HW 3

1. A particle moves along the x-axis so that its velocity v at time t, for $0 \le t \le 5$, is given by $v(t) = \ln(t^2 - 3t + 3)$.

A. Find the acceleration of the particle at time $t = 4$.
B. Is the particle speeding up or slowing down at $t = 4$? Explain.
C. Find all times t in the open interval $0 < t < 5$ at which the particle changes direction. During which time intervals, for $0 \le t \le 5$, does the particle travel to the left?
D. Find the average acceleration of the particle over the interval $0 \le t \le 2$.

A particle moves along the y-axis so that its velocity v at time $t \ge 0$ is given by $v(t) = 1 - \tan^{-1}(e^t)$. At time $t = 0$, the particle is at $y = -1$.

A. Find the acceleration of the particle at time $t = 2$.
B. Is the speed of the particle increasing or decreasing at time $t = 2$? Give a reason for your answer.
C. Find the time $t \ge 0$ at which the particle reaches its highest point. Justify your answer.

A particle moves along the x-axis so that its velocity at any time t is given by $v(t) = -(t+1)\sin\left(\frac{t^2}{2}\right)$.

A. Find the acceleration of the particle at $t = 2$. Is the speed of the particle increasing at $t = 2$? Why or why not?
B. Find all times in the interval $0 \le t \le 3$ when the particle changes direction. Justify your answer.
C. If the particle starts at the origin at $t = 0$, on which side of the origin will the particle be at $t = 2$? Justify your answer.

A particle moves along the x-axis so that its velocity at any time t, for $0 \le t \le 16$, is given by $v(t) = e^{2\sin t} - 1$. At time $t = 0$, the particle is at the origin.

A. At what time is the particle at rest? Justify your answer.
B. During what intervals of time is the particle moving to the left? Give a reason for your answer.
C. What is the acceleration of the particle at time $t = 2$? Is the particle's speed increasing or decreasing at time $t = 2$? Justify your answer.

An object moves along the x-axis with initial position $x(0) = 2$. The velocity of the object at time $t \ge 0$ is given by $v(t) = \sin\left(\frac{\pi}{3}t\right)$.

A. What is the acceleration of the object at time $t = 4$?
B. Consider the following two statements.

Statement I: For $3 < t < 4.5$, the velocity of the object is decreasing.
Statement II: For $3 < t < 4.5$, the speed of the object is increasing.

Are either or both of these statements correct? For each statement provide a reason why it is correct or not correct.

A particle moves along the x-axis in such a way that its position at time t for $t \geq 0$ is given by $p(t) = \frac{1}{3}t^3 - 3t^2 + 8t$.

a) Show that at time t = 0 the particle is moving to the right.
b) Find all values of t for which the particle is moving to the left.
c) What is the position of the particle at time t = 3?
d) When t = 3, what is the total distance the particle has traveled?

2.

A particle moves on the x-axis in such a way that its position at time t is given by $p(t) = (2t-1)(t-1)^2$.

a) At what times t is the particle at rest? Justify your answer.
b) During what interval of time is the particle moving to the left? Justify your answer.
c) At what time during the interval found in (b) is the particle moving most rapidly (that is, the speed is a maximum)? Justify your answer.

3.

A particle moves along the x-axis so that at time t its position is given by $p(t) = t^3 - 6t^2 + 9t + 11$.

a) What is the velocity of the particle at t = 0?
b) During what time intervals is the particle moving to the left?
c) What is the total distance traveled by the particle from t = 0 to t = 2?
d) For what values of t is the speed increasing?

4.

A particle starts at time t = 0 and moves on a number line so that its position at time t is given by $p(t) = (t-2)^2(t-6)$.

a) When is the particle moving to the right?
b) When is the particle at rest?
c) When does the particle change direction?
d) What is the farthest to the left of the origin that the particle moves?