

Section I–Part B (50 minutes)

Choose the *best* answer for each question. (If the exact answer does not appear among the choices, choose the best approximation for the exact answer.) Your score is determined by subtracting one-fourth of the number of wrong answers from the number of correct answers. **You may use a graphing calculator.**

29. Which of the following functions has the fastest rate of growth as $x \rightarrow \infty$?

- (A) $y = x^{18} - 5x$ (B) $y = 5x^2$ (C) $y = \ln x^2$ (D) $y = (\ln x)^2$ (E) $y = e^{0.01x}$
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30. The velocity of a particle moving along a straight line is given by $v(t) = 3t^2 - 4t$. Find an expression for the acceleration of the particle.

- (A) $t^3 - 4$ (B) $t^3 - 2t^2$ (C) $3t^2 - 4$ (D) $3t - 4$ (E) $6t - 4$
-

31. Find the average value of the function $y = x^3 - 4x$ on the closed interval $[0, 4]$.

- (A) 8 (B) 12 (C) 24 (D) 32 (E) 48
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32. A region is enclosed by the x -axis and the graph of the parabola $y = 9 - x^2$. Find the volume of the solid generated when this region is revolved about the x -axis.

- (A) 36π (B) 40.5π (C) 129.6π (D) 194.4π (E) 259.2π
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33. Which of the following is an antiderivative of $x\sqrt{x^2 + 3}$?

- (A) $\frac{1}{3}x^{3/2}$ (B) $\frac{1}{3}x^3$ (C) $\frac{1}{3}(x^2 + 3)^{3/2}$ (D) $\frac{2}{3}(x^2 + 3)^{3/2}$ (E) $(x^2 + 3)^{3/2}$

34.

x	3.3	3.4	3.5	3.6	3.7
$f(x)$	3.69	3.96	4.25	4.56	4.89

Let f be a differentiable function that is defined for all real numbers x . Use the table above to estimate $f'(3.6)$.

- (A) 0.3 (B) 1.8 (C) 2.7 (D) 3.0 (E) 3.2
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35. The weight in pounds of a certain bear cub t months after birth is given by $w(t)$. If $w(2) = 36$, $w(7) = 84$, and $\frac{dw}{dt}$ was proportional to the cub's weight for the first 15 months of his life, how much did the cub weigh when he was 11 months old?

- (A) 125 pounds (B) 135 pounds (C) 145 pounds (D) 155 pounds (E) 165 pounds
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36. Let $f(x) = \begin{cases} 3x^2 - 4, & \text{for } x \leq 1 \\ 6x - 5, & \text{for } x > 1 \end{cases}$.

Which of the following are true statements about this function?

I. $\lim_{x \rightarrow 1} f(x)$ exists.

II. $f'(1)$ exists.

III. $\lim_{x \rightarrow 1} f'(x)$ exists.

- (A) None (B) II only (C) III only (D) II and III (E) I, II, and III
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37. Two particles are moving along the x -axis. Their positions are given by $x_1(t) = 2t^2 - 5t + 7$ and $x_2(t) = \sin 2t$, respectively. If $a_1(t)$ and $a_2(t)$ represent the acceleration functions of the particles, find the numbers of values of t in the closed interval $[0, 5]$ for which $a_1(t) = a_2(t)$.

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4 or more
-

38. The function $f(x) = e^x - x^3$ has how many critical points?

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4 or more

39. A dog heading due north at a constant speed of 2 meters per second trots past a fire hydrant at $t = 0$ sec. Another dog heading due east at a constant speed of 3 meters per second trots by the hydrant at $t = 1$ sec. At $t = 9$ sec, the rate of change of the distance between the two dogs is
- (A) 3.2 m/sec (B) 3.6 m/sec (C) 4.0 m/sec (D) 4.4 m/sec (E) 4.8 m/sec
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40. Let $f(x) = x^5 + x$. Find the value of $\frac{d}{dx} f^{-1}(x)$ at $x = 2$.

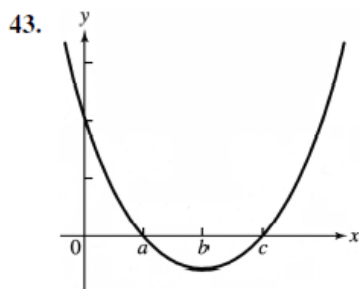
- (A) $-\frac{1}{6}$ (B) $\frac{1}{6}$ (C) $\frac{1}{81}$ (D) 6 (E) 81
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41. Suppose air is pumped into a balloon at a rate given by $r(t) = \frac{(\ln t)^2}{t}$ ft³/sec for $t \geq 1$ sec. If the volume of the balloon is 1.3 ft³ at $t = 1$ sec, what is the volume of the balloon at $t = 5$ sec?

- (A) 2.7 ft³ (B) 3.0 ft³ (C) 3.3 ft³ (D) 3.6 ft³ (E) 3.9 ft³
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42. Find the approximate value of x where $f(x) = x^2 - 3\sqrt{x+2}$ has its absolute minimum.

- (A) -4.5 (B) -2 (C) 0 (D) 0.5 (E) 2.5
-



The graph of $y = f'(x)$ is shown. Which of the following statements about the function $f(x)$ are true?

- I. $f(x)$ is decreasing for all x between a and c .
II. The graph of f is concave up for all x between a and c .
III. $f(x)$ has a relative minimum at $x = a$.

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

44. Suppose f and g are even functions that are continuous for all x , and let a be a real number. Which of the following expressions must have the same value?

I. $\int_{-a}^a [f(x) + g(x)] dx$

II. $2\int_0^a [f(x) + g(x)] dx$

III. $\int_{-a}^a f(x) dx + \int_{-a}^a g(x) dx$

(A) I and II only (B) I and III only (C) II and III only (D) I, II, and III (E) None

45. Let $f(x) = g(h(x))$, where $h(2) = 3$, $h'(2) = 4$, $g(3) = 2$, and $g'(3) = 5$. Find $f'(2)$.

(A) 6

(B) 8

(C) 15

(D) 20

(E) More information is needed to find $f'(2)$.