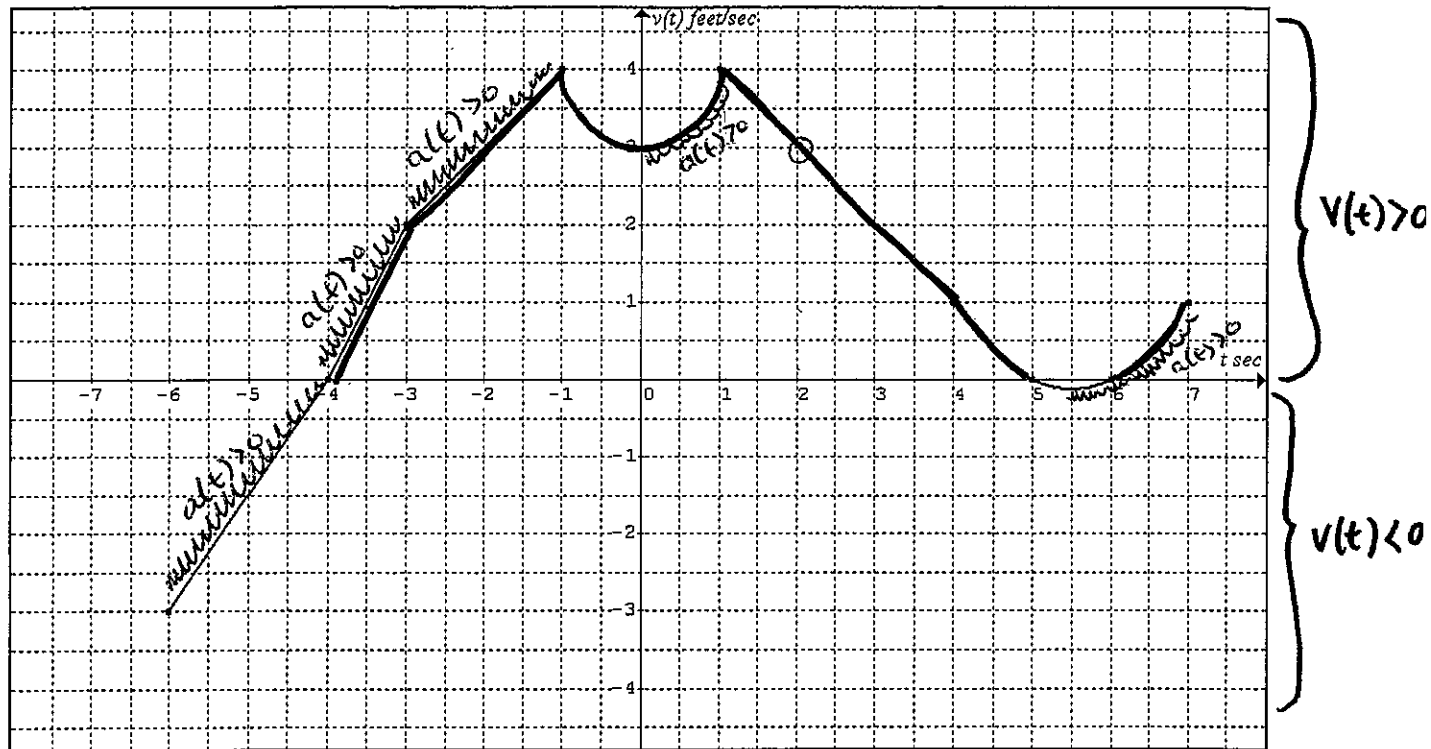


HW Solutions

2. The graph shows the velocity $v = v(t)$ of a particle moving along a vertical coordinate axis.
NO TECHNOLOGY:



A. At what time on the interval $(-6, 7)$ is the particle standing still? Justify.

The particle is standing still at $t = -4, 5, 6$ b/c $v(t) = 0$ at these t -values.

B. On what interval is the particle moving up? Justify.

The particle is moving up on $(-4, 5) \cup (6, 7)$ b/c $v(t) > 0$ on this interval.

C. On what interval is the particle moving down? Justify.

The particle is moving down on $(-6, -4) \cup (5, 6)$ b/c $v(t) < 0$ on this interval.

D. On what interval is the acceleration positive? Justify.

acceleration is positive on $(-6, -4) \cup (-4, -3) \cup (-3, -1) \cup (0, 1) \cup (5.5, 7)$ b/c $v'(t) > 0$ on the interval.

E. On what interval is the particle getting slower? Justify.

The particle is getting slower on $(-6, -4) \cup (-1, 0) \cup (1, 4) \cup (4, 5) \cup (5.5, 6)$ because $v(t)$ and $a(t)$ have opposite signs on this interval.

