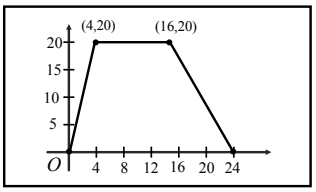
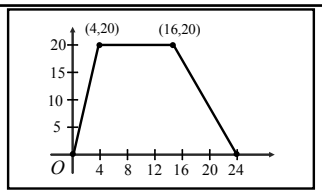
AP Test Question 2005 No Calculator Allowed

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



a) Find $\int_0^{24} v(t)dt$. Using correct units, explain the meaning of $\int_0^{24} v(t)dt$.

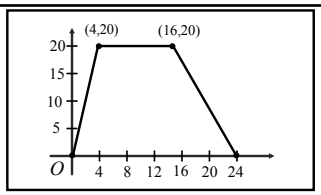
360 m, which is the total distance traveled in meters during the 24 seconds.



b) For each of $v'(4)$ and $v'(20)$, find the value or explain why it does not exist. Indicate units of measure.

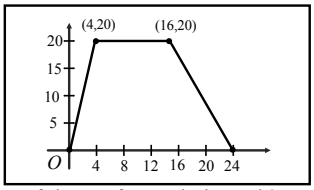
$v'(4)$ is undefined because it is not a smooth curve at that point.

$v'(20) = -\frac{5}{2}$ m/sec^2



c) Let $a(t)$ be the car's acceleration at time t, in meters per second. For $0 < t < 24$, write a piecewise-defined function for $a(t)$.

$$a(t) = \begin{cases} 5, & 0 < t < 4 \\ 0, & 4 < t < 16 \\ -\frac{5}{2}, & 16 < t < 24 \end{cases}$$



d) Find the average rate of change of v over the interval $8 \le t \le 20$. 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?

$-\frac{5}{6}$ m/sec

no, because $v'(t)$ is not differentiable at time $t = 16$ sec.