P20 Unit 1 - Kinematics

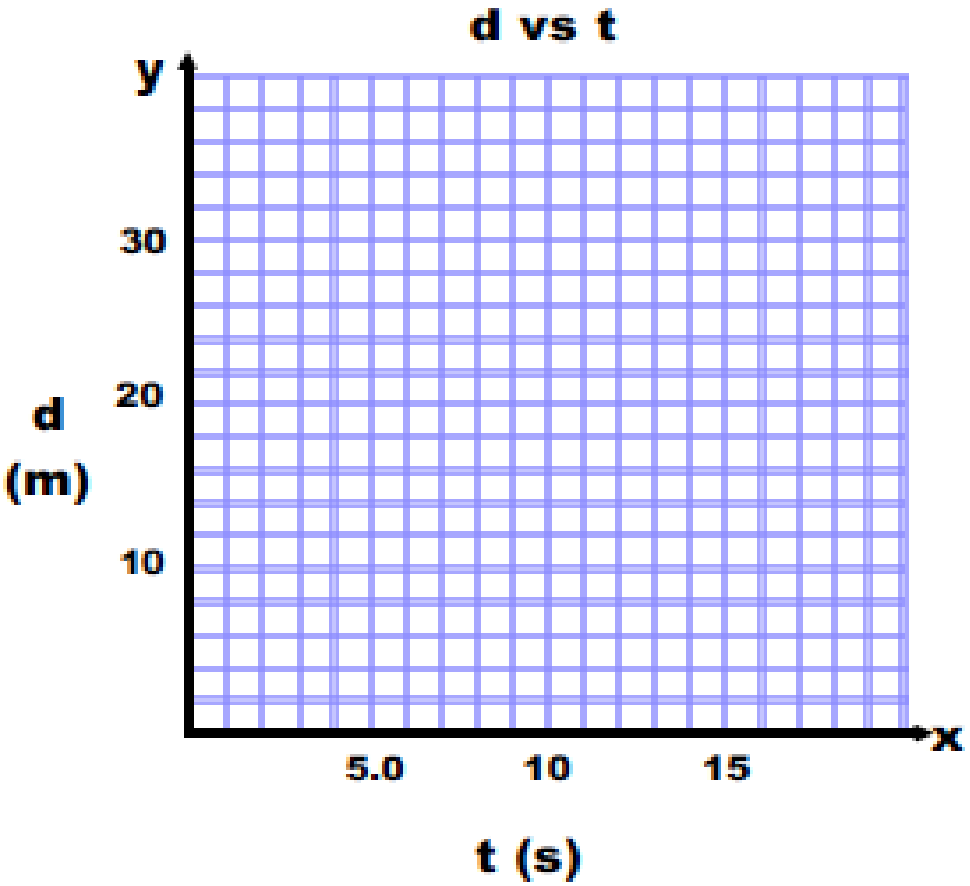
Graphing Uniform Motion

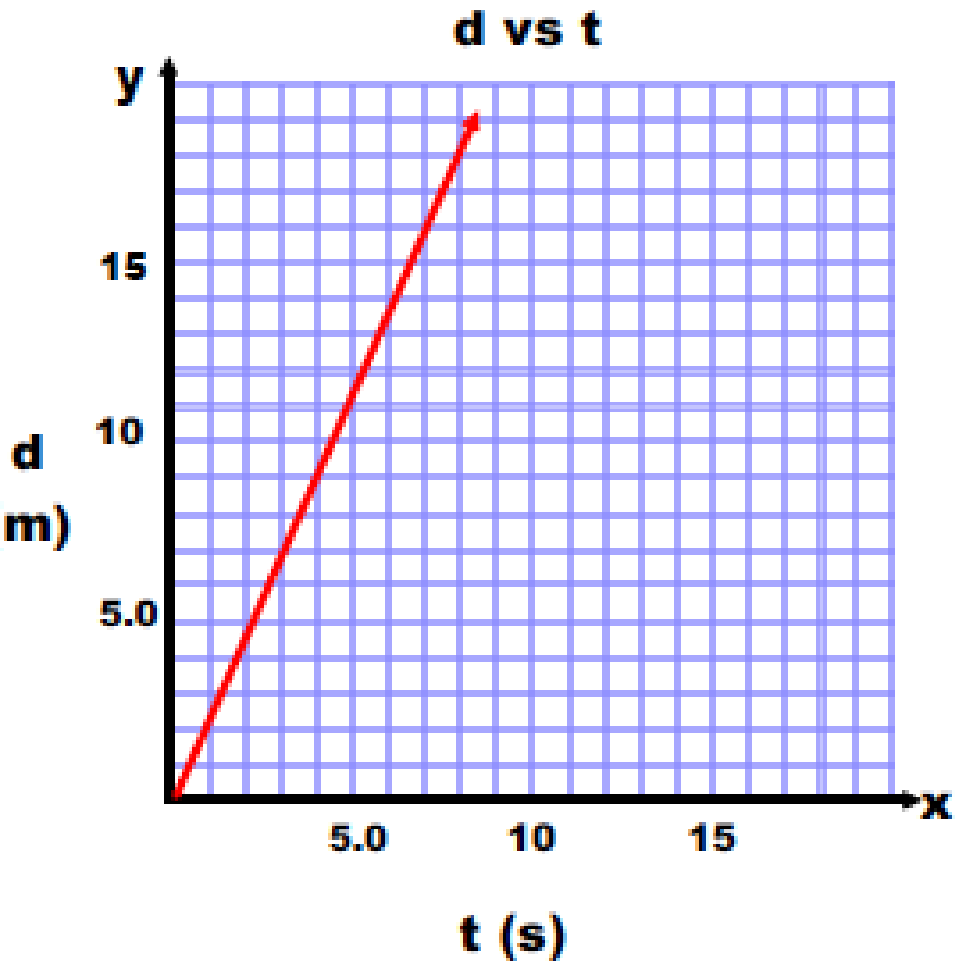
Question!

Can objects traveling at the same speed have different velocities?

A Gedankin:

Let's say a bear runs 30 metres in 15 seconds. What would a graph of its displacement vs. time look like?



