Unit 5 Progress Check: MCQ Part B

1. The second derivative of the function f is given by $f''(x) = x^2 \cos\left(\frac{x^2+2x}{6}\right)$. At what values of x in the interval $(-4, 3)$ does the graph of f have a point of inflection?

(A) 2.229 only ✓

(B) 0 and 2.229

(C) -2.357 and 0.987

(D) -3.259, 0, and 1.603

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2. The second derivative of the function f is given by $f''(x) = \sin\left(\frac{x^2}{8}\right) - 2\cos x$. The function f has many critical points, two of which are at $x = 0$ and $x = 6.949$. Which of the following statements is true?

(A) f has a local minimum at $x = 0$ and at $x = 6.949$.

(B) f has a local minimum at $x = 0$ and a local maximum at $x = 6.949$.

(C) f has a local maximum at $x = 0$ and a local minimum at $x = 6.949$.

(D) f has a local maximum at $x = 0$ and at $x = 6.949$. ✓

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3. Let f be the function given by $f(x) = 2x^3 + 3x^2 + 1$. What is the absolute maximum value of f on the closed interval $[-3, 1]$?

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(A) 1

(B) 2

(C) 6 ✓

(D) 26

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4. Let f be the function defined by $f(x) = \sin x + \cos x$. What is the absolute minimum value of f on the interval $[0, 2\pi]$?

(A) -2

(B) $-\sqrt{2}$ ✓

(C) -1

(D) 0

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5. Let g be the function defined by $g(x) = (x^2 - x + 1)e^x$. What is the absolute maximum value of g on the interval $[-4, 1]$?

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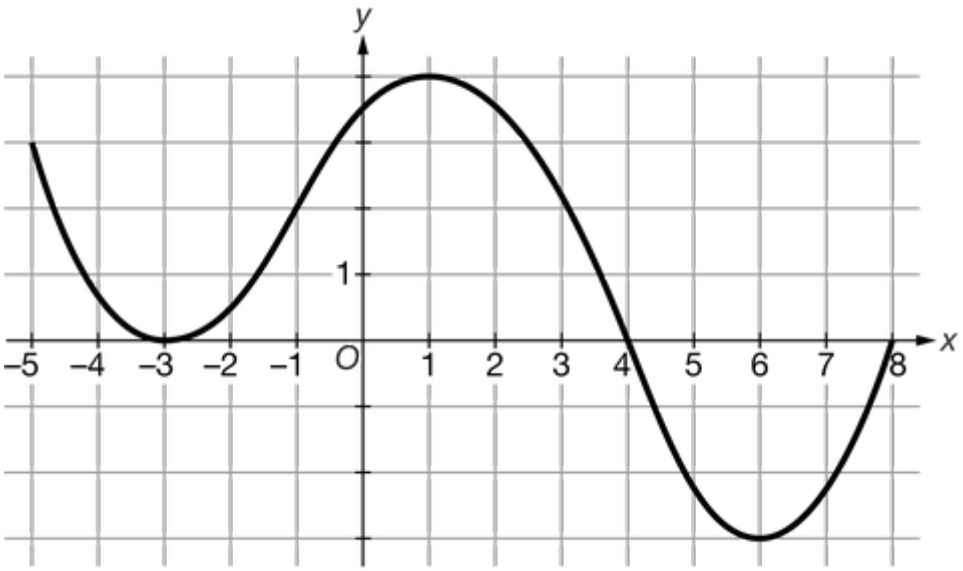
(A) 1

(B) e ✓

(C) $\frac{3}{e}$

(D) $\frac{21}{e^4}$

6.



Graph of f'

The graph of f', the derivative of the function f, is shown above. On which of the following open intervals is the graph of f concave down?

