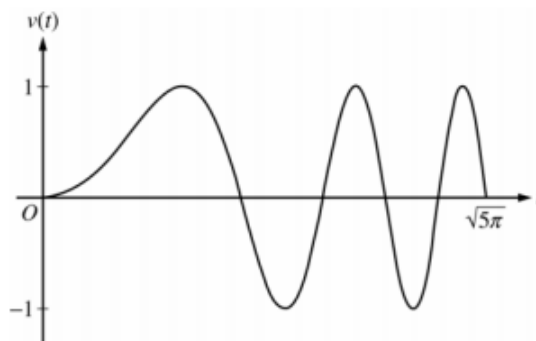


2007 AP Calculus AB FRQ (Form B) Question 2

Calculator - In Class

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 $x(0) = 5$.

- Find the acceleration of the particle at time $t = 3$.
- Find the total distance traveled by the particle from time $t = 0$ to $t = 3$.
- Find the position of the particle at time $t = 3$.
- For $0 \leq t \leq \sqrt{5\pi}$, find the time t at which the particle is farthest to the right. Explain your answer.



2004 AP Calculus AB FRQ (Form A) Question 3

Calculator - In Class

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

At time $t = 0$, the particle is at $y = -1$. (Note: $\tan^{-1} x = \arctan x$)

- (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 $t \geq 0$ at which the particle reaches its highest point. Justify your answer.
- (d) Find the position of the particle at time $t = 2$. Is the particle moving toward the origin or away from the origin at time $t = 2$? Justify your answer.

2006 AP Calculus AB FRQ (Form B) Question 6

No Calculator - HW Not Timed

t (sec)	0	15	25	30	35	50	60
$v(t)$ (ft/sec)	-20	-30	-20	-14	-10	0	10
$a(t)$ (ft/sec ²)	1	5	2	1	2	4	2

A car travels on a straight track. During the time interval $0 \leq t \leq 60$ seconds, the car's velocity v , measured in feet per second, and acceleration a , measured in feet per second per second, are continuous functions. The table above shows selected values of these functions.

- (a) Using appropriate units, explain the meaning of $\int_{30}^{60} |v(t)| dt$ in terms of the car's motion. Approximate

$\int_{30}^{60} |v(t)| dt$ using a trapezoidal approximation with the three subintervals determined by the table.

- (b) Using appropriate units, explain the meaning of $\int_0^{30} a(t) dt$ in terms of the car's motion. Find the exact value

of $\int_0^{30} a(t) dt$.

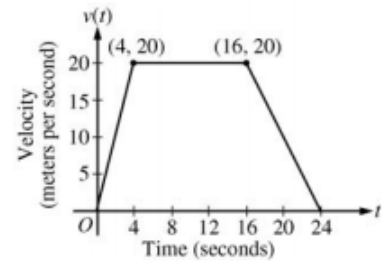
- (c) For $0 < t < 60$, must there be a time t when $v(t) = -5$? Justify your answer.

- (d) For $0 < t < 60$, must there be a time t when $a(t) = 0$? Justify your answer.

2005 AP Calculus AB FRQ (Form A) Question 5

No Calculator - HW Timed 15 minutes

A car is traveling on a straight road. For $0 \leq t \leq 24$ seconds, the car's velocity $v(t)$, in meters per second, is modeled by the piecewise-linear function defined by the graph above.



- (a) Find $\int_0^{24} v(t) dt$. Using correct units, explain the meaning of $\int_0^{24} v(t) dt$.
- (b) For each of $v'(4)$ and $v'(20)$, find the value or explain why it does not exist. Indicate units of measure.
- (c) Let $a(t)$ be the car's acceleration at time t , in meters per second per second. For $0 < t < 24$, write a piecewise-defined function for $a(t)$.
- (d) Find the average rate of change of v over the interval $8 \leq t \leq 20$. Does the Mean Value Theorem guarantee a value of c , for $8 < c < 20$, such that $v'(c)$ is equal to this average rate of change? Why or why not?

2003 AP Calculus AB FRQ (Form A) Question 2

Calculator - HW Timed 15 minutes

A particle moves along the x -axis so that its velocity at time t is given by

$$v(t) = -(t+1)\sin\left(\frac{t^2}{2}\right).$$

At time $t = 0$, the particle is at position $x = 1$.

- Find the acceleration of the particle at time $t = 2$. Is the speed of the particle increasing at $t = 2$? Why or why not?
- Find all times t in the open interval $0 < t < 3$ when the particle changes direction. Justify your answer.
- Find the total distance traveled by the particle from time $t = 0$ until time $t = 3$.
- During the time interval $0 \leq t \leq 3$, what is the greatest distance between the particle and the origin? Show the work that leads to your answer.