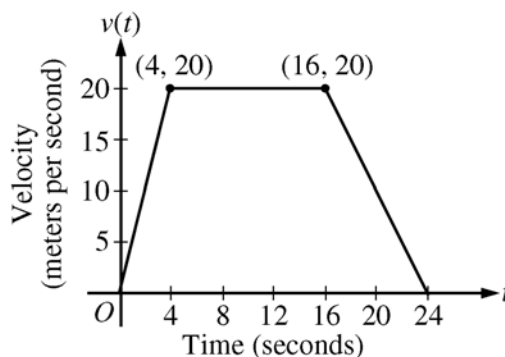


2005 AP[®] CALCULUS AB FREE-RESPONSE QUESTIONS

5. 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?
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WRITE ALL WORK IN THE TEST BOOKLET.