Acceleration

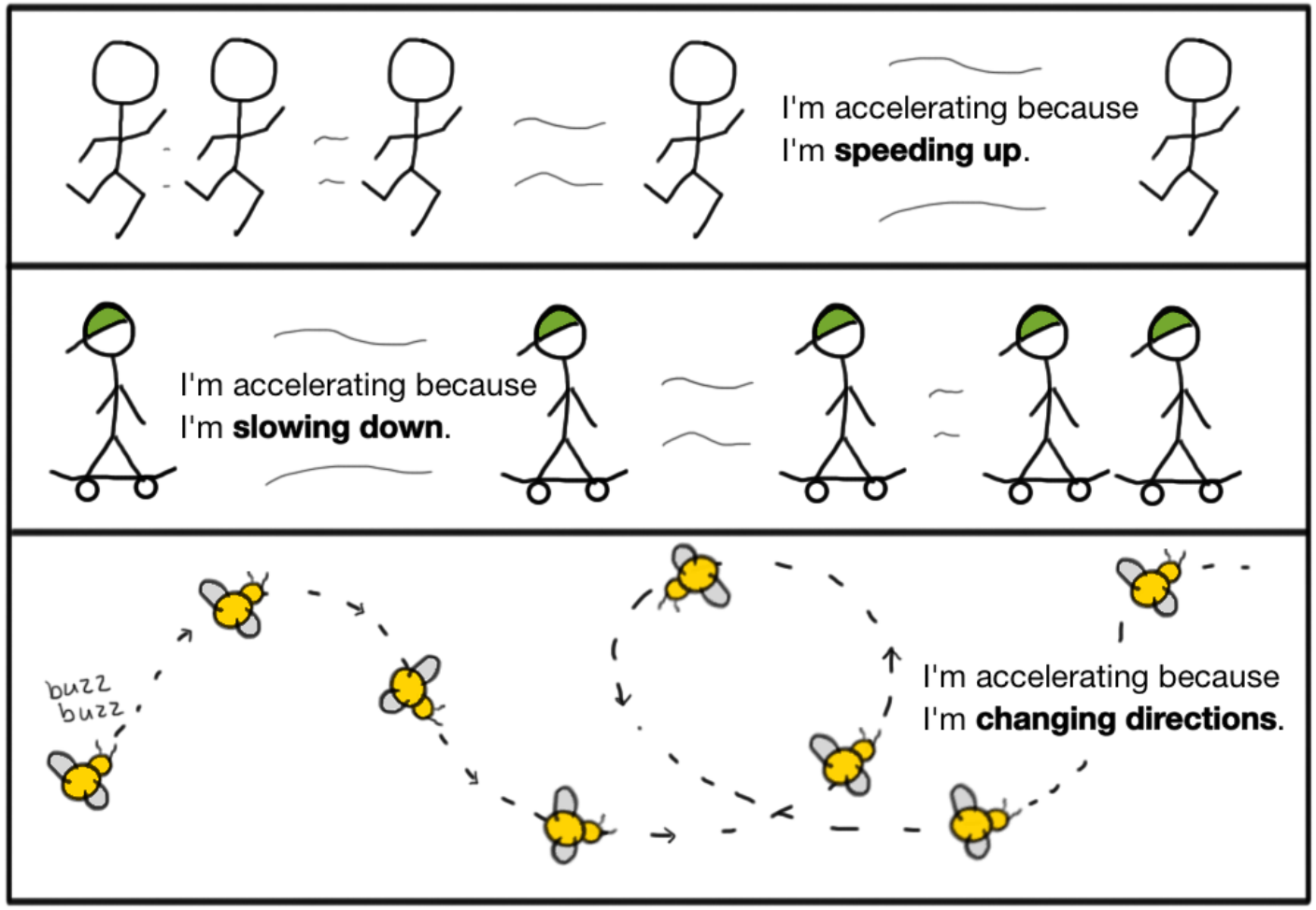
Graphing

Acceleration

Acceleration occurs when objects speed up or slow down or when there is a change in direction at a constant speed.

Displacement does not change uniformly.