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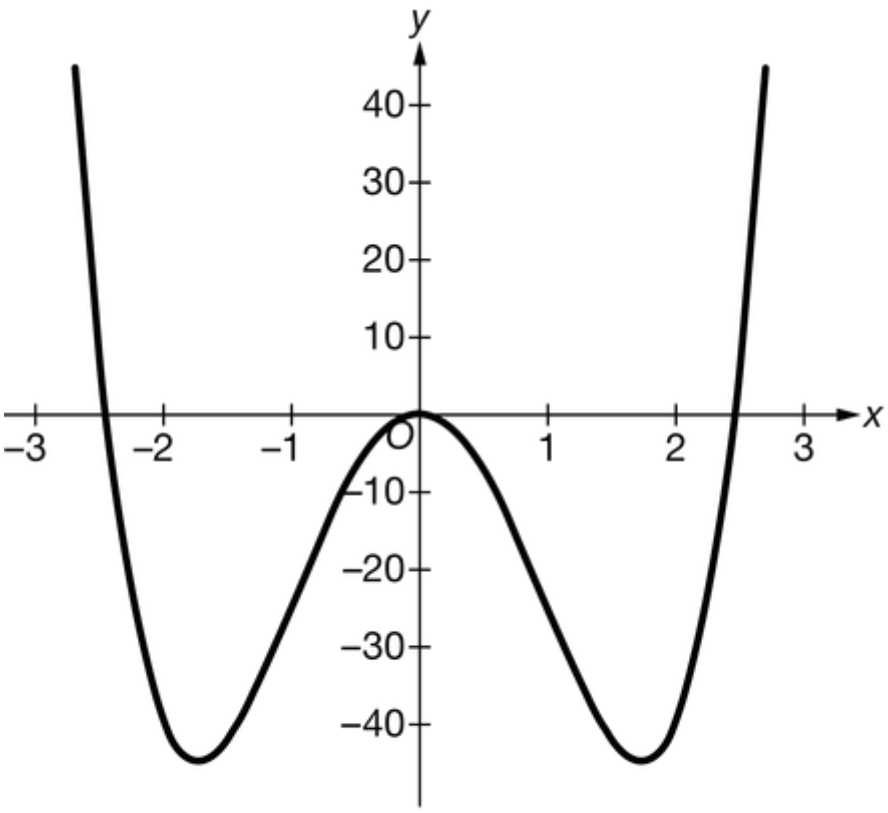
(A) $(-5, -3)$ and $(1, 6)$ ✓

(B) $(-3, 1)$ and $(6, 8)$

(C) $(-1, 4)$

(D) $(4, 8)$

7.



Graph of f'

Let f be the function defined by $f(x) = x^5 - 10x^3$. The graph of f', the derivative of f, is shown above. On which of the following intervals is the graph of f concave up?

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(A) $x < -\sqrt{3}$ and $0 < x < \sqrt{3}$

(B) $-\sqrt{3} < x < 0$ and $x > \sqrt{3}$ ✓

(C) $x < -\sqrt{6}$ and $x > \sqrt{6}$

(D) $-\sqrt{6} < x < \sqrt{6}$

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8. The Second Derivative Test cannot be used to conclude that $x = 2$ is the location of a relative minimum or relative maximum for which of the following functions?

(A) $f(x) = \cos(x-2)$, where $f'(x) = -\sin(x-2)$

(B) $f(x) = xe^{-\frac{x}{2}}$, where $f'(x) = e^{-\frac{x}{2}} - \frac{1}{2}xe^{-\frac{x}{2}}$

