AP CALCULUS   Name _____
INTRO TO PARTICLE MOTION PRACTICE   (No calculator!)

1) A particle travels along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = t^3 - 9t^2 + 24t + 2$. For what value(s) of t is the velocity equal to zero?

A) $t = 4$, only
B) $t = 2$, only
C) $t = 0$ and $t = 3$
D) $t = 3$, only
E) $t = 2$ and $t = 4$

2) A particle moves on the x-axis so that its position is given by $x(t) = t^4 - 6t^2 + 8$ for $t \geq 0$. For what times t is the velocity of the particle increasing?

A) $t > 0$
B) $0 < t < \sqrt{3}$
C) $t > \sqrt{3}$
D) $0 < t < 1$
E) $1 < t < \sqrt{3}$

3) The position of a particle moving on a horizontal axis for time t, where $t \geq 0$, is $S(t) = 3 \sin \frac{1}{2} t + 1$. What is the average velocity of the particle for $0 \leq t \leq \frac{3\pi}{2}$?

A) $\dfrac{\pi}{\sqrt{2}}$
B) $\dfrac{\sqrt{2}}{\pi}$
C) $\dfrac{3\sqrt{2}}{\pi}$
D) $\dfrac{-\sqrt{2}}{\pi}$
E) $-\dfrac{\pi}{\sqrt{2}}$

4) What is the maximum acceleration of a particle on the interval $0 \leq t \leq 3$ if its position is given by $s(t) = t^4 - 4t^3$?

A) 36
B) -16
C) 0
D) -12
E) 24

5) The table below shows the position of a particle, S, at various times, t, as it moves along a straight line.

t (sec)	1.0	1.4	1.8	2.2	2.6
s (ft)	6.0	7.0	10.0	15.0	21.0

What is an estimated value of the velocity of the particle at time $t = 2$?

A) 15 ft/sec
B) 12.5 ft/sec
C) 20 ft/sec
D) 10 ft/sec
E) 5 ft/sec

6) If the position of a particle moving on the x-axis at any time t is given by $x(t) = 2t^3 - 3t^2$, what is the average acceleration of the particle for $0 \leq t \leq 3$?

A) 15
B) 18
C) 8
D) 9
E) 12

7) A particle moves along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = 2t + \sin(\pi t)$. What is the acceleration of the particle at time $t = \frac{3}{2}$?

A) $-\pi^2$
B) 2
C) π
D) π^2
E) 0

8) A particle moves along the x-axis so that is position at any time t is given by $x(t) = t^3 - 6t^2 + 9t + 12$. During what times is the speed of the particle increasing?

A) $t < 1$ or $2 < t < 3$
B) $1 < t < 2$ or $t > 3$
C) $t < 2$ or $t > 3$
D) $1 < t < 3$
E) $t < 1$ or $t > 3$

9) A particle moves along a coordinate line so that its position is given by $S(t) = 2 \sin \frac{1}{2}t + \frac{1}{2} \cos 2t$ for $0 \le t \le 2\pi$. What is the acceleration of the particle at $t = \pi$?

A) $-\frac{3}{2}$
B) $-\frac{1}{2}$
C) 1
D) $-\frac{5}{2}$
E) $\frac{5}{2}$

10) A particle moves along the x-axis in such a way that its position at any time t is given by $x(t) = t^4 - 8t^3 + 18t^2 + 2$ for $t > 0$. At what time is acceleration of the particle equal to 36?

A) 3
B) 4
C) 12
D) 6
E) 2

11) A particle moves on the x-axis such that its position at any time $t > 0$ is given by $x(t) = t^3 - 9t^2 + 24t$. What is the velocity of the particle when its acceleration is zero?

A) 105
B) 24
C) -3
D) 3
E) 0

12) A particle moves along a horizontal axis so that its position is defined by $S(t) = 4 \cos \frac{\pi}{2}t$ for $0 \le t \le 5$. What is the velocity of the particle at the time its acceleration is first equal to zero?

A) 2π
B) -2π
C) -4π
D) 4π
E) $-\pi^2$

13) A particle moves along a horizontal coordinate line so that its position at time t, $0 \le t \le 4$ is given by $S(t) = t^4 - \frac{16}{3}t^3 + 8t^2 + 1$. For what times t is the velocity of the particle decreasing?

A) $\frac{2}{3} < t < 2$
B) $t > \frac{2}{3}$
C) $0 < t < 2$
D) $0 < t < 4$
E) $2 < t < 4$

14) The table below shows velocity of a particle at various times t of a particle that moves along a horizontal line.

t (sec)	0.5	1.0	1.5	2.0
v (m/sec)	8.3	9.2	9.8	10.6

What is an approximate value of the acceleration of the particle at time $t = 2$?

A) 1.2 ft/sec^2
B) -0.8 ft/sec^2
C) 1.6 ft/sec^2
D) -1.6 ft/sec^2
E) 1.8 ft/sec^2