

CALCULUS BC
SECTION I, Part B
Time—50 minutes
Number of questions—17

A GRAPHING CALCULATOR IS REQUIRED FOR SOME QUESTIONS ON THIS PART OF THE EXAMINATION.

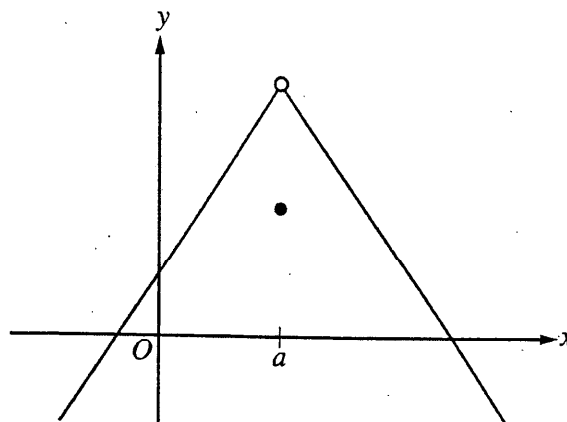
Directions: Solve each of the following problems, using the available space for scratchwork. After examining the form of the choices, decide which is the best of the choices given and fill in the corresponding oval on the answer sheet. No credit will be given for anything written in the test book. Do not spend too much time on any one problem.

BE SURE YOU ARE USING PAGE 3 OF THE ANSWER SHEET TO RECORD YOUR ANSWERS TO QUESTIONS NUMBERED 76-92.

YOU MAY NOT RETURN TO PAGE 2 OF THE ANSWER SHEET.

In this test:

- (1) The exact numerical value of the correct answer does not always appear among the choices given. When this happens, select from among the choices the number that best approximates the exact numerical value.
- (2) Unless otherwise specified, the domain of a function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number.
- (3) The inverse of a trigonometric function f may be indicated using the inverse function notation f^{-1} or with the prefix “arc” (e.g., $\sin^{-1} x = \arcsin x$).

Graph of f

76. The graph of the function f is shown above. Which of the following statements must be false?

- (A) $f(a)$ exists.
- (B) $f(x)$ is defined for $0 < x < a$.
- (C) f is not continuous at $x = a$.
- (D) $\lim_{x \rightarrow a} f(x)$ exists.
- (E) $\lim_{x \rightarrow a} f'(x)$ exists.

77. Let $P(x) = 3x^2 - 5x^3 + 7x^4 + 3x^5$ be the fifth-degree Taylor polynomial for the function f about $x = 0$. What is the value of $f'''(0)$?

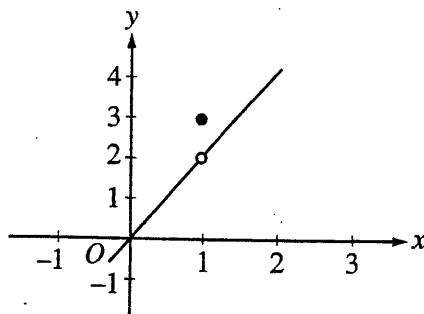
- (A) -30 (B) -15 (C) -5 (D) $-\frac{5}{6}$ (E) $-\frac{1}{6}$

78. The radius of a circle is increasing at a constant rate of 0.2 meters per second. What is the rate of increase in the area of the circle at the instant when the circumference of the circle is 20π meters?
- (A) 0.04π m²/sec
(B) 0.4π m²/sec
(C) 4π m²/sec
(D) 20π m²/sec
(E) 100π m²/sec

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
-1	6	5	3	-2
1	3	-3	-1	2
3	1	-2	2	3

79. The table above gives values of f , f' , g , and g' at selected values of x . If $h(x) = f(g(x))$, then $h'(1) =$
- (A) 5 (B) 6 (C) 9 (D) 10 (E) 12
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80. Insects destroyed a crop at the rate of $\frac{100e^{-0.1t}}{2 - e^{-3t}}$ tons per day, where time t is measured in days. To the nearest ton, how many tons did the insects destroy during the time interval $7 \leq t \leq 14$?
- (A) 125 (B) 100 (C) 88 (D) 50 (E) 12

Graph of f

81. The graph of the function f is shown in the figure above. The value of $\lim_{x \rightarrow 1} \sin(f(x))$ is
- (A) 0.909 (B) 0.841 (C) 0.141 (D) -0.416 (E) nonexistent

82. The rate of change of the altitude of a hot-air balloon is given by $r(t) = t^3 - 4t^2 + 6$ for $0 \leq t \leq 8$. Which of the following expressions gives the change in altitude of the balloon during the time the altitude is decreasing?