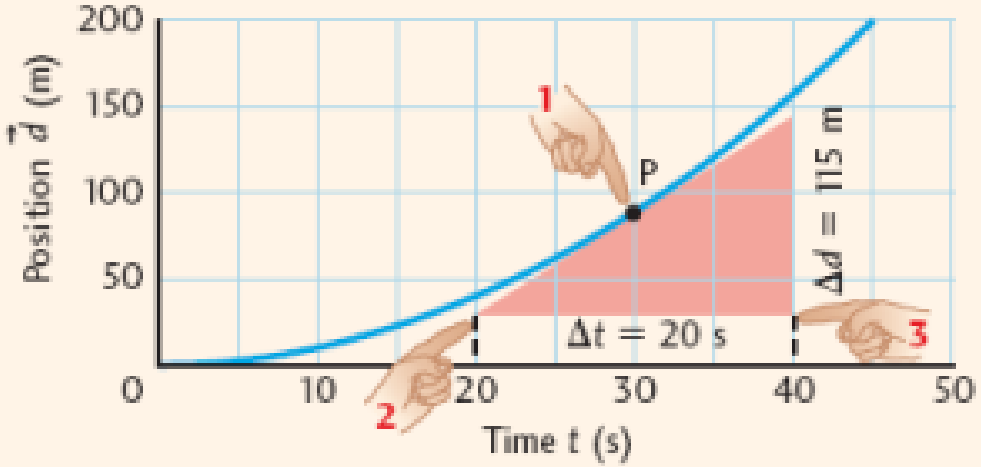
Acceleration



Acceleration Lab

PROCEDURE FOR DRAWING A TANGENT TO A CURVE

Fig.1.19



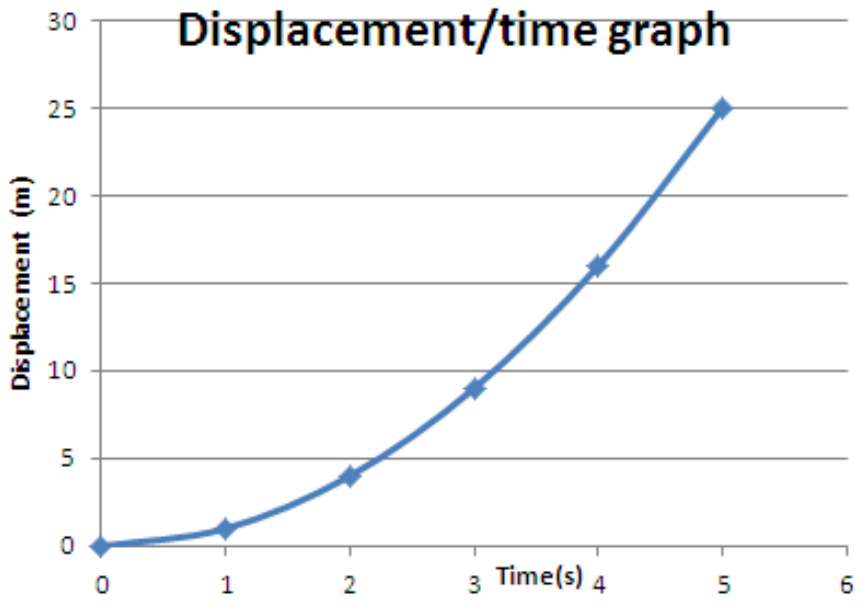
(1) Choose point P on the curve.

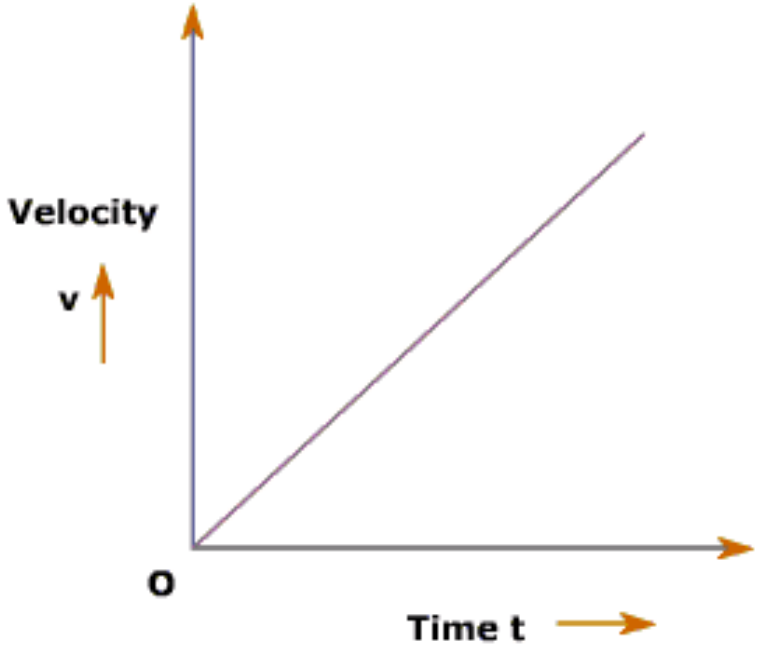
(2) Draw a straight line parallel to the direction of the curve at that point. The line touches the curve at P only; and the "angles" between the curve and the line on either side of P are equal.

