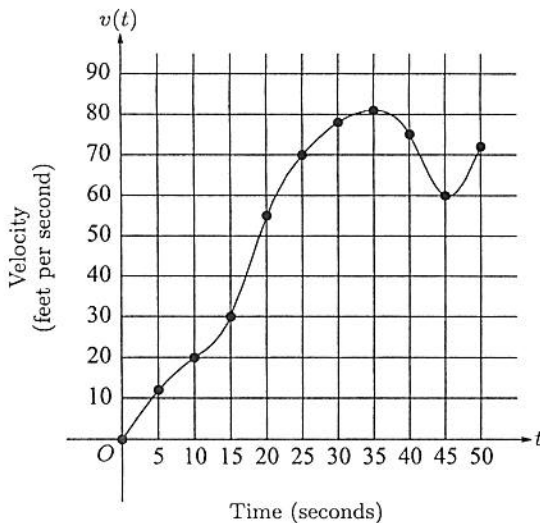




1998 AP Calculus AB Free-Response Questions



t (seconds)	$v(t)$ (feet per second)
0	0
5	12
10	20
15	30
20	55
25	70
30	78
35	81
40	75
45	60
50	72

3. The graph of the velocity $v(t)$, in ft/sec, of a car traveling on a straight road, for $0 \leq t \leq 50$, is shown above. A table of values for $v(t)$, at 5 second intervals of time t , is shown to the right of the graph.
- During what intervals of time is the acceleration of the car positive? Give a reason for your answer.
 - Find the average acceleration of the car, in ft/sec^2 , over the interval $0 \leq t \leq 50$.
 - Find one approximation for the acceleration of the car, in ft/sec^2 , at $t = 40$. Show the computations you used to arrive at your answer.

a) acceleration positive $\rightarrow v'(t) > 0$ (velocity increasing)
 $(0, 35) \cup (45, 50)$ b/c $v'(t) > 0$

b) $a_{\text{avg}} = \frac{v(50) - v(0)}{50 - 0} = \frac{72 - 0}{50 - 0} = 1.44 \text{ ft}/\text{sec}^2$

c) $a(40) = \frac{v(45) - v(35)}{45 - 35} = \frac{60 - 81}{10} = -2.1 \text{ ft}/\text{sec}^2$

or $\frac{v(40) - v(35)}{40 - 35}$ or $\frac{v(45) - v(40)}{45 - 40}$... ☺

1999



1. A particle moves along the y -axis with velocity given by $v(t) = t \sin(t^2)$ for $t \geq 0$.

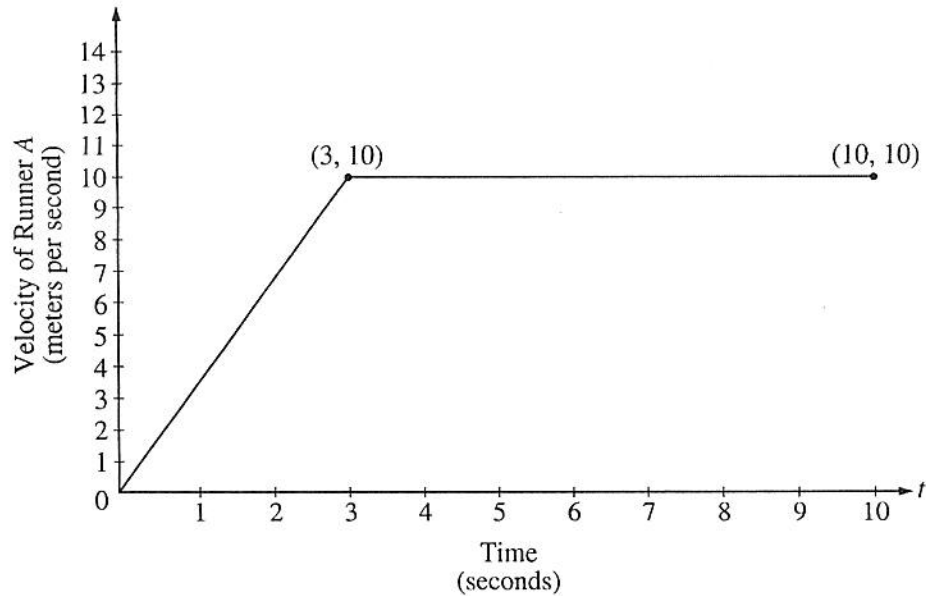
- In which direction (up or down) is the particle moving at time $t = 1.5$? Why?
- Find the acceleration of the particle at time $t = 1.5$. Is the velocity of the particle increasing at $t = 1.5$? Why or why not?

a) $v(1.5) = .059$ Particle moves up @ $t = 1.5$ b/c $v(1.5) > 0$.

b) $a(1.5) = v'(1.5) = -2.049$

velocity decreasing @ $t = 1.5$ b/c $v'(1.5) < 0$

2000 AP[®] CALCULUS AB FREE-RESPONSE QUESTIONS



2. Two runners, A and B , run on a straight racetrack for $0 \leq t \leq 10$ seconds. The graph above, which consists of two line segments, shows the velocity, in meters per second, of Runner A . The velocity, in meters per second, of Runner B is given by the function v defined by $v(t) = \frac{24t}{2t+3}$.
- (a) Find the velocity of Runner A and the velocity of Runner B at time $t = 2$ seconds. Indicate units of measure.
- (b) Find the acceleration of Runner A and the acceleration of Runner B at time $t = 2$ seconds. Indicate units of measure.

a) @ $t = 2$, need eq. of line for graph

$$y - 0 = \frac{10}{3}(x - 0)$$

$$y = \frac{10}{3}x$$

$$v_A(2) = \frac{10}{3}(2) = \frac{20}{3} \text{ meters/sec}$$

$$v_B(2) = \frac{24(2)}{2(2)+3} = \frac{48}{7} \text{ meters/sec}$$

b) $a_A(2) = v'_A(2)$ (slope of velocity @ $t = 2$)
 $= \frac{10}{3} \text{ meter/sec}^2$

$$a_B(2) = v'_B(2)$$

$$= 1.469 \text{ meters/sec}^2$$