constant speed.



18. A cart is rolling down a ramp. If the angle of the ramp is increased to make the ramp steeper, the cart will:

- a. accelerate slower.
- b. accelerate at the same rate.
- c. accelerate faster.
- d. move at a constant velocity.

19. A race car travels at a constant speed. Position and time data are recorded. A graph is prepared using the data. Use this graph to determine the speed of the race car. **SHOW WORK !!!**



Listed below are descriptions of the motion of several objects. If they are accelerating answer YES next to the description of the object. If they are not accelerating answer NO.

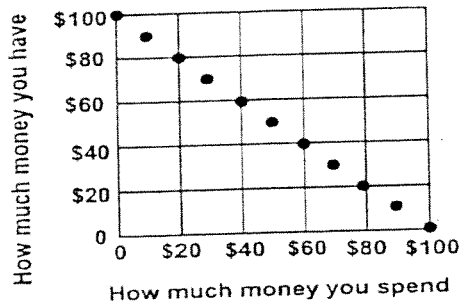
- 20. _____ A car traveling on a turnpike at a 60 mph with its cruise control engaged
- 21. _____ A motorcycle whose brakes have been applied
- 22. _____ A baseball dropped from the roof of a building
- 23. _____ A girl on a skateboard going around a corner at a speed of 3 m/sec
- 24. _____ A tractor-trailer parked in a rest area

25. A sports car can accelerate from 0 mph to 50 mph in 3 seconds. What is its acceleration? Make sure you have the correct final units.

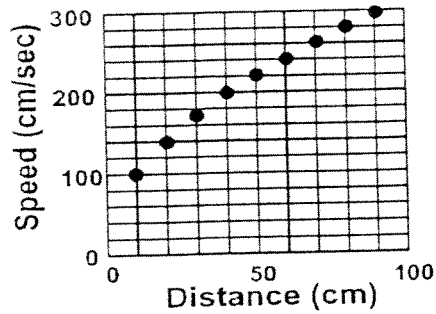
26. How long will it take a cheetah (23 miles / hour / second) to reach 50 mph?

Experiments are done to discover the relationship between variables. When results are graphed, the graph may indicate a strong, weak or inverse relationship or no relationship at all. Label each graph with the words strong, inverse, weak or none to indicate the type of relationship shown by the graph.

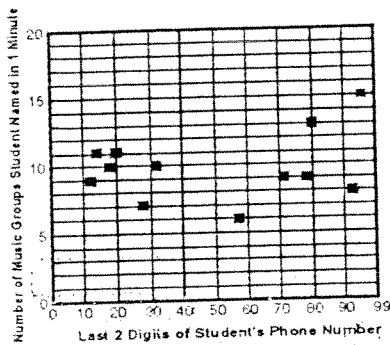
27.



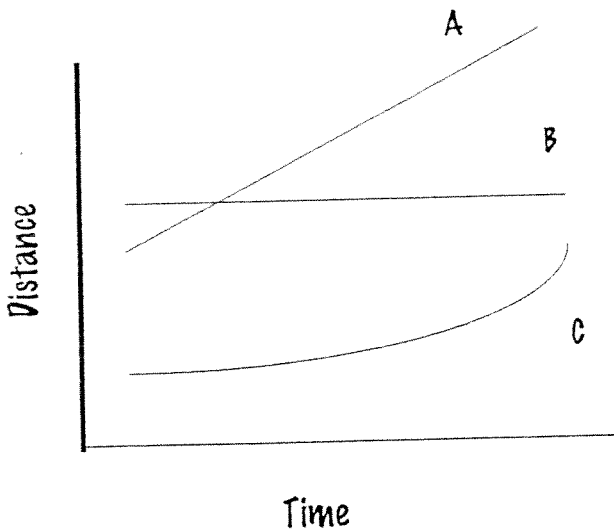
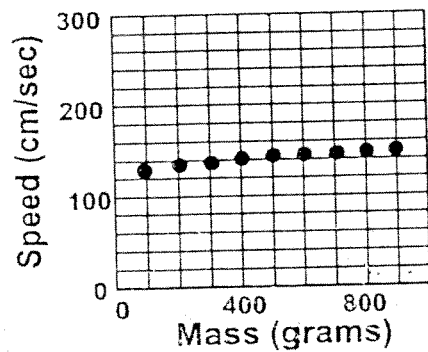
29.



28.



30.



31. Which line(s) represents an object that is moving?
32. Which line(s) represents an object that is accelerating?
33. Which line(s) represents an object with constant velocity?

Bonus

The greater the deceleration of an object, the greater the stopping force the object experienced. It is the stopping force that causes bruises, breaks bones or worse. Look at the formula for calculating acceleration. If an object goes from 130 mph to 0 mph in .01 seconds, the deceleration is large. What could we do to lessen the deceleration of this object? Design a system to do so.

34. To make a graph, five steps are routinely followed. List the five steps in logical order for preparing a proper graph.

1.

2.

3.

4.

5.