(3) Then draw a rise-run triangle and calculate the slope.

$$\frac{\Delta d}{\Delta t} = \frac{d_2 - d_1}{t_2 - t_1} = \frac{140\ \text{m} - 25\ \text{m}}{40\ \text{s} - 20\ \text{s}} = \frac{115\ \text{m}}{20\ \text{s}} = 5.8\ \text{m/s}$$

Graphing





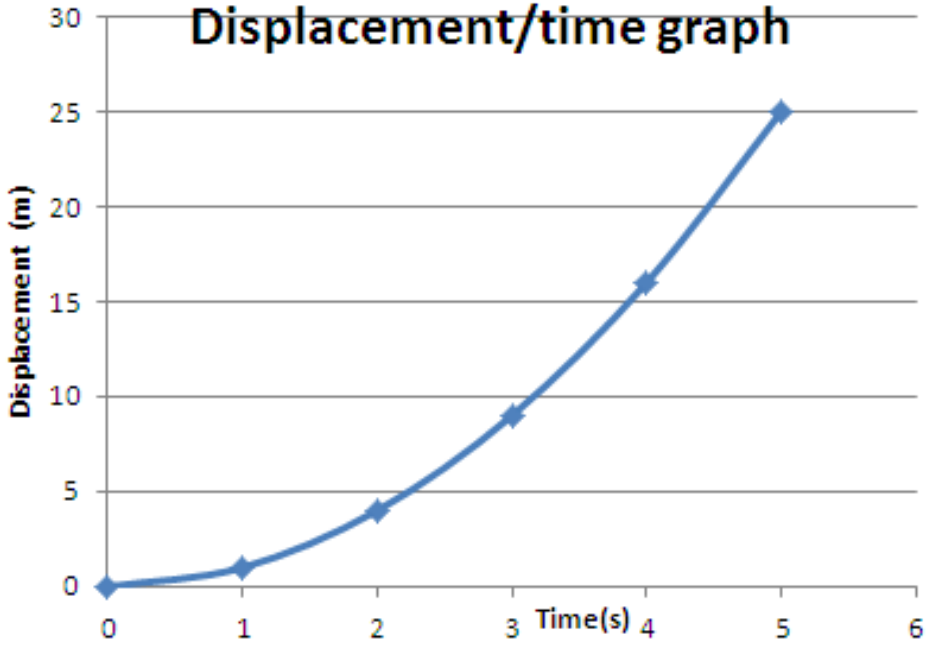
Slope of tangent = instantaneous velocity

Slope = acceleration
Area = displacement

Displacement-Time Graph

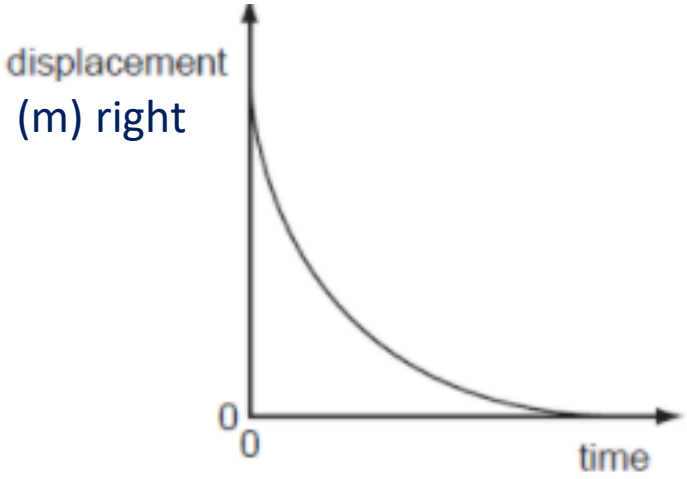
0 is the reference point – where we measure the motion from.

Positive slope indicates movement to the right. Negative slope is movement to the left. Zero slope indicates the object is at rest.

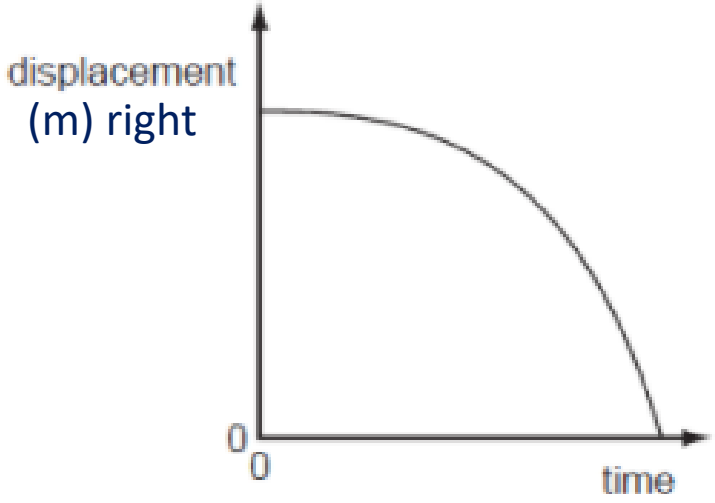


Note that if tangents drawn to the curve get steeper as time goes on the object is speeding up. If they get flatter the object is slowing down.

