

Multiple Choice AP Calculus

Numerical Integration Problems

Years: 1997 to 2008

Hopkins

All of these problems require the use of some numerical (or geometric) approximation of an integral in order to solve for the answer. Remember, that numerical approximations are: left bound, right bound, midpoint, or trapezoidal computations. Geometric approximations require simple geometry area formulas to evaluate an integral.

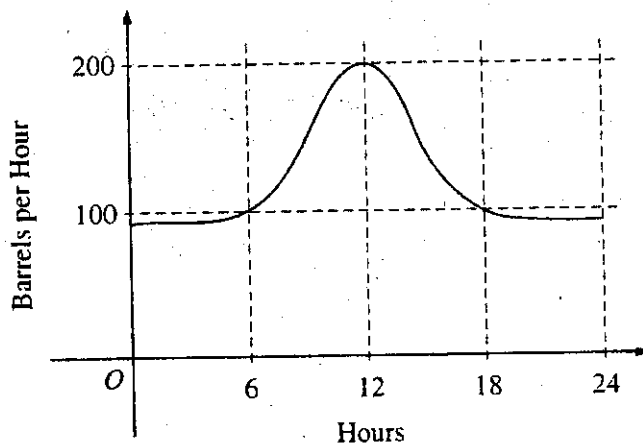
1998 AP Calculus AB:
Section I, Part B

x	2	5	7	8
$f(x)$	10	30	40	20

85. The function f is continuous on the closed interval $[2, 8]$ and has values that are given in the table above. Using the subintervals $[2, 5]$, $[5, 7]$, and $[7, 8]$, what is the trapezoidal approximation of

$$\int_2^8 f(x) dx?$$

- (A) 110 (B) 130 (C) 160 (D) 190 (E) 210



9. The flow of oil, in barrels per hour, through a pipeline on July 9 is given by the graph shown above. Of the following, which best approximates the total number of barrels of oil that passed through the pipeline that day?

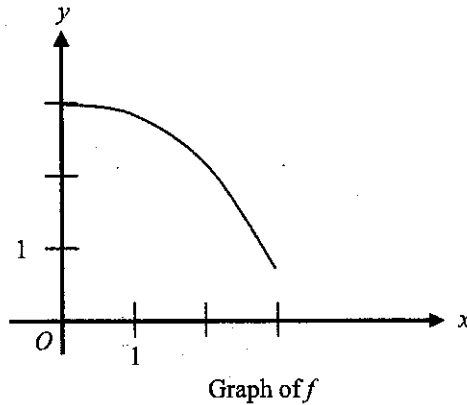
- (A) 500 (B) 600 (C) 2,400 (D) 3,000 (E) 4,800

x	0	0.5	1.0	1.5	2.0
$f(x)$	3	3	5	8	13

89. A table of values for a continuous function f is shown above. If four equal subintervals of $[0, 2]$ are used, which of the following is the trapezoidal approximation of $\int_0^2 f(x) dx$?

- (A) 8 (B) 12 (C) 16 (D) 24 (E) 32

2008



10. The graph of function f is shown above for $0 \leq x \leq 3$. Of the following, which has the least value?

- (A) $\int_1^3 f(x) dx$
- (B) Left Riemann sum approximation of $\int_1^3 f(x) dx$ with 4 subintervals of equal length
- (C) Right Riemann sum approximation of $\int_1^3 f(x) dx$ with 4 subintervals of equal length
- (D) Midpoint Riemann sum approximation of $\int_1^3 f(x) dx$ with 4 subintervals of equal length
- (E) Trapezoidal sum approximation of $\int_1^3 f(x) dx$ with 4 subintervals of equal length

2008

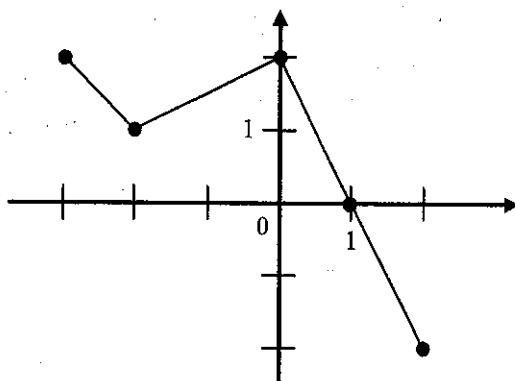
x	-4	-3	-2	-1
$f(x)$	0.75	-1.5	-2.25	-1.5
$f'(x)$	-3	-1.5	0	1.5

85. The table above gives values of a function f and its derivative at selected values of x . If f' is continuous on the interval $[-4, -1]$, what is the value of $\int_{-4}^{-1} f'(x) dx$?

