Calculus Name_____

Particle Motion #1

A particle moves along a horizontal line. Its position function is $s(t)$ for $t \geq 0$. For each problem, find the times t when the particle changes directions.

1) $s(t) = t^3 - 12t^2$

2) $s(t) = -t^3 + 4t^2 + 60t$

3) $s(t) = -t^3 + 11t^2 - 24t$

4) $s(t) = -t^4 + 14t^3$

A particle moves along a horizontal line. Its position function is $s(t)$ for $t \geq 0$. For each problem, find the intervals of time when the particle is moving left and moving right.

5) $s(t) = -t^3 + 15t^2$

6) $s(t) = t^3 - 22t^2 + 121t$

7) $s(t) = t^3 - 23t^2 + 120t$

8) $s(t) = t^3 - 10t^2$

A particle moves along a horizontal line. Its position function is $s(t)$ for $t \geq 0$. For each problem, find the velocity and acceleration at the given value for t.

9) $s(t) = -t^3 + 14t^2$; at $t = 3$

10) $s(t) = -t^3 + 4t^2 + 60t$; at $t = 6$

11) $s(t) = -t^3 + t^2 + 56t$; at $t = 4$

12) $s(t) = t^3 - 11t^2$; at $t = 2$

Answers to Particle Motion #1

1) Changes direction at: $t = \{8\}$

2) Changes direction at: $t = \{6\}$

3) Changes direction at: $t = \left\{\frac{4}{3}, 6\right\}$

4) Changes direction at: $t = \left\{\frac{21}{2}\right\}$

5) Moving left: $t > 10$, Moving right: $0 < t < 10$

6) Moving left: $\frac{11}{3} < t < 11$, Moving right: $0 \le t < \frac{11}{3}$, $t > 11$

7) Moving left: $\frac{10}{3} < t < 12$, Moving right: $0 \le t < \frac{10}{3}$, $t > 12$

8) Moving left: $0 < t < \frac{20}{3}$, Moving right: $t > \frac{20}{3}$

9) $v(3) = 57$, $a(3) = 10$

10) $v(6) = 0$, $a(6) = -28$

11) $v(4) = 16$, $a(4) = -22$

12) $v(2) = -32$, $a(2) = -10$