Displacement-Time Graphs

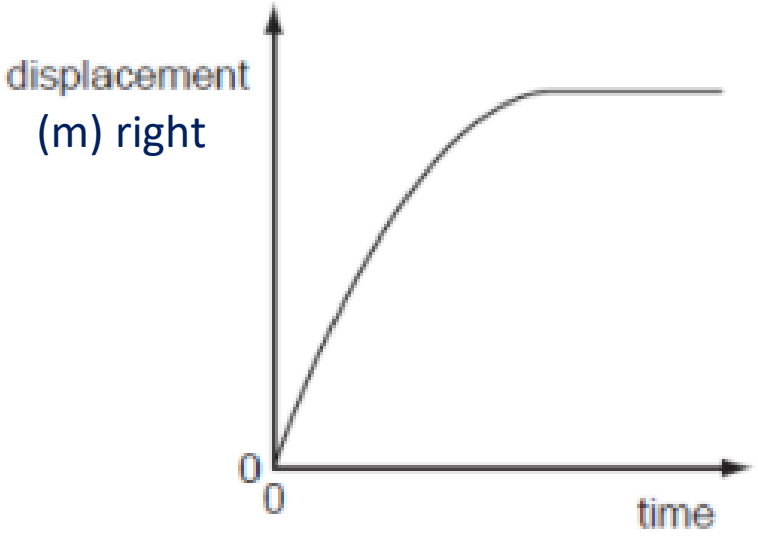


Object starts to the right of the reference point.
Slows down to the left.
Ends up at reference point.

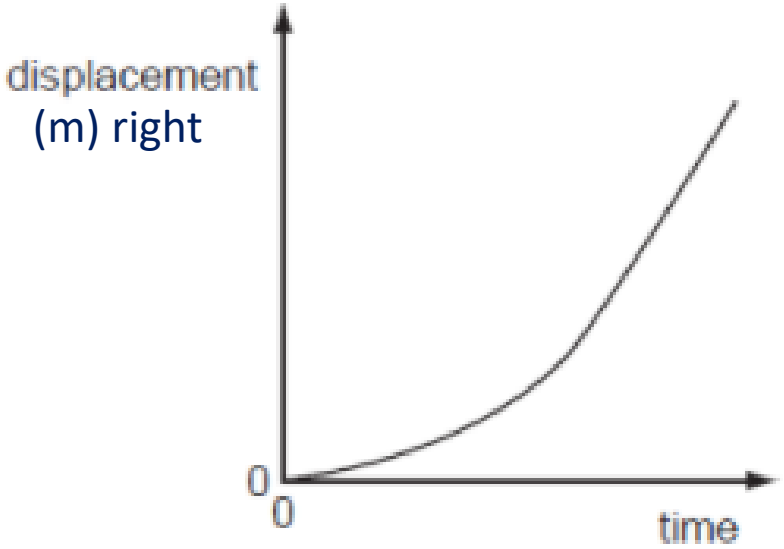


Object starts to the right of the reference point.
Speeds up to the left.
Ends up at reference point.

Displacement-Time Graph



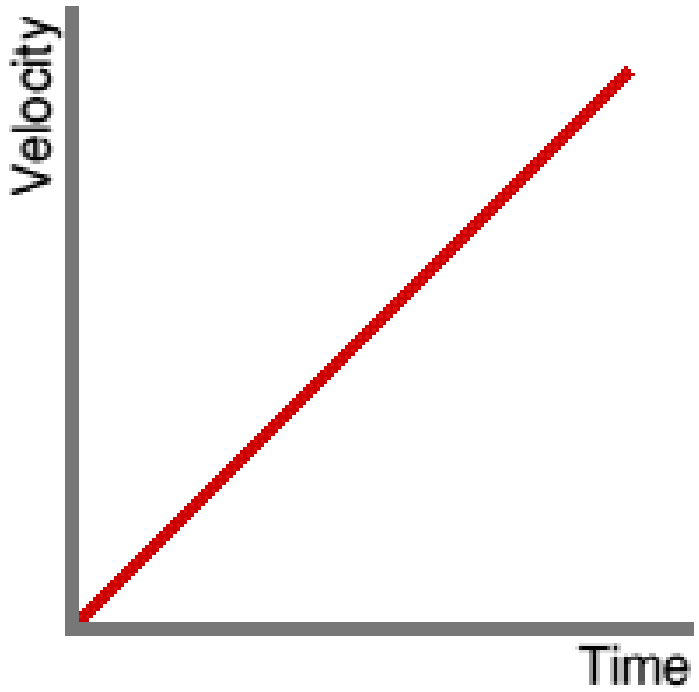
Object starts at the reference point.
Slows down to the right and stops.



