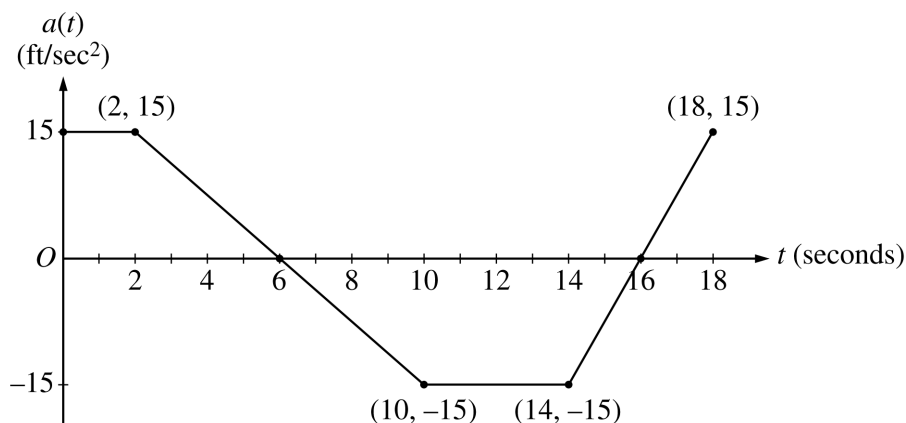


2001 AP[®] CALCULUS BC FREE-RESPONSE QUESTIONS



3. A car is traveling on a straight road with velocity 55 ft/sec at time $t = 0$. For $0 \leq t \leq 18$ seconds, the car's acceleration $a(t)$, in ft/sec^2 , is the piecewise linear function defined by the graph above.
- (a) Is the velocity of the car increasing at $t = 2$ seconds? Why or why not?
 - (b) At what time in the interval $0 \leq t \leq 18$, other than $t = 0$, is the velocity of the car 55 ft/sec? Why?
 - (c) On the time interval $0 \leq t \leq 18$, what is the car's absolute maximum velocity, in ft/sec, and at what time does it occur? Justify your answer.
 - (d) At what times in the interval $0 \leq t \leq 18$, if any, is the car's velocity equal to zero? Justify your answer.
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END OF PART A OF SECTION II

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CALCULUS BC SECTION II, Part B

Time—45 minutes

Number of problems—3

No calculator is allowed for these problems.

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4. Let h be a function defined for all $x \neq 0$ such that $h(4) = -3$ and the derivative of h is given by

$$h'(x) = \frac{x^2 - 2}{x} \text{ for all } x \neq 0.$$

- (a) Find all values of x for which the graph of h has a horizontal tangent, and determine whether h has a local maximum, a local minimum, or neither at each of these values. Justify your answers.
- (b) On what intervals, if any, is the graph of h concave up? Justify your answer.
- (c) Write an equation for the line tangent to the graph of h at $x = 4$.
- (d) Does the line tangent to the graph of h at $x = 4$ lie above or below the graph of h for $x > 4$? Why?

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5. Let f be the function satisfying $f'(x) = -3xf(x)$, for all real numbers x , with $f(1) = 4$ and $\lim_{x \rightarrow \infty} f(x) = 0$.

- (a) Evaluate $\int_1^{\infty} -3xf(x)dx$. Show the work that leads to your answer.
 - (b) Use Euler's method, starting at $x = 1$ with a step size of 0.5, to approximate $f(2)$.
 - (c) Write an expression for $y = f(x)$ by solving the differential equation $\frac{dy}{dx} = -3xy$ with the initial condition $f(1) = 4$.
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