(A) $\int_{1.572}^{3.514} r(t) dt$

(B) $\int_0^8 r(t) dt$

(C) $\int_0^{2.667} r(t) dt$

(D) $\int_{1.572}^{3.514} r'(t) dt$

(E) $\int_0^{2.667} r'(t) dt$

x	0	1	2	3	4
$f(x)$	2	3	4	3	2

83. The function f is continuous and differentiable on the closed interval $[0, 4]$. The table above gives selected values of f on this interval. Which of the following statements must be true?
- (A) The minimum value of f on $[0, 4]$ is 2.
(B) The maximum value of f on $[0, 4]$ is 4.
(C) $f(x) > 0$ for $0 < x < 4$
(D) $f'(x) < 0$ for $2 < x < 4$
(E) There exists c , with $0 < c < 4$, for which $f'(c) = 0$.

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84. A particle moves in the xy -plane so that its position at any time t is given by $x(t) = t^2$ and $y(t) = \sin(4t)$. What is the speed of the particle when $t = 3$?
- (A) 2.909 (B) 3.062 (C) 6.884 (D) 9.016 (E) 47.393
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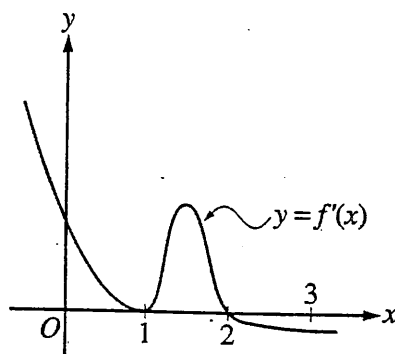
85. Let f be the function with derivative defined by $f'(x) = \sin(x^3)$ on the interval $-1.8 < x < 1.8$. How many points of inflection does the graph of f have on this interval?

- (A) Two (B) Three (C) Four (D) Five (E) Six

86. A particle moves along the x -axis so that at any time $t \geq 0$, its velocity is given by $v(t) = \cos(2 - t^2)$. The position of the particle is 3 at time $t = 0$. What is the position of the particle when its velocity is first equal to 0?

- (A) 0.411 (B) 1.310 (C) 2.816 (D) 3.091 (E) 3.411

87. The region bounded by the graph of $y = 2x - x^2$ and the x -axis is the base of a solid. For this solid, each cross section perpendicular to the x -axis is an equilateral triangle. What is the volume of the solid?
- (A) 1.333 (B) 1.067 (C) 0.577 (D) 0.462 (E) 0.267



88. The graph of f' , the derivative of the function f , is shown above. If $f(0) = 0$, which of the following must be true?
- I. $f(0) > f(1)$
 II. $f(2) > f(1)$
 III. $f(1) > f(3)$
- (A) I only
 (B) II only
 (C) III only
 (D) I and II only
 (E) II and III only

89. The height h , in meters, of an object at time t is given by $h(t) = 24t + 24t^{3/2} - 16t^2$. What is the height of the object at the instant when it reaches its maximum upward velocity?
- (A) 2.545 meters
(B) 10.263 meters
(C) 34.125 meters
(D) 54.889 meters
(E) 89.005 meters
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Let f be the function defined by $f(x) = x + \ln x$. What is the value of c for which the instantaneous rate of change of f at $x = c$ is the same as the average rate of change of f over $[1, 4]$?

- (A) 0.456 (B) 1.244 (C) 2.164 (D) 2.342 (E) 2.452
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END OF SECTION I

AFTER TIME HAS BEEN CALLED, TURN TO THE NEXT PAGE AND
ANSWER QUESTIONS 93-96.