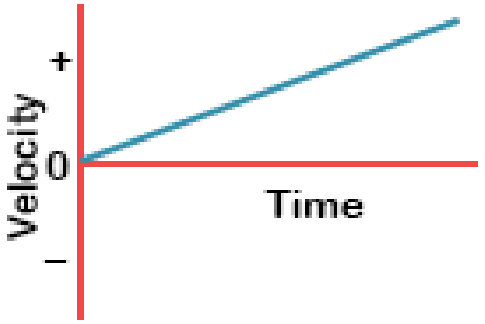
Object starts at the reference point.
Speeds up to the right.

Velocity-Time Graph

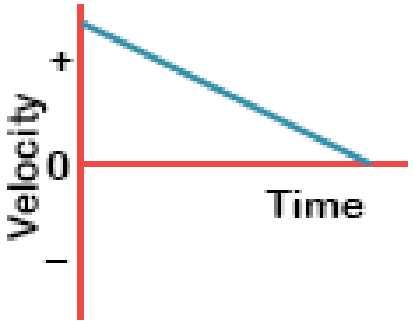
- 0 means the object is not moving.
- Graph drawn above 0 indicates movement to the right.
- Graph drawn below 0 indicates movement to the left.
- If the line is moving away from 0, the object is speeding up. If it is moving closer to 0, the object is slowing down.



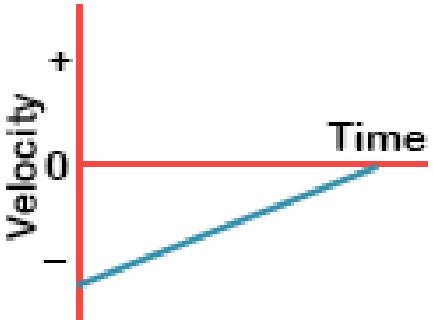
Velocity-Time Graphs



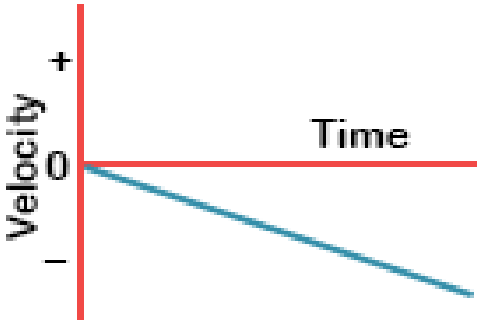
Object is moving to the right.
Object is speeding up.



Object is moving to the right.
Object is slowing down.

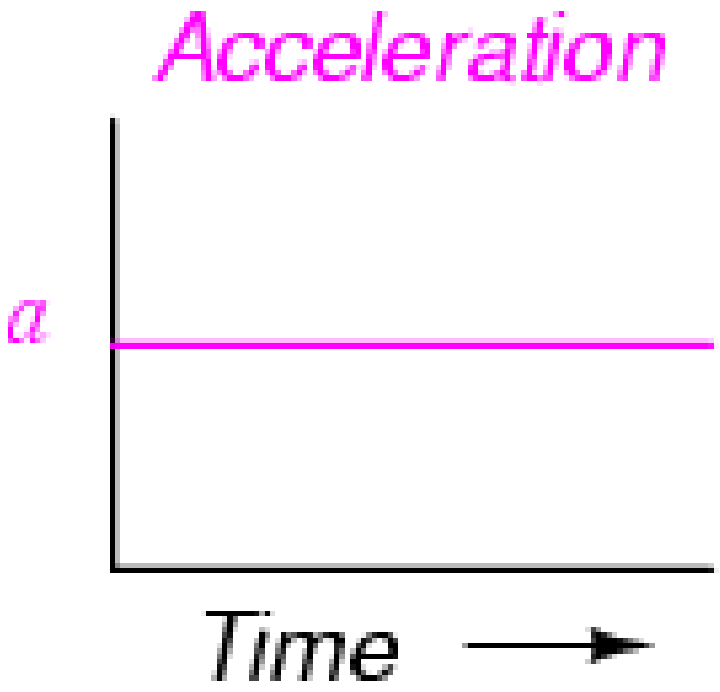


Object is moving to the left.
Object is slowing down.

