Particle Motion Worksheet Answers

1. (a) $3t^2 - 24t + 36, \ -9\text{m/sec}$

(b) At rest at $t = 2$ because $v(t) = 0$ there. Moving right for [0, 2) and $(6, \infty)$ because $v(t) > 0$.

Moving left for (2, 6) because $v(t) < 0$.

(c) 32 meters

(d) 96 meters

(e) $6t - 24, \ -6\text{m/sec}^2$

(f) Graph

(g) Speeding up on (2, 4) because vel. and acc. are both neg. there and on $(6, \infty)$ because vel. and acc. are both pos. there. Slowing down on [0. 2) because vel. is pos. and acc. is neg. and on (4, 6) because vel. is neg. and acc. is pos.

2. D

3. (a) Moving left on (2, 3) and (5, 6) because $v(t) < 0$. Moving right on (0, 1) because $v(t) > 0$.

Standing still on (1, 2) and (3, 5) because $v(t) = 0$ there.

(b) 0, - 4, 0, dne because graph of s has a sharp turn there

(c) and (d) Graphs

4. (2005 AB 5)

(a) $v'(4)$ does not exist because the graph of $v(t)$ has a sharp turn at $t = 4$.

$$v'(20) = -\frac{5}{2}\text{m/sec}^2.$$

$$\text{(b)} \ a(t) = \begin{cases} 5, \ 0 < t < 4 \\ 0, \ 4 < t < 16 \\ -\frac{5}{2}, \ 16 < t < 24 \end{cases}$$

(c) Ave. rate of change = $-\frac{5}{6}\text{m/sec}^2$. No, the MVT does not apply for $8 < c < 20$ because the graph of $v(t)$ is not differentiable at $t = 16$.

5. (2009 Form B, Problem 6)

(a) $\frac{11}{8}\frac{\text{m}}{\text{sec}^2}$

(b) The particle changes direction on (8, 20) because $v(8) = 5$ and $v(20) = -10$. The particle also changes direction on (32, 40) because $v(32) = -4$ and $v(40) = 7$.

(c) $v(t)$ must equal $-9\frac{\text{m}}{\text{sec}}$ at least two times on (0, 40). Since $v(t)$ is differentiable, it must be continuous. $v(8) = 5, \ v(20) = -10,$ and -9 lies between 5 and – 10 so $v(t)$ must equal – 9 for some t between 8 and 20. Similarly, since $v(20) = -10, \ v(25) = -8,$ and -9 lies between – 10 and – 8 so $v(t)$ must equal – 9 for some t between 20 and 25 by the IVT.

6. $a(0.45018...) = 2.435\,\text{m/sec}^2$

7. 1.600 $\frac{\text{m}}{\text{sec}}$, 0.730 $\frac{\text{m}}{\text{sec}}$

8. (2017 AB 5)

(a) The particle is moving left on [0, 1) since $v_P(t) < 0$

(b) Both particles move in the same direction for $1 < t < 3$ and $5 < t \le 8$ since $v_P(t)$ and $v_Q(t)$ have the same sign on these intervals.

(c) $a_Q(2) = -4$; At time $t = 2$, the speed of the particle is decreasing because velocity and acceleration have opposite signs.

9. (a) 0.714

(b) The particle changes direction at t = 1 and at t = 2 because $v(t)$ changes from positive to negative or vice versa there. The particle travels to the left on (1, 2) because $v(t) < 0$ there.

(c) 0.929

10. 106.1087