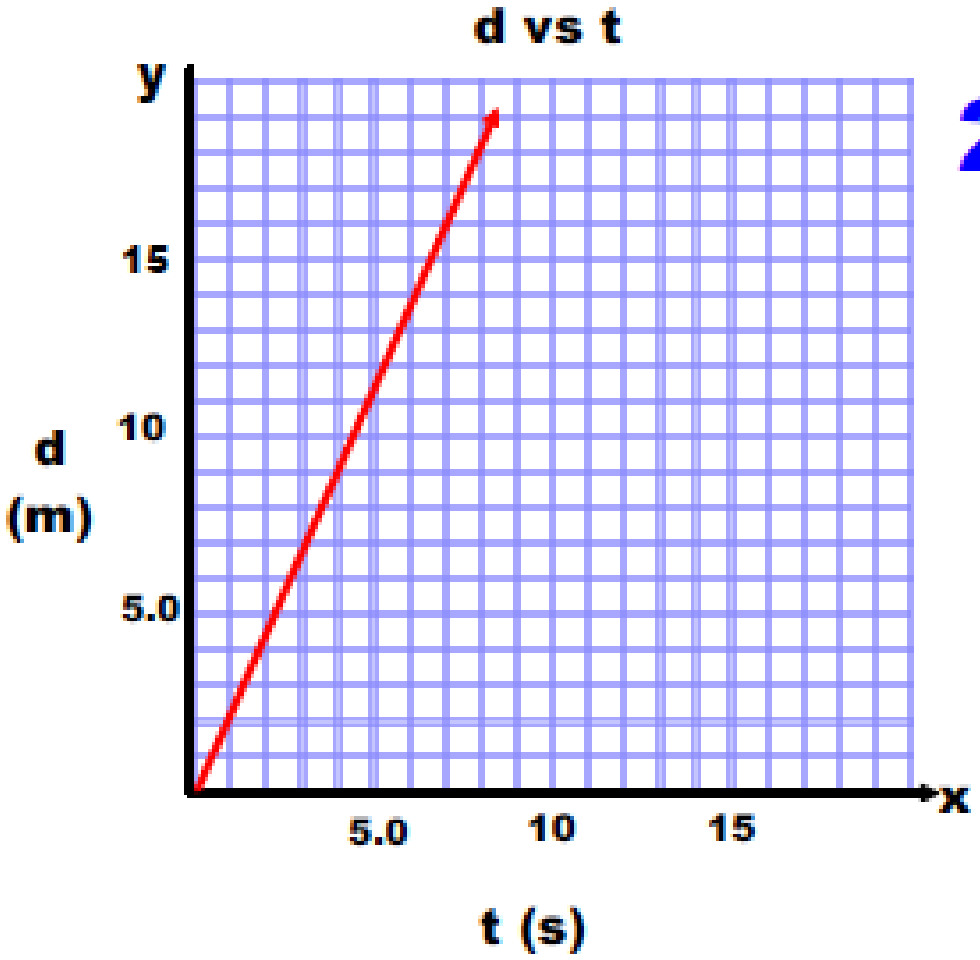


Things we can do with the graph:

1. Find points.

ex) How far has the bear gone after 7 s?

ex) How long does it take the bear to move 11 m?



2. The Velocity

i) Pick a point from the graph. This will give a displacement and time.