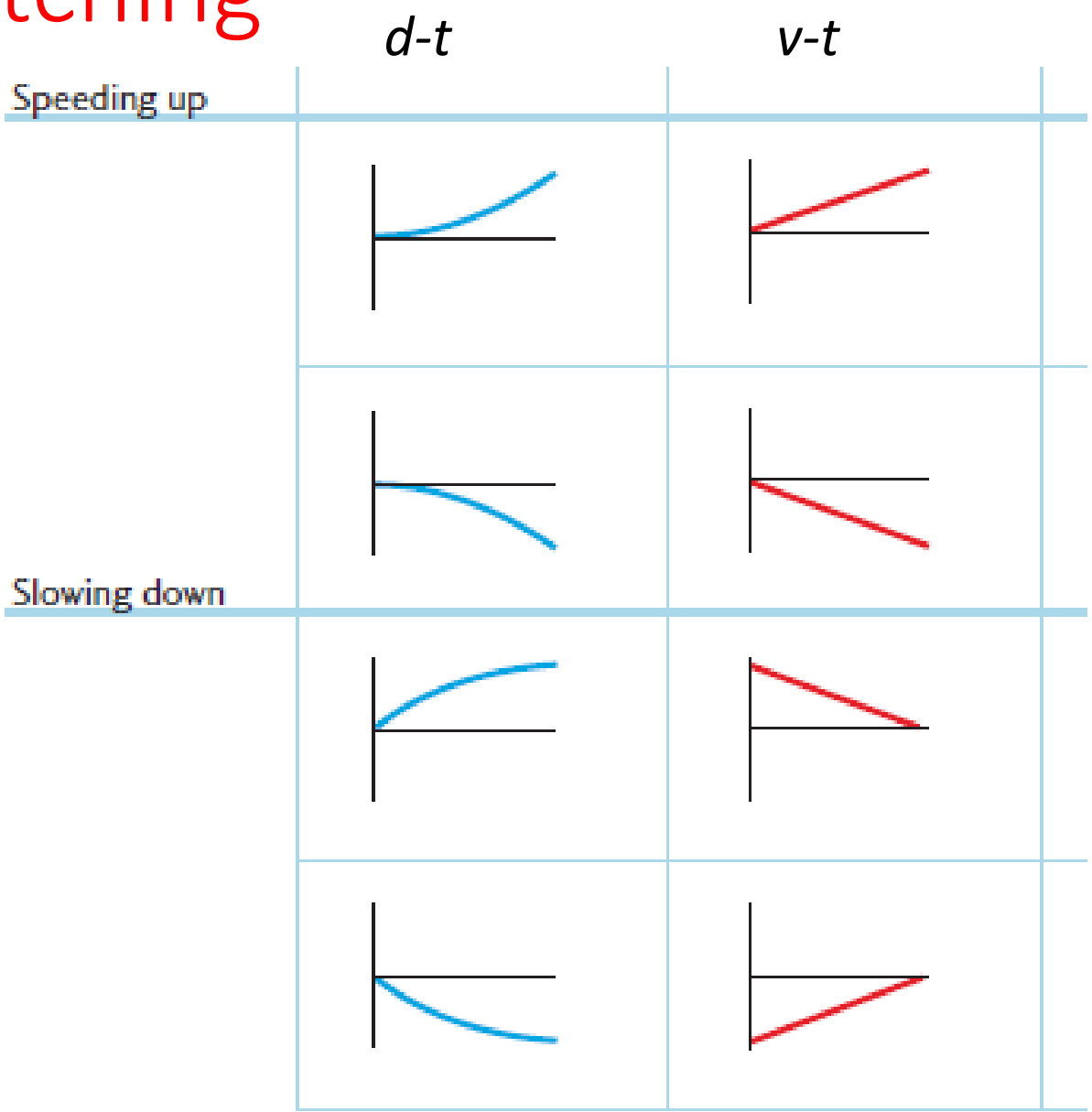


Object is moving to the left.
Object is speeding up.

