

Activity –Motion Along a Line (Using Technology)

Instructions:

Write the set up for each part of a problem using correct notation. When your group has reached consensus on your **Set-Up** for the first problem and I have approved, then calculate on your calculator. Remember to write your calculated value correct to three decimal places, rounded or truncated. Make sure each of you practices with the calculator. You may move to the next problem when I have checked your work. Do one problem at a time.

A good organization for your white board might be:

	Your Set Up:	Your Response:
a) b) c) d)		

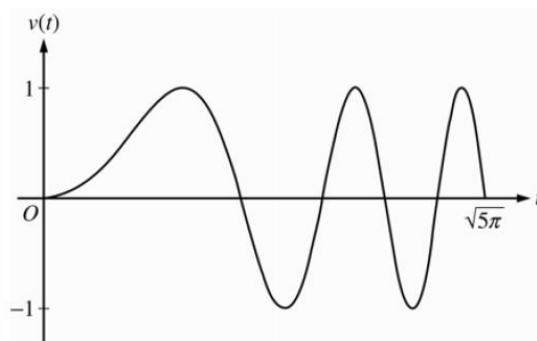
Problem 1

A particle moves along the x -axis so that its velocity v at time t , for $t \geq 0$, is given by

$$v(t) = \frac{7t - 3t^2}{1 + t^3}. \text{ The particle is at position } x = -3 \text{ at time } t = 2.$$

a)	Find the acceleration at time $t = 2$.
b)	Find the displacement of the particle from $t = 0$ to $t = 5$.
c)	Find the position of the particle at time $t = 5$.
d)	Find the total distance traveled from $t = 0$ to $t = 5$.

Problem 2



A particle moves along the x -axis so that its velocity v at time $t \geq 0$ is given by $v(t) = \sin(t^2)$.

The graph of v is shown above for $0 \leq t \leq \sqrt{5\pi}$. The position of the particle at time t is $x(t)$ and its position at time $t = 0$ is $x(0) = 5$.

a)	Find the acceleration at time $t = 3$.
b)	Find the total distance traveled from $t = 0$ to $t = 3$.
c)	Find the position of the particle at time $t = 3$.
d)	Find the displacement of the particle from $t = 0$ to $t = \sqrt{5\pi}$.

Problem 3

For $0 \leq t \leq 6$, a particle is moving along the x -axis. The particle's position, $x(t)$, is not explicitly given. The velocity of the particle is given by $v(t) = 2\sin(e^{t/4}) + 1$. The acceleration of the particle is given by $a(t) = \frac{1}{2}e^{t/4}\cos(e^{t/4})$ and $x(0) = 2$.

a)	Is the speed of the particle increasing or decreasing at time $t = 5.5$? Give a reason for your answer.
b)	Find the average velocity of the particle for the time period $0 \leq t \leq 6$.
c)	Find the total distance traveled by the particle from time $t = 0$ to $t = 6$.
d)	Find the position of the particle at time $t = 6$.

Problem 4

A particle moves along a straight line. For $0 \leq t \leq 5$, the velocity of the particle is given by $v(t) = -2 + (t^2 + 3t)^{6/5} - t^3$, and the position of the particle is given by $s(t)$. It is known that $s(0) = 10$.

a)	Find all values of t in the interval $2 < t < 4$ for which the speed of the particle is 2.
b)	Find the position of the particle at time $t = 5$.
c)	Find the displacement of the particle from $t = 0$ to $t = 5$.
d)	Is the speed of the particle increasing or decreasing at time $t = 4$? Give a reason for your answer.

Student Answer: 1a $a(2) = v'(2)$ $= -\frac{23}{27} = -0.852 \text{ } (-0.851)$	Student Answer: 1b Displacement $= \int_0^5 v(t) dt$ $= 2.231 \text{ } (2.230)$
Student Answer: 1c $x(5) = x(2) + \int_2^5 v(t) dt$ $-3 + \int_2^5 v(t) dt = -3.638$	Student Answer: 1d Total Distance $= \int_0^5 v(t) dt$ $= 3.576 \text{ } (3.575)$
Student Answer: 2a $a(3) = v'(3)$ $= 6 \cos 9 = -5.467 \text{ } (-5.466)$	Student Answer: 2b Total Distance $= \int_0^3 v(t) dt$ $= 1.702$
Student Answer: 2c $x(3) = x(0) + \int_0^3 v(t) dt$ $= 5 + \int_0^3 v(t) dt = 5.774 \text{ } (5.773)$	Student Answer: 2d Displacement $= \int_0^{\sqrt{5\pi}} v(t) dt$ $= 0.752$
Student Answer: 3a $v(5.5) = a(5.5) =$ $v(5.5) = -0.453 \quad a(5.5) = -1.358$ speed increases; same sign	Student Answer: 3b Average velocity $= \frac{1}{6-0} \int_0^6 v(t) dt$ $= 1.949$
Student Answer: 3c Total Distance $= \int_0^6 v(t) dt$ $= 12.573$	Student Answer: 3d $x(7) = x(0) + \int_0^6 v(t) dt$ $= 2 + \int_0^6 v(t) dt = 13.696$
Student Answer: 4a Solve $ v(t) = 2$ $t = 3.128 \text{ } (3.127)$ and $t = 3.473$	Student Answer: 4b $s(5) = s(0) + \int_0^5 v(t) dt$ $= 10 + \int_0^5 v(t) dt = -9.207$
Student Answer: 4c Displacement $= \int_0^5 v(t) dt$ $= -19.207$	Student Answer: 4d $v(4) = a(4) =$ $v(4) = -11.475 \quad a(2) = -22.295$ speed increases; same sign

Note: Problem 1 is a newly written sample FRQ
Problem 2 is a modification of 2007 AB 2 Form B
Problem 3 is a modification of 2011 AB 1
Problem 4 is a modification of 2013 AB 2