F. What are the velocity and acceleration at time $t = 2$?

$v(2) = 3$ ← point on graph

$a(2) = -1$ ← slope of line segment on graph

G. What are the velocity and acceleration at time $t = 0$?

$v(0) = 3$ ← point on graph

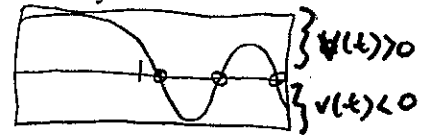
$a(0) = 0$ ← slope of tangent to graph at $t = 0$.

HW Solutions

4. The velocity of a particle moving along a horizontal coordinate axis is defined by

$$v(t) = \cos(t^3) \text{ for } 0 < t < 2.$$

TECHNOLOGY REQUIRED:



A. At what time on the interval (0,2) is the particle standing still? Justify.

The particle is standing still at $t = 1.162, 1.672, 1.988$ b/c $v(t) = 0$ at these t -values.

B. On what interval is the particle moving right? Justify.

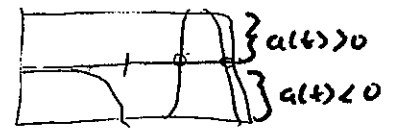
The particle is moving right on $(0, 1.162) \cup (1.672, 1.988)$ b/c $v(t) > 0$ on this interval.

C. On what interval is the particle moving left? Justify.

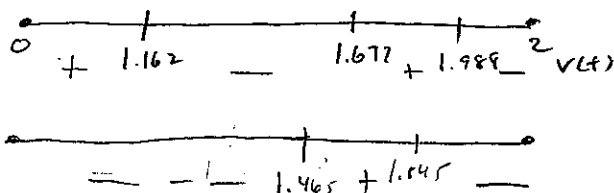
The particle is moving left on $(1.162, 1.672) \cup (1.988, 2)$ b/c $v(t) < 0$ on this interval.

D. On what interval is the acceleration positive? Justify.

The acc. is pos. on $(1.465, 1.845)$ b/c $v'(t) > 0$ on this interval.



E. On what interval is the particle getting faster? Justify.



The particle is getting faster on $(1.162, 1.465) \cup (1.672, 1.845) \cup (1.988, 2)$ b/c $v(t)$ and $a(t)$ share the same sign on this interval.

□ on $(1.162, 1.465)$ $v(t) < 0$ and $a(t) < 0$

□ on $(1.672, 1.845)$ $v(t) > 0$ and $a(t) > 0$

□ on $(1.988, 2)$ $v(t) < 0$ and $a(t) < 0$

G. What are the velocity and acceleration at time $t = 1$?

$$v(1) = \cos(1) \approx 0.540$$

$$a(1) = -3\sin(1) \approx -2.524$$

↑
exact

↑
approx
◊ ENTER

6. The position of a particle moving along a horizontal coordinate axis is defined by

$$s(t) = -\frac{2t^3}{3} + \frac{5t^2}{2} - 3t - 1 \text{ for } 0 < t < 2. \text{ NO TECHNOLOGY:}$$

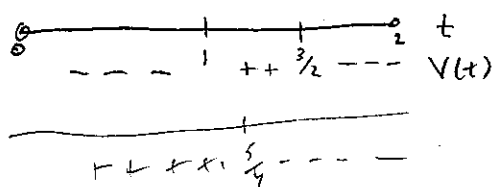
- A. At what time on the interval $(0, 2)$ is the particle standing still? Justify.

$$v(t) = s'(t) = -2t^2 + 5t - 3 = 0 \quad -(2t^2 - 5t + 3) = 0$$

$$-(2t - 3)(t - 1) = 0 \quad t = \frac{3}{2}, 1$$

The part. is standing still at $t = \frac{3}{2}, 1$ b/c $v(t) = 0$ at these t values.

- B. On what interval is the particle moving right? Justify.



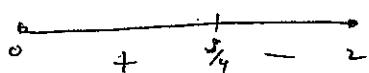
The particle is moving to the right on $(1, \frac{3}{2})$ b/c $v(t) > 0$ on this interval.

- C. On what interval is the particle moving left? Justify.

The particle is moving to the left on $(0, 1) \cup (\frac{3}{2}, 2)$ b/c $v(t) < 0$ on this interval.

- D. On what interval is the acceleration positive? Justify.

$$a(t) = v'(t) = -4t + 5 = 0 \quad t = \frac{5}{4}$$



Acc. is positive on $(0, \frac{5}{4})$ b/c $v'(t) > 0$ on this interval.

- E. On what interval is the particle getting slower? Justify.

The particle is getting slower on $(0, 1) \cup (\frac{5}{4}, \frac{3}{2})$ b/c "v" and "a" have opposite signs on this interval.

□ on $(0, 1)$: $v < 0$ and $a > 0$

□ on $(\frac{5}{4}, \frac{3}{2})$: $v > 0$ and $a < 0$

- G. What are the position, velocity, and acceleration at time $t = 1$?

$$s(1) = -\frac{2}{3} + \frac{5}{2} - 3 - 1 = -\frac{13}{6}$$

$$v(1) = -2(1)^2 + 5(1) - 3 = 0$$

$$a(1) = -4(1) + 5 = 1$$