- (A) -4.5
- (B) -2.25
- (C) 0
- (D) 2.25
- (E) 4.5

(2)

2008

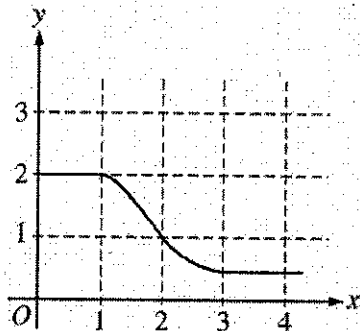


Graph of f

9. The graph of the piecewise linear function f is shown in the figure above. If $g(x) = \int_{-2}^x f(t) dt$, which of the following values is greatest?

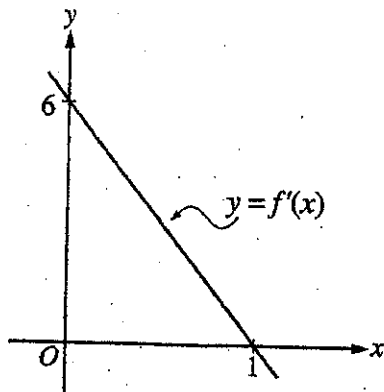
- (A) $g(-3)$ (B) $g(-2)$ (C) $g(0)$ (D) $g(1)$ (E) $g(2)$

1997



78. The graph of f is shown in the figure above. If $\int_1^3 f(x) dx = 2.3$ and $F'(x) = f(x)$, then $F(3) - F(0) =$

- (A) 0.3 (B) 1.3 (C) 3.3 (D) 4.3 (E) 5.3



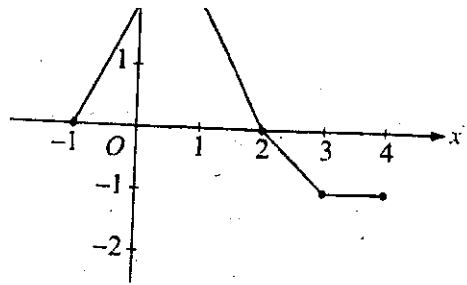
2003

22. The graph of f' , the derivative of f , is the line shown in the figure above. If $f(0) = 5$, then $f(1) =$

- (A) 0 (B) 3 (C) 6 (D) 8 (E) 11

(3)

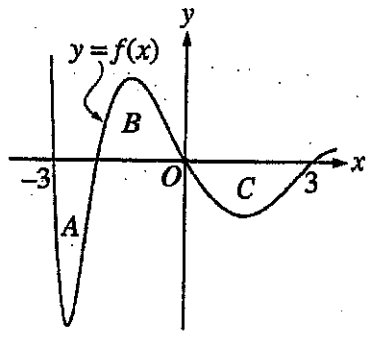
1998



2. The graph of a piecewise-linear function f , for $-1 \leq x \leq 4$, is shown above. What is the value of $\int_{-1}^4 f(x) dx$?

- (A) 1 (B) 2.5 (C) 4 (D) 5.5 (E) 8

2003



77. The regions A , B , and C in the figure above are bounded by the graph of the function f and the x -axis. If the area of each region is 2, what is the value of $\int_{-3}^3 (f(x) + 1) dx$?

- (A) -2 (B) -1 (C) 4 (D) 7 (E) 12

1998 BC

t (sec)	0	2	4	6
$a(t)$ (ft/sec ²)	5	2	8	3

91. The data for the acceleration $a(t)$ of a car from 0 to 6 seconds are given in the table above. If the velocity at $t = 0$ is 11 feet per second, the approximate value of the velocity at $t = 6$, computed using a left-hand Riemann sum with three subintervals of equal length, is

- (A) 26 ft/sec (B) 30 ft/sec (C) 37 ft/sec (D) 39 ft/sec (E) 41 ft/sec