ii) Use $\vec{v} = \vec{d}/t$ to find the velocity.

*Note: This is the same as finding the slope of the line.

The slope of a distance/displacement vs. time graph gives velocity.

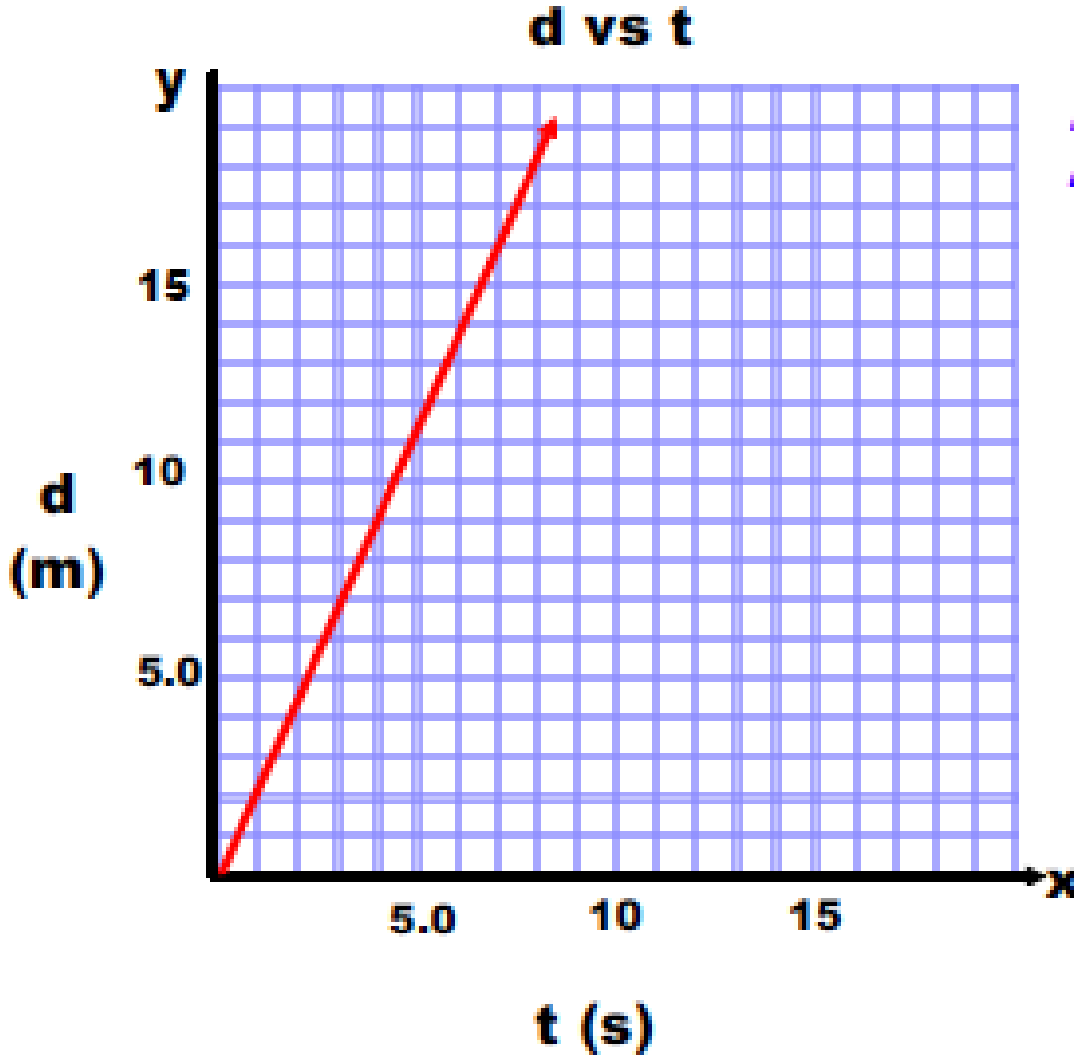
To find instantaneous velocity: just use

