ALLIANCE: Q2

AP CALCULUS AB FRQ SCORING GUIDELINES

QUESTION 1

A particle is moving along the x-axis for $0 \le t \le 2$. The particle's position, $x(t)$, is not given. The particle's velocity is given by the function $v(t) = \sin(t^2 - 0.5t) - 0.75$.

(a) What is the acceleration of the particle at $t = 1.5$?
(b) Is the speed of the particle increasing or decreasing at time $t = 1.8$? Give a reason for your answer.
(c) For $0 \le t \le 2$, at what value(s) of t does the particle change direction?
(d) For $0 \le t \le 2$, in what time interval(s) is the particle's speed decreasing? Show the reasoning that lead to your answer.

(a) $a(t) = v'(t)$, $a(1.5) = 0.17684$	1 : answer
(b) $v(1.8) = -0.03153$ (or -0.03154), $a(1.8) = -2.15624$ (or -2.15625) The speed is increasing at time $t = 1.8$, because velocity and acceleration have the same sign (or are both negative).	2 : {1 : conclusion; 1 : reason}
(c) $v(t) = 0$ when $t = 1.204$, and when $t = 1.784$ (or 1. 785). $v(t)$ changes sign from negative to positive at time $t = 1.204$. $v(t)$ changes sign from positive to negative at time $t = 1.784$. So, the particle changes direction at $t = 1.204$ and at $t = 1.784$.	2 : {1 : considers $v(t) = 0$; 1 : both time values}
(d) $a(t) = 0$ when $t = 0.25$, and when $t = 1.528$. $a(t)$ changes sign from negative to positive at time $t = 0.25$. $a(t)$ changes sign from positive to negative at time $t = 1.528$. The speed of the particle is decreasing in the time intervals (0.25, 1.204) and (1.528, 1.784), because both velocity and acceleration have different signs in those time intervals.	4 : {1 : the interval (0.25, 1.204); 1 : the interval (1.528, 1.784); 2 : analysis}