(C) $f(x) = x^2 - 4x - 2$, where $f'(x) = 2x - 4$

(D) $f(x) = x^3 - 6x^2 + 12x + 1$, where $f'(x) = 3x^2 - 12x + 12$ ✓

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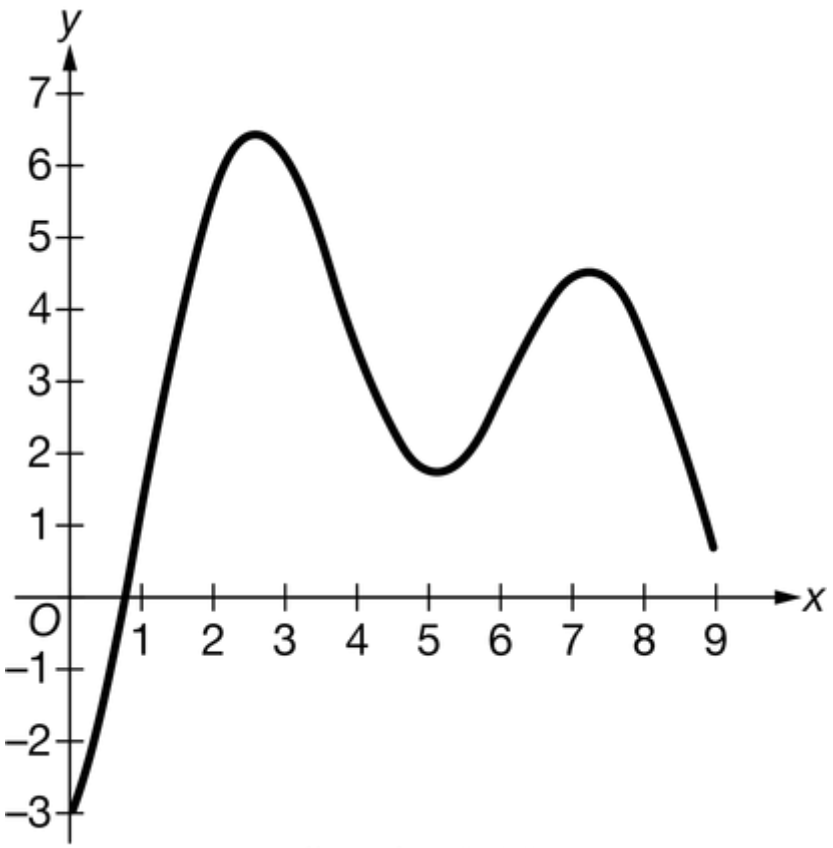
9.



Graph of f''

The graph of f'', the second derivative of the continuous function f, is shown above on the interval $[0, 9]$. On this interval f has only one critical point, which occurs at $x = 6$. Which of the following statements is true about the function f on the interval $[0, 9]$?

(A) f has a relative minimum at $x = 6$ but not an absolute minimum.

(B) The absolute minimum of f is at $x = 6$. ✓

(C) f has a relative maximum at $x = 6$ but not an absolute maximum.

(D) The absolute maximum of f is at $x = 6$.

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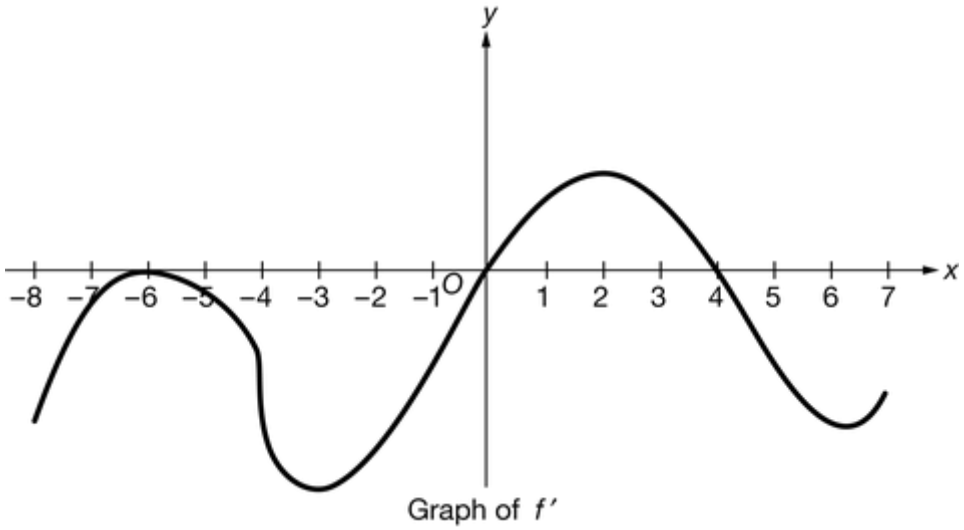
10.



