

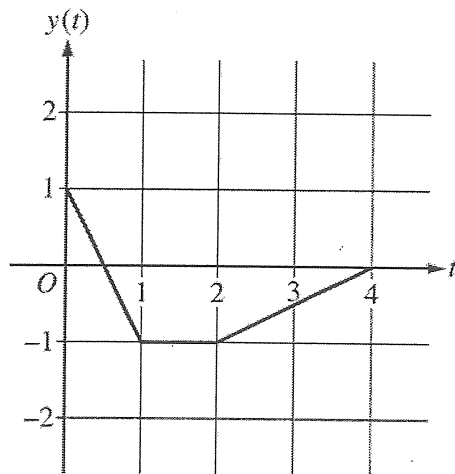
2016 AP[®] CALCULUS AB FREE-RESPONSE QUESTIONS

2. For $t \geq 0$, a particle moves along the x -axis. The velocity of the particle at time t is given by

$$v(t) = 1 + 2 \sin\left(\frac{t^2}{2}\right). \text{ The particle is at position } x = 2 \text{ at time } t = 4.$$

- At time $t = 4$, is the particle speeding up or slowing down?
 - Find all times t in the interval $0 < t < 3$ when the particle changes direction. Justify your answer.
 - Find the position of the particle at time $t = 0$.
 - Find the total distance the particle travels from time $t = 0$ to time $t = 3$.
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2. At time t , the position of a particle moving in the xy -plane is given by the parametric functions $(x(t), y(t))$, where $\frac{dx}{dt} = t^2 + \sin(3t^2)$. The graph of y , consisting of three line segments, is shown in the figure above. At $t = 0$, the particle is at position $(5, 1)$.
- Find the position of the particle at $t = 3$.
 - Find the slope of the line tangent to the path of the particle at $t = 3$.
 - Find the speed of the particle at $t = 3$.
 - Find the total distance traveled by the particle from $t = 0$ to $t = 2$.
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x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	-6	3	2	8
2	2	-2	-3	0
3	8	7	6	2
6	4	5	3	-1

6. The functions f and g have continuous second derivatives. The table above gives values of the functions and their derivatives at selected values of x .

(a) Let $k(x) = f(g(x))$. Write an equation for the line tangent to the graph of k at $x = 3$.

(b) Let $h(x) = \frac{g(x)}{f(x)}$. Find $h'(1)$.

(c) Evaluate $\int_1^3 f''(2x) dx$.