$$\vec{v} = \frac{\vec{d}}{t}$$

To find average velocity, find the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \longrightarrow \vec{v} = \frac{\Delta \vec{d}}{\Delta t} \longrightarrow \vec{v} = \frac{\vec{d}_2 - \vec{d}_1}{t_2 - t_1}$$

Slope Calculation:



The slope of a distance/displacement vs. time graph gives velocity.

A +ive slope = positive direction

A -ive slope = negative direction

The sign on velocity is direction!
100% of the time!!

Memorize this! It is very important!

Question:

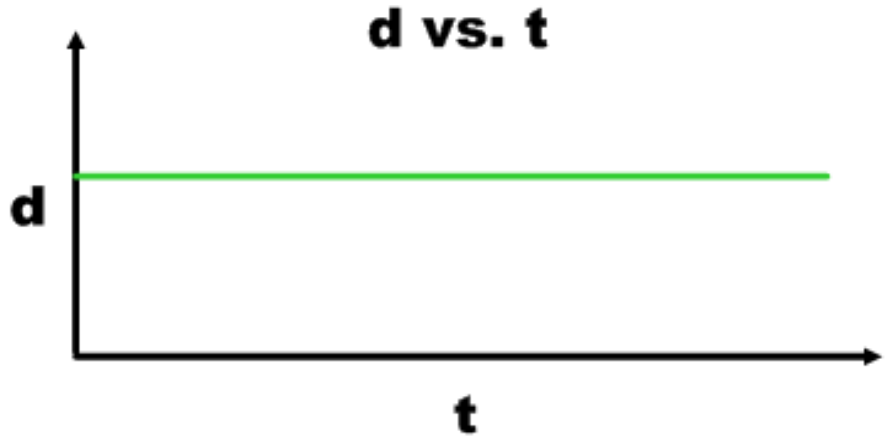
Which of the following is not an example of uniform motion?

a) A robot moving 1.0 m every second.
b) A bird flying at a constant speed.
c) A car driving down the road at 100 km/h.
d) A slug standing still.
e) All of the above.

An object at rest or moving at a constant velocity undergoes uniform motion.