Graph of f'

The graph of f', the derivative of the continuous function f, is shown above on the interval $-8 < x < 7$. The graph of f' has horizontal tangent lines at $x = -6$, $x = -3$, $x = 2$, and $x = 6.3$, and a vertical tangent line at $x = -4$. On which of the following intervals is the graph of f both decreasing and concave up ?

(A) $(-8, 0)$ and $(4, 7)$

(B) $(-6, -3)$ and $(4, 6.3)$ only

(C) $(-4, -3)$ and $(4, 6.3)$ only

(D) $(-8, -6)$, $(-3, 0)$, and $(6.3, 7)$ only ✓

11.

x	$0 < x < 2$	$x = 2$	$2 < x < 4$	$x = 4$	$4 < x < 6$	$x = 6$	$6 < x < 8$	$x = 8$	$8 < x < 9$
$f'(x)$	Unknown	0	Negative	0	Negative	DNE	Positive	0	Unknown
$f''(x)$	Negative	-1	Negative	0	Positive	DNE	Negative	0	Unknown

The function f is continuous on the interval $(0, 9)$ and is twice differentiable except at $x = 6$, where the derivatives do not exist (DNE). Information about the first and second derivatives of f for some values of x in the interval $(0, 9)$ is given in the table above. Which of the following statements could be false?

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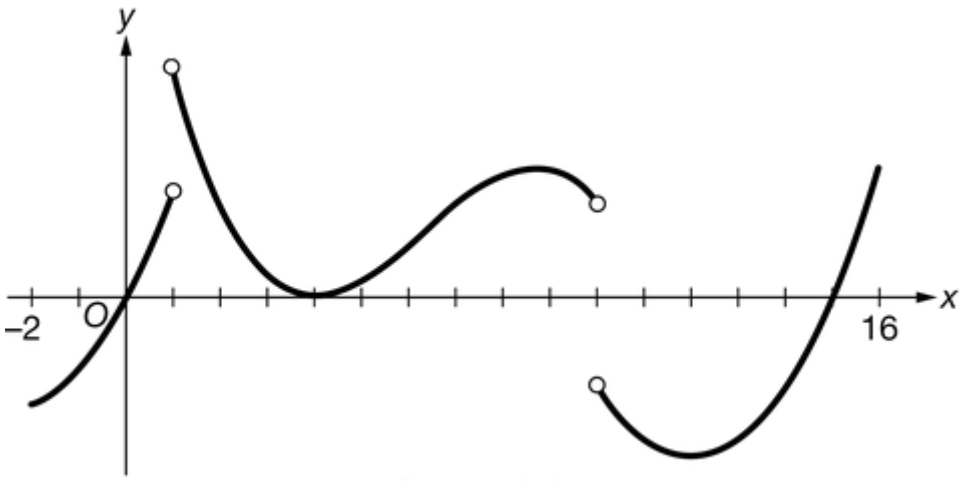
(A) The function f has a relative maximum at $x = 2$.

(B) The graph of f has a point of inflection at $x = 4$.

(C) The function f has a relative minimum at $x = 6$.

(D) The graph of f has a point of inflection at $x = 8$. ✔

12.



Graph of f'

The graph of f', the derivative of the continuous function f, is shown above on the interval $-2 < x < 16$. Which of the following statements is true about f on the interval $-2 < x < 16$?

(A) f has two relative extrema, and the graph of f has three points of inflection.

(B) f has three relative extrema, and the graph of f has three points of inflection.

(C) f has three relative extrema, and the graph of f has four points of inflection. ✔

(D) f has five relative extrema, and the graph of f has four points of inflection.
