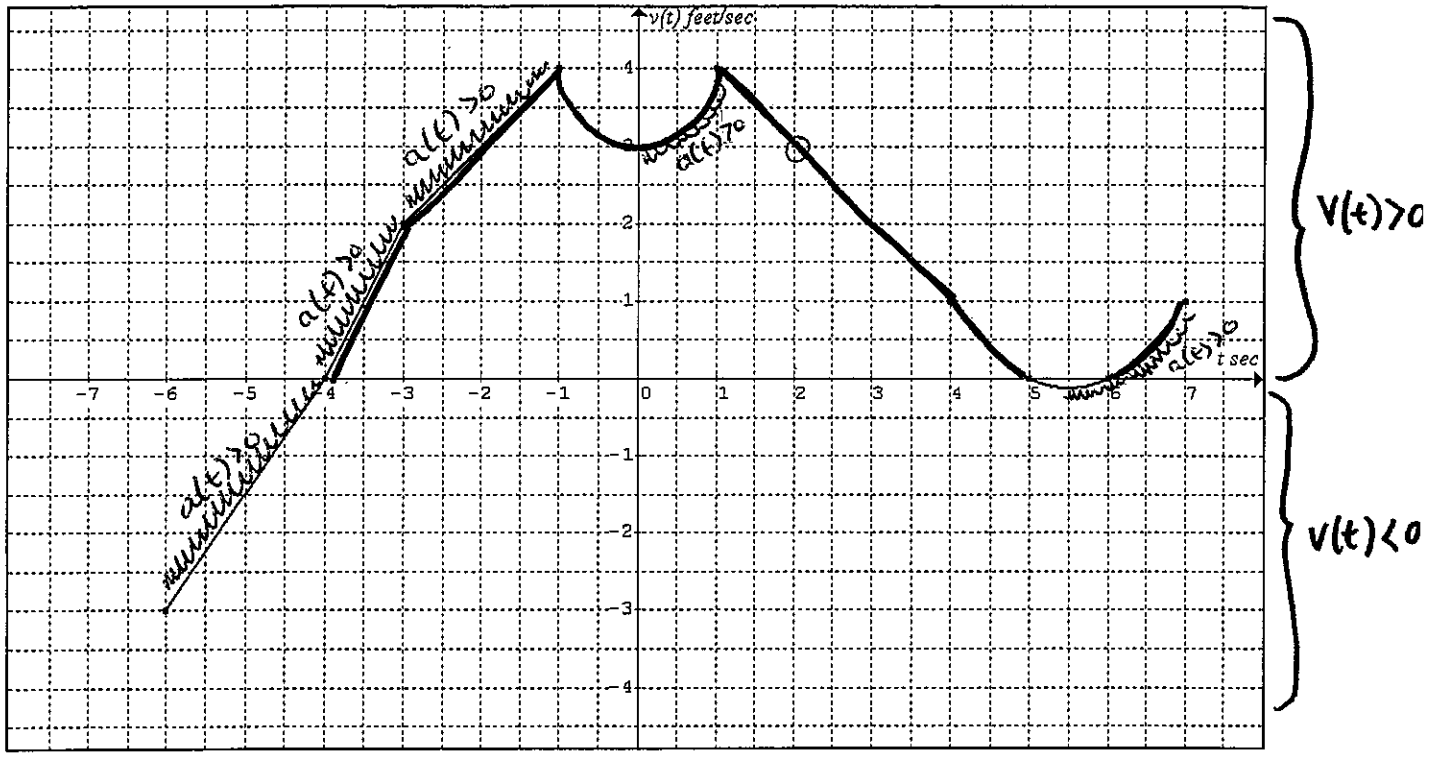
HW Solutions

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



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!
($v<0, a>0$) ($v>0, a<0$) ($v>0, a<0$) ($v>0, a<0$) ($v<0, a>0$)

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

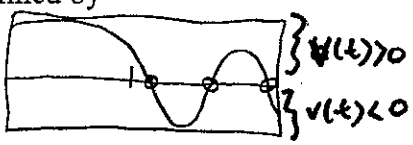
G. What are the velocity and acceleration at time $t = 0$?

$v(0) = 3$ ← 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 $v(t) = \cos(t^3)$ for $0 < t < 2$.
TECHOLOGY REQUIRED:



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

The particle is standing still at $t = 1.162, 1.677, 1.988$ b/c $v(t) = 0$ at these t-values

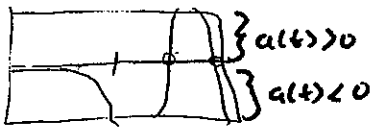
B. On what interval is the particle moving right? Justify.

The particle is moving right on $(0, 1.162) \cup (1.677, 1.988)$ b/c $v(t) > 0$ on this interval

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

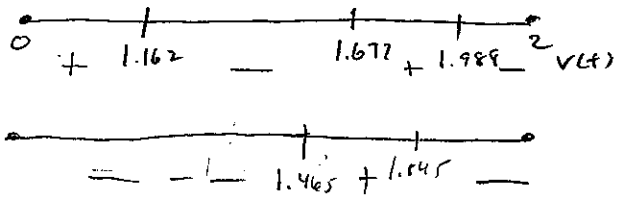
The particle is moving left on $(1.162, 1.677) \cup (1.988, 2)$ b/c $v(t) < 0$ on this interval

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

HW Solutions

6. The position of a particle moving along a horizontal coordinate axis is defined by $s(t) = -\frac{2t^3}{3} + \frac{5t^2}{2} - 3t - 1$ for $0 < t < 2$. NO TECHOLOGY:

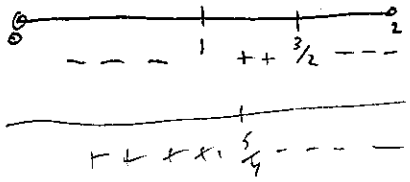
A. At what time on the interval (0,2) is the particle standing still? Justify.

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

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

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

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



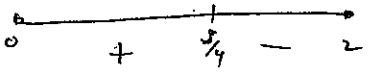
The particle is moving to the right on $(1, 3/2)$ b/c $v(t) > 0$ on this interval.

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

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

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

$a(t) = v'(t) = -4t + 5 = 0 \quad t = 5/4$



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

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

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

- on $(0,1)$: $v < 0$ and $a > 0$
- on $(5/4, 3/2)$: $v > 0$ and $a < 0$

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

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

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

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