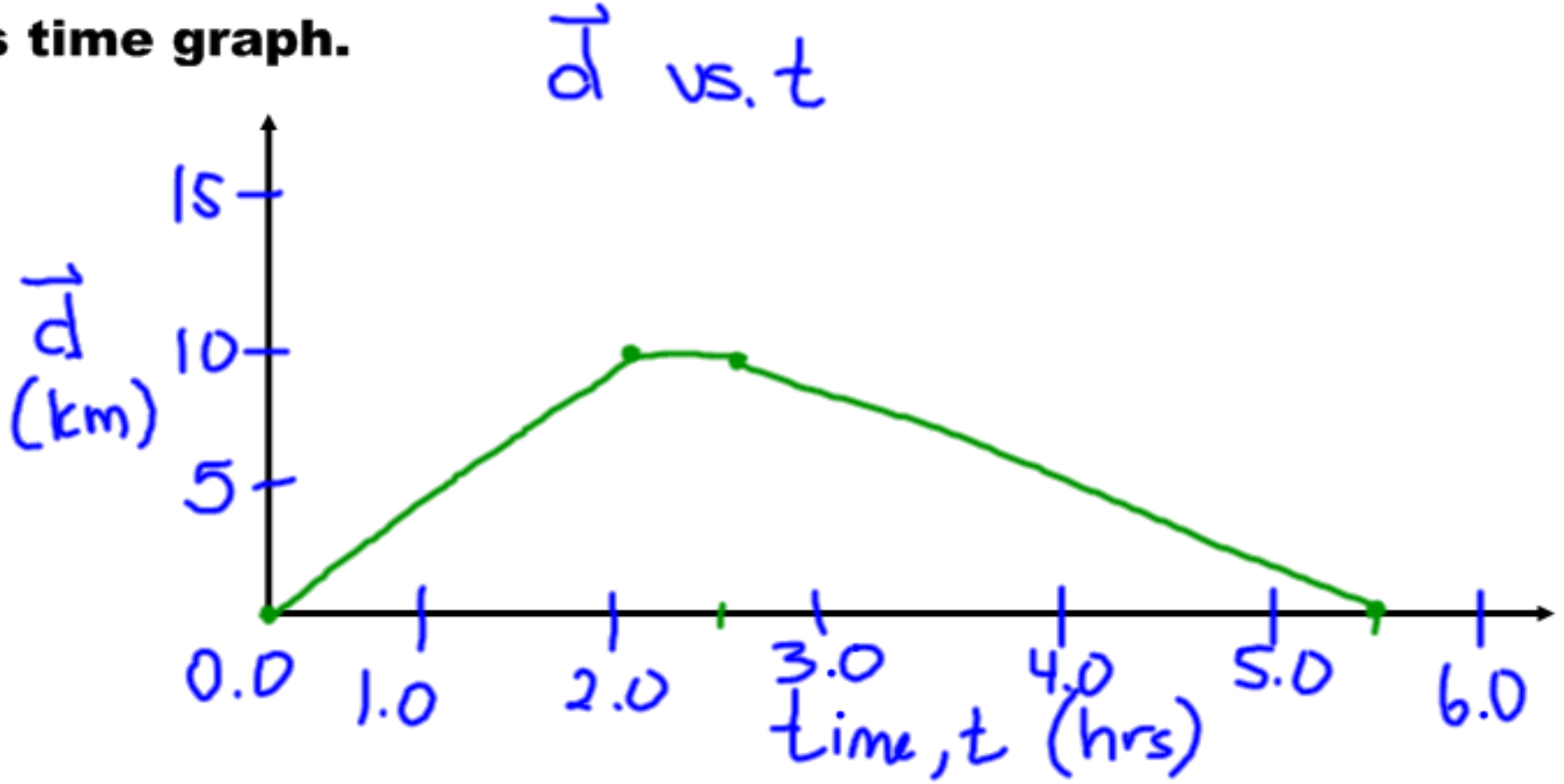
- Even if an object is moving 0.0 m every second, the amount change in position is still the same.
- d vs t graphs for objects at rest are horizontal lines.

example:



Uniform Motion

ex) Starting from t = 0.0 h, a hiker walks 10 km N in 2.0 h, stops for a 0.50 h, then walks 10 km S in 3 hours back to his starting position. Display this movement in a displacement vs time graph.

