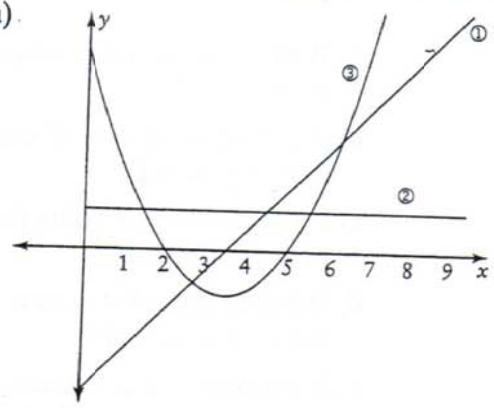
2.3 Velocity, Acceleration, and Second Derivatives

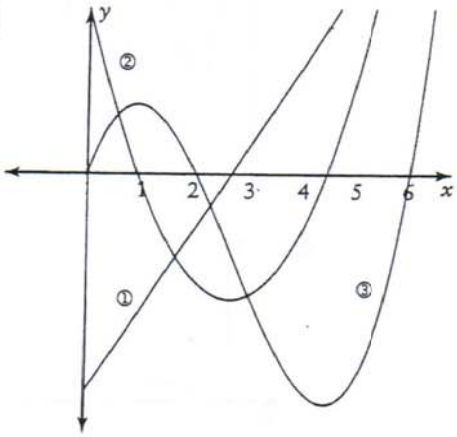
- When $v(t) = 0$, the object is at rest, or stationary. There are many instances where an object will be momentarily at rest when changing directions. For example, a ball thrown straight upward will be momentarily at rest at its highest point, and will then begin to descend.
- When $v(t) > 0$, the object is moving in the positive direction.
- When $v(t) < 0$, the object is moving in the negative direction.
- When $a(t) > 0$, the velocity of an object is increasing (i.e., the object is accelerating).
- When $a(t) < 0$, the velocity of an object is decreasing (i.e., the object is decelerating).
- An object is speeding up if $v(t) \times a(t) > 0$ and slowing down if $v(t) \times a(t) < 0$.

Identify which curve or line in each graph represents each function: $y = s(t)$, $y = v(t)$, and $y = a(t)$. Justify your choice.

a)



b)

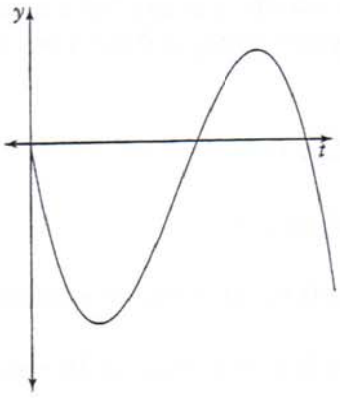


Copy and complete a chart for each graph [Hint: 2 intervals for (a) and 4 intervals for (b)]

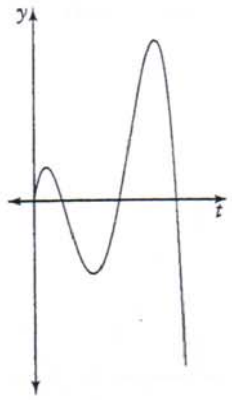
Interval	
$v(t)$	
$a(t)$	
$v(t) \times a(t)$	
Motion of Object	
Description of slope of $s(t)$	

Copy each graph of a position function $y = s(t)$. Sketch the graphs of $y = v(t)$ and $y = a(t)$.

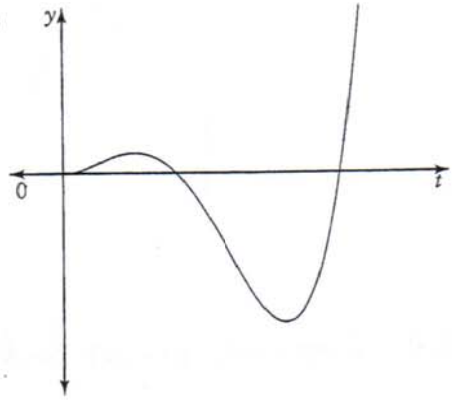
a)



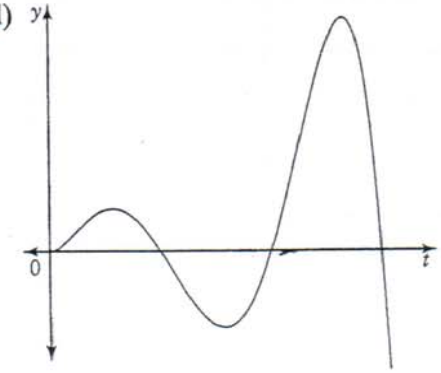
b)



c)



d)



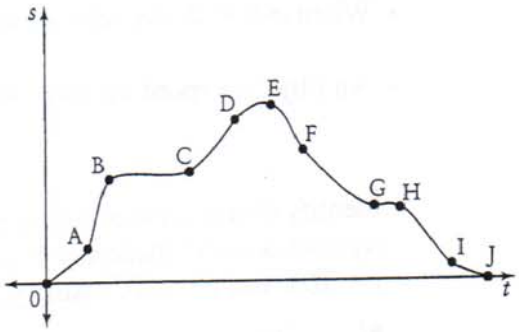
Sketch a graph of $y = s(t)$ that satisfies each pair of conditions.

a) Velocity is increasing; acceleration is positive.

b) Velocity is decreasing; acceleration is negative.

c) Velocity is constant; acceleration is zero.

The graph shows the position function of a motorcycle during a 30-min trip.



a) What is the initial velocity of the motorcycle?

b) What is the velocity of the motorcycle at E?

c) Is the motorcycle going faster at A or at D? Explain.

d) What happens between B and C? between G and H?

e) Is the motorcycle speeding up or slowing down at A, D, F, and I? Explain.

f) What happens at J?

Refer to the graph in question 9. Is the acceleration positive, zero, or negative between each pair of points?

a) O to B

b) B to C

c) D to E

d) E to G

e) G to H

f) H to J