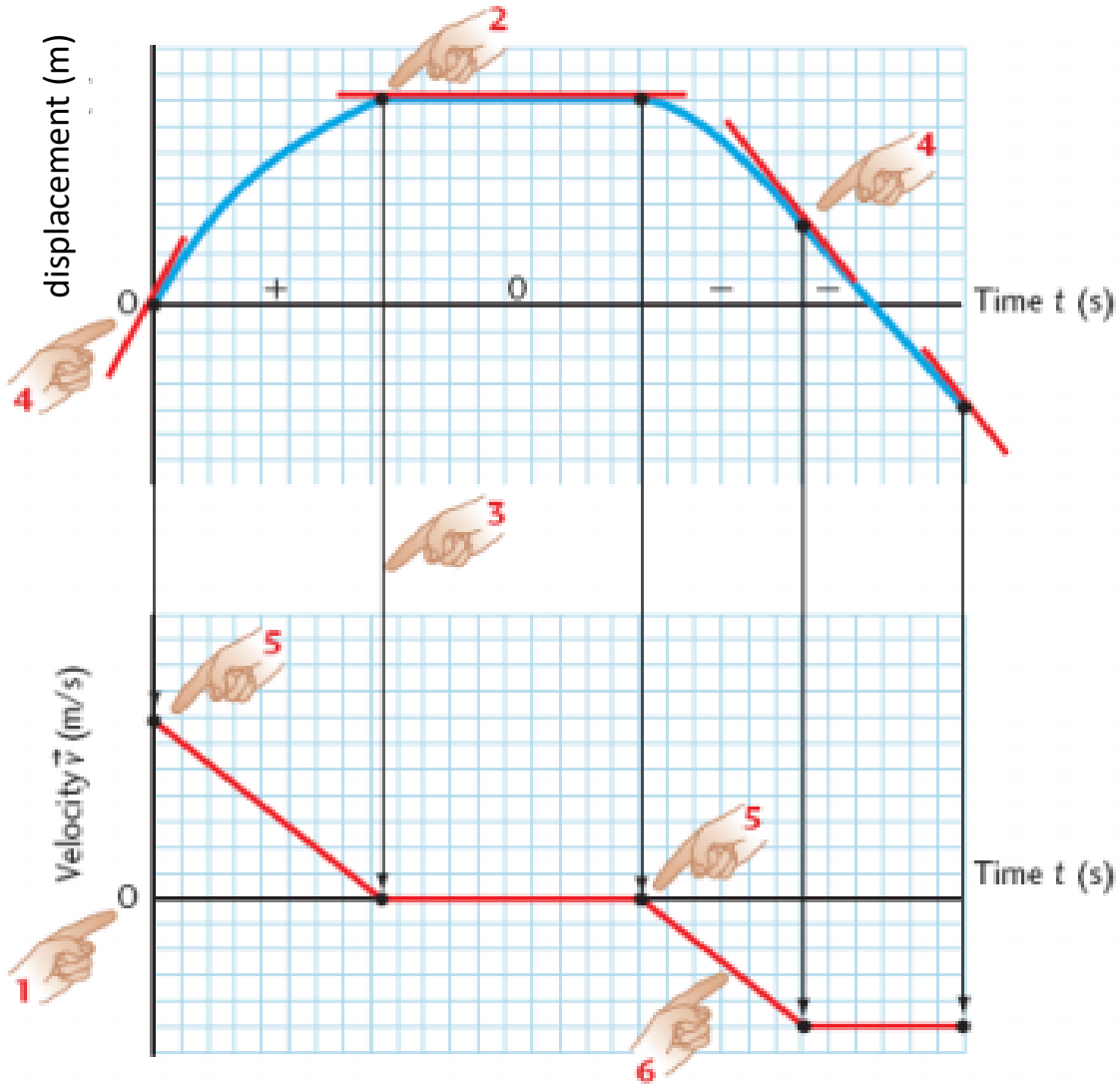
Acceleration Graph



Graph Matching



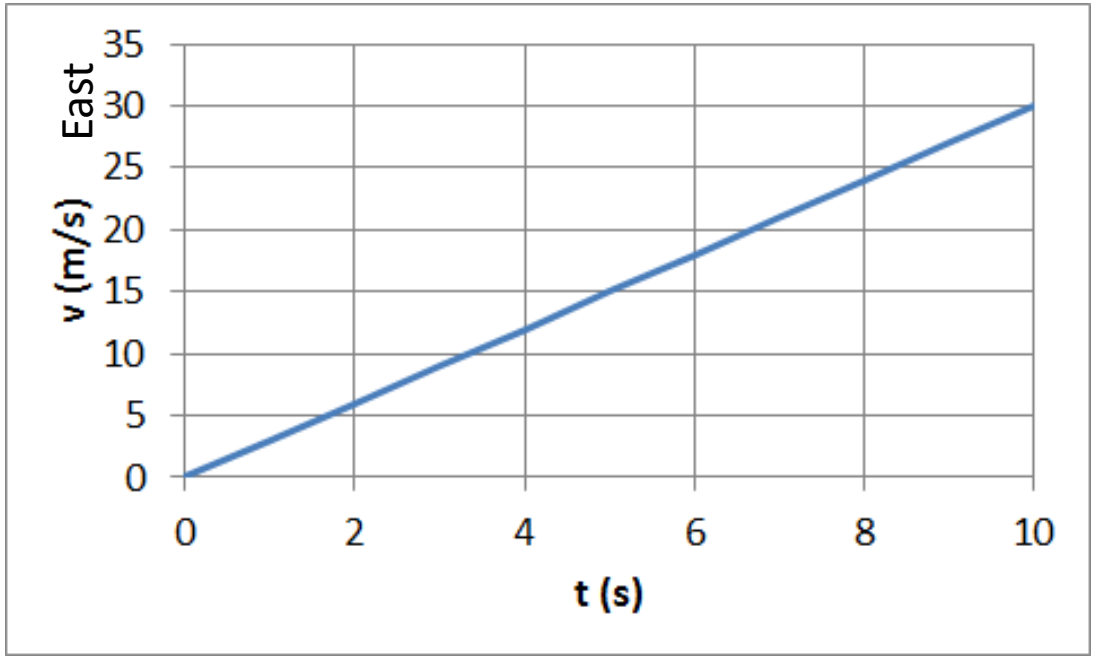
Graph Matching



Graphing Numerical

a) Calculate the acceleration of the object graphed.

b) Calculate the distance moved in 10 s.



Graphing Numerical

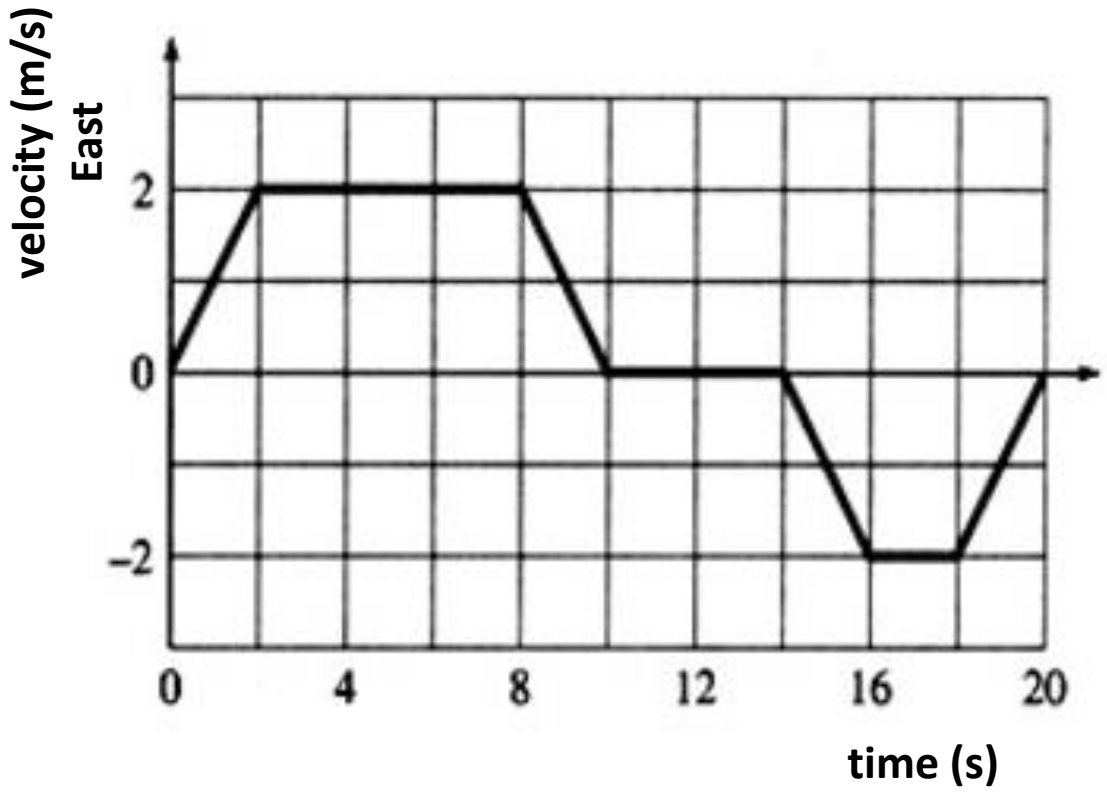
a) What is the acceleration of the object at 1 s?

b) During which time(s) is the object moving at a constant speed?

c) What is the acceleration of the object at 15 s?

d) What is the total distance moved in 20 s?

e) What is the displacement at 20 s?



Graphing Numerical

Use the graph to determine the instantaneous velocity of the object graphed at 4 s.