Advanced Calculus

AB.Q403.REVIEW ASSESSMENT (Part E)

PARTICLE MOVEMENT (VELOCITY)

(20 points)

CALCULATORS PERMITTED

[**Decimal Answers – Round to Three Decimal Places**]

NAME:

DATE:

BLOCK:

I (*print name*)_____ certify that I wrote **all** marks made in this assessment. I did not write **anything** that I do not fully understand. I would now, having completed this assessment, be able to make similar (but equally accurate) responses if asked complete the same exact assessment on my own.

Signature:

1. A particle moves up and down along the *y*-axis. This particle has position $y = -4$ at $t = 0$ seconds. The velocity of the particle is defined as $v(t) = t \cdot \tan^{-1}(t) - t^2 + 2t + 2$ m/s.

A. What is the acceleration of the particle at $t = 2$?

B. Find all values of *t* on $0 < t < 5$ where in instantaneous velocity is equal to the average velocity over the interval $0 < t < 5$. Justify.

C. For what value(s) of *t* on $0 < t < 5$ is the speed of the particle equal to 2? Justify.

D. What is the position of the particle at $t = 3$? Is the particle moving up or down the *y*-axis at this time? Justify.

E. What is the position of the particle at $t = 6$? Is there some time on $0 < t < 6$ for which the particle will be at the same position in started? Justify your answer?

2. A particle moves left and right long the *x*-axis. The particle has a velocity of 5 when $t = 0$. The acceleration of the particle is defined as $a(t) = -3t - 10\sin(t^2 - t)$.

What is the velocity of the particle at time $t = 2$? Is the particle speeding up or slowing down at $t = 2$? Justify your answer.

What is the velocity of the particle at time $t = -2$? Is the particle speeding up or slowing down at $t = -2$? Justify your answer.

3. At time $t = 0$, particle **Q** starts at $x = 3.5$ and moves horizontally along the line $y = 2$ with a constant velocity of $q(t) = 0.4912$ m/s.

At time $t = 0$, particle **P** starts at $x = 2.5$ and moves horizontally along the *x*-axis with a velocity of $p(t) = 2 + t - t\ln(t+1)$ m/s.

The distance between particle **P** and particle **Q** at $t = 0$ is $\sqrt{5}$ m.

Keep $q(t) = 0.4912$ *but round decimal answers to three decimal places.*

A. Find the total distance traveled by each particle on $0 \le t \le 6$.

B. What is the distance between particle **P** and particle **Q** at time $t = 6$ seconds.

C. What is the rate of change in the distance between the two particles at time $t = 6$ seconds?

4. A particle starts at $x = 6$ and moves along the x-axis. Its velocity, in feet per second, was recorded at several times as shown in the chart below. Note: v is a differentiable function of t.

t (seconds)	$v(t)$ (feet per second)
0	10
3	4
5	-1
10	-2
12	9

A. Approximate $\int_0^{12} |v(t)|dt$ using a trapezoidal sum with 4 intervals. Using correct units, explain the meaning of the integral.

B. Approximate the acceleration of the particle at $t = 3.7$ seconds. Indicate the units.

C. Find the average acceleration of the particle over the interval $0 \le t \le 12$.

D. Based on the values in the table, what is the smallest number of instances at which the acceleration of the particle could equal zero on the open interval $0 < t < 12$. Justify.