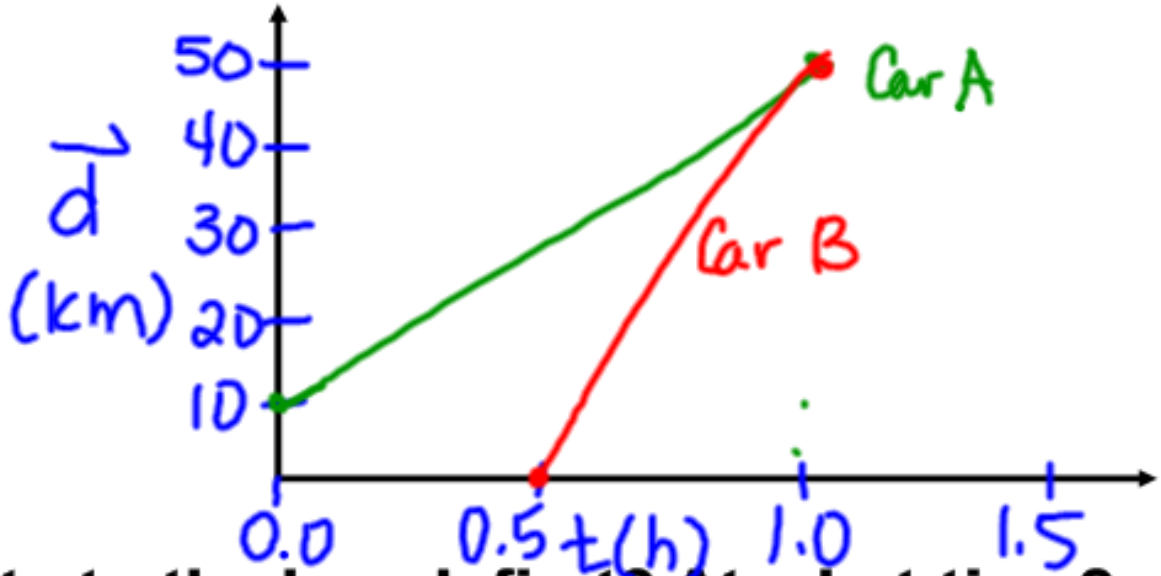


We could also graph the motion of more than one object on the same axis as long as the objects move in the same time frame.

By doing this, we can tell which object is moving faster (larger slope) and where the objects will meet (the intersection point of the two lines).

ex) Two cars drive towards a beach, 50 km from a school. Car A starts 10 km closer to the beach at noon and travels at 40 km/h. Car B starts from the school at 12:30 and drives at 100 km/h.

a) Draw a position vs. time graph for this movement.



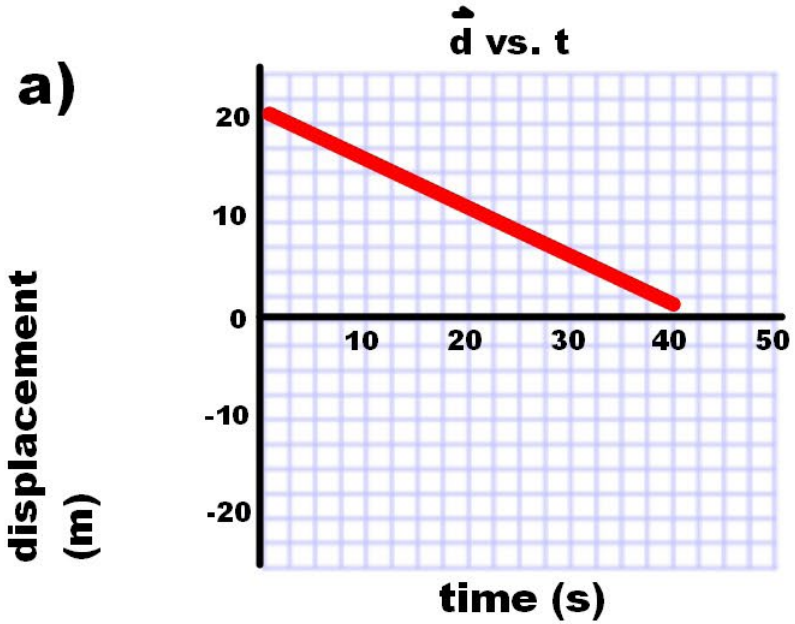
$d = vt$

b) Who gets to the beach first? At what time?

They both arrive at 1:00 pm.

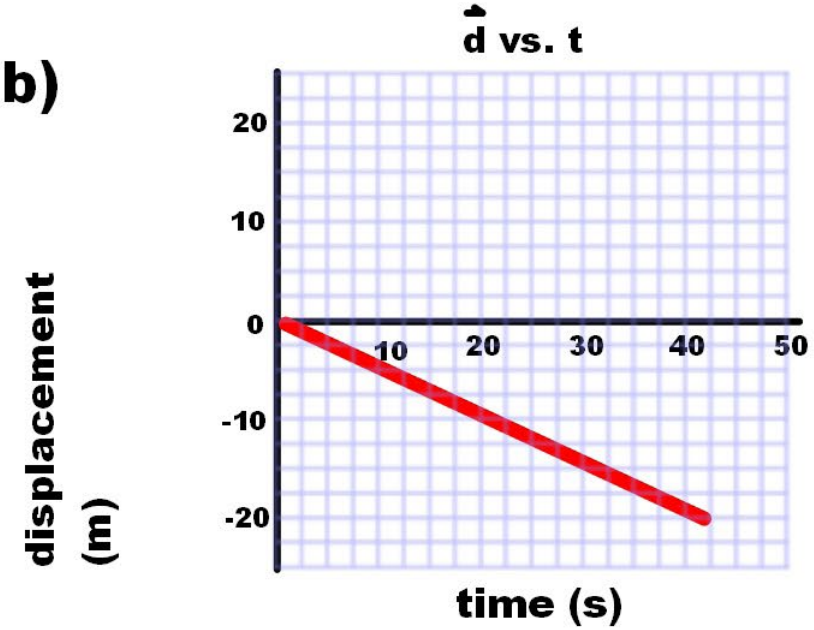
ex) Examine the graph. Describe in words the motion of the object producing each graph.

