A.P. Calculus BC Test Four
Section One
Multiple-Choice
No Calculators

Time—35 minutes

Number of Questions—15

The scoring for this section is determined by the formula

$$[C - (0.25 \times I)] \times 1.8$$

where C is the number of correct responses and I is the number of incorrect responses. An unanswered question earns zero points. The maximum possible points earned on this section is 27, which represents 50% of the total test score.

Directions: Solve each of the following problems, using the available space for scratch work. After examining the form of the choices, decide which is the best of the choices given and fill in the corresponding choice on your answer sheet. Do not spend too much time on any one problem.

Good Luck!

NAME:

1. $\displaystyle\int_0^3 |x-2|\,dx =$

A) $\displaystyle\int_0^3 (x-2)\,dx$

B) $\displaystyle\int_0^3 (-x+2)\,dx$

C) $\displaystyle\int_2^0 (-x+2)\,dx + \int_2^3 (x-2)\,dx$

D) $\displaystyle\int_0^2 (-x+2)\,dx + \int_3^2 (x-2)\,dx$

E) $\displaystyle\int_0^2 (-x+2)\,dx + \int_2^3 (x-2)\,dx$

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2. $\displaystyle\int \frac{1}{x^2+1}\,dx =$

A) $\ln(x^2+1)+C$

B) $-\frac{1}{2}(x^2+1)^{-2}+C$

C) $\arctan x + C$

D) $\operatorname{arcsec} x + C$

E) $-\frac{1}{x}+x+C$

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3. The acceleration of a particle moving along a straight line is given by $a = 6t$. If, when $t = 0$ its velocity v is 1 and its position s is 3, then at any time t the position function given by

A) $s(t) = t^3 + 3t + 1$

B) $s(t) = t^3 + 3$

C) $s(t) = t^3 + t + 3$

D) $s(t) = \frac{1}{3}t^3 + t + 3$

E) $s(t) = \frac{1}{3}t^3 + \frac{1}{2}t^2 + 3$

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4. Which of the following is a solution to $\dfrac{dy}{dx} - 4y = 0$?

A) $y = e^{-4x}$

B) $y = 2x$

C) $y = e^{-2x}$

D) $y = \dfrac{1}{4x+1}$

E) $y = e^{4x}$

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5. Which of the following expressions represents the length of the curve $y = e^{-x^2}$ from $x = 0$ to $x = 2$?

A) $\displaystyle\int_0^2 \sqrt{1 + e^{-2x^2}}\ dx$

B) $\displaystyle\int_0^2 \sqrt{1 + 4x^2 e^{-2x^2}}\ dx$

C) $\displaystyle\int_0^2 \sqrt{1 - e^{-2x^2}}\ dx$

D) $\displaystyle\int_0^2 \sqrt{1 + 2xe^{-2x^2}}\ dx$

E) $\pi \displaystyle\int_0^2 e^{-2x^2}\ dx$

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6. $\displaystyle\int \tan x\ dx =$

A) $-\ln|\sec x| + C$

B) $\sec^2 x + C$

C) $\ln|\sin x| + C$

D) $\sec x + C$

E) $-\ln|\cos x| + C$

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7. Let $f(x)$ be a differentiable function whose domain is the closed interval $[0, 5]$, and let $F(x) = \int_0^x f(t)\,dt$. If $F(5) = 10$, which of the following must be true?

I. $F(x) = 2$ for some value of x in $[0, 5]$
II. $f(x) = 2$ for some value of x in $[0, 5]$
III. $f'(x) = 2$ for some value of x in $[0, 5]$

A) I only
B) II only
C) III only
D) I and II only
E) I, II, and III

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8. $\int_1^2 \sqrt{x^2 - 2x + 1}\,dx =$

A) -1
B) $-\frac{1}{2}$
C) 0
D) $\frac{1}{2}$
E) 1

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9. Suppose a population of bears grows according to the logistic differential equation

$$\frac{dP}{dt} = 2P - 0.01P^2,$$

where P is the number of bears at time t in years. Which of the following statements are true?

I. The growth rate of the bear population is greatest at $P = 100$.
II. If $P > 200$, the population of bears is decreasing.
III. $\lim_{t\to\infty} P(t) = 200$.

A) I only
B) II only
C) I and III only
D) II and III only
E) I, II, and III

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10. If $F(x) = \displaystyle\int_{\pi/2}^{x} 4t \sin\left(\frac{t}{3}\right)\, dt$, then an equation of the line tangent to $F(x)$ at the point where $x = \pi/2$ is

A) $2x - \pi y - \pi = 0$.

B) $2x - 2y - \pi = 0$.

C) $2\pi x - 2y - \pi^2 = 0$.

D) $\pi x - 2y - \pi^2 = 0$.

E) $\pi x - y - \pi = 0$.

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11. The area of the region in the first quadrant bounded by the curve $y = e^{-x}$ and the line $x = \ln 2$ is equal to

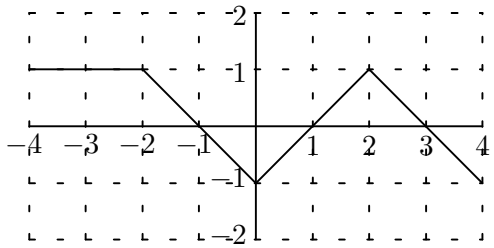
A) $-\frac{1}{2}$.

B) 0.

C) $\frac{1}{2}$.

D) 1.

E) $\frac{3}{2}$.



12. The graph of f is shown above. Which of the following statements are true?

I. $f'(3) > f'(1)$

II. $\displaystyle\int_0^2 f(x)\, dx > f'(3.5)$

III. $\displaystyle\int_1^0 f(x)\, dx = \int_2^3 f(x)\, dx$

A) I only

B) II only

C) I and II only

D) II and III only

E) I, II and III

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13. Given the differential equation $\dfrac{dy}{dx} = x + y$ and $y(0) = 2$, an approximation of $y(1)$ using Euler's method with two steps and step size 0.5 is

A) 3
B) $\frac{7}{2}$
C) $\frac{15}{4}$
D) $\frac{19}{4}$
E) $\frac{21}{4}$

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14. A particle is moving along the x-axis with velocity $v(t) = \sin 2t$, $t \geq 0$. At time $t = \pi/2$ it has position $x = 3$. Find the net distance traveled by this particle on the interval $0 \leq t \leq \pi$.

A) 0
B) 1
C) 2
D) 3
E) π

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15. If $g(x) = \displaystyle\int_0^x \sqrt{t^2 + 2}\, dt$, then $g'(x) =$

A) 0
B) x
C) $\sqrt{x^2 + 2}$
D) $\frac{2}{3}(x^2 + 2)^{3/2}$
E) $\frac{2}{3}(x^2 + 2)^{3/2} - 2^{3/2}$