a)



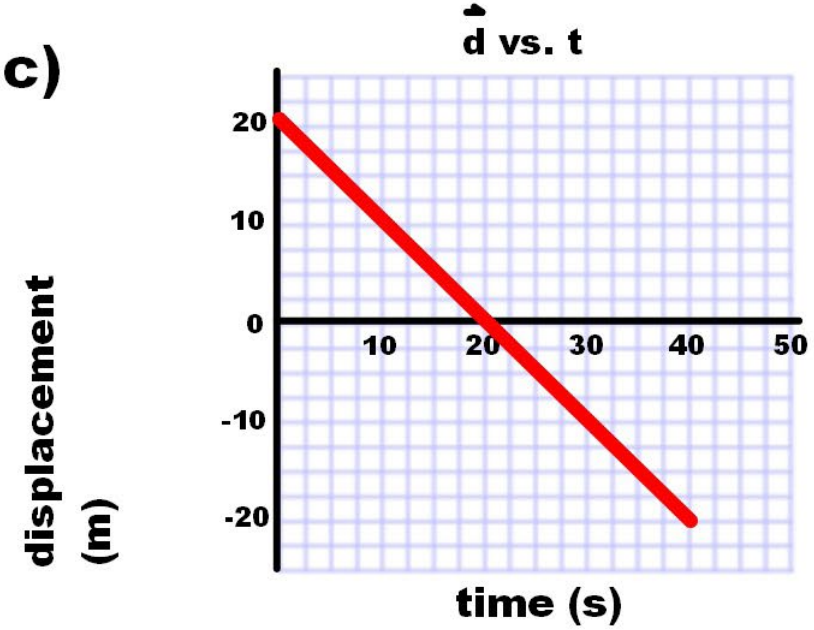
velocity : _____

b)



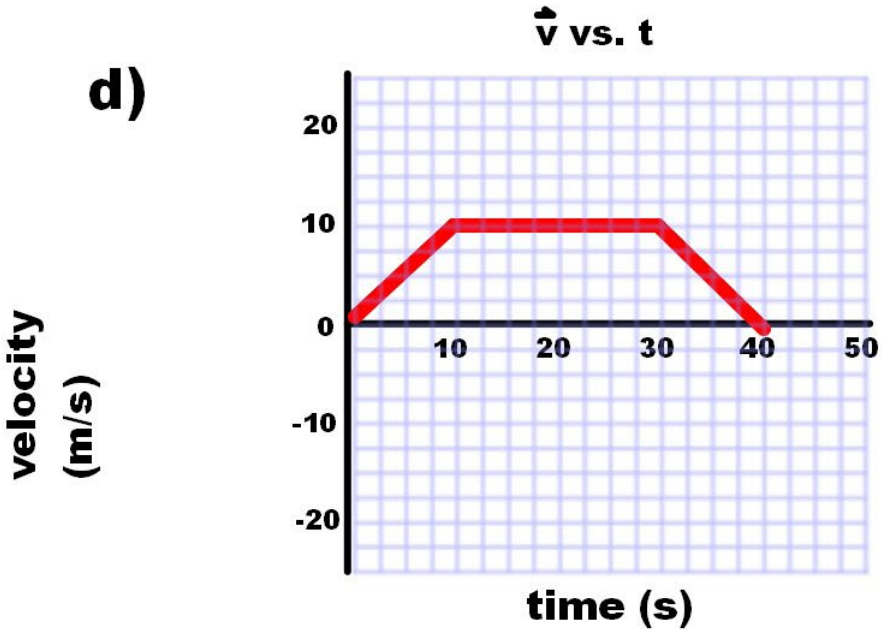
velocity : _____

c)



velocity : _____

d)



velocities : _____