This print-out should have 21 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

If f is a differentiable function such that

$$f'(x) = (x^2 - 9)g(x),$$

where $g(x) > 0$ for all x, at which value(s) of x does f have a local minimum?

1. only at $x = -3$

2. at both $x = -9, \ 9$

3. only at $x = -9$

4. at both $x = -3, \ 3$

5. only at $x = 9$

6. only at $x = 3$

002 10.0 points

Let f be the function defined by

$$f(x) = 5 - x^{2/3}.$$

Consider the following properties:

A. has local maximum at $x = 0$;

B. derivative exists for all x;

C. concave up on $(-\infty, 0) \cup (0, \infty)$;

Which does f have?

1. A and C only

2. B only

3. A and B only

4. C only

5. All of them

6. A only

7. B and C only

8. None of them

003 10.0 points

Let f be the function defined by

$$f(x) = 1 + x^{2/3}.$$

Consider the following properties:

A. has local maximum at $x = 0$

B. concave up on $(-\infty, 0) \cup (0, \infty)$

Which does f have?

1. B only

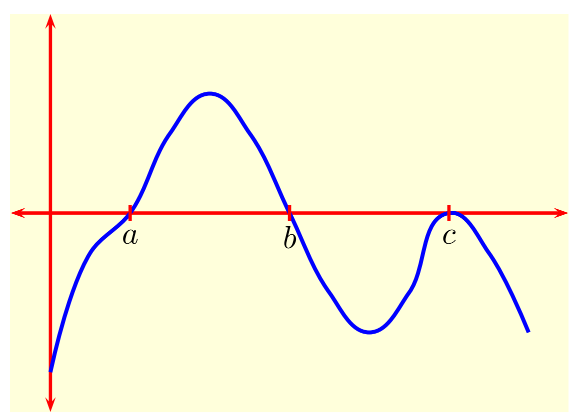
2. neither of them

3. A only

4. both of them

004 10.0 points

Use the graph



of the derivative of f to locate the critical points x_0 at which f has a local minimum?

1. none of a, b, c

2. $x_0 = c, a$

3. $x_0 = c$

4. $x_0 = a$

5. $x_0 = b$

6. $x_0 = a, b$

7. $x_0 = b, c$

8. $x_0 = a, b, c$

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005 10.0 points

Locate all the critical points of

$$f(x) = (x+3)^4(2-x)^3 .$$

1. $x = -2, \ -3, \ -\frac{1}{7}$

2. $x = 2, \ -3, \ -\frac{1}{7}$

3. $x = 2, \ -3, \ \frac{1}{7}$

4. $x = 2, \ 3, \ -\frac{1}{7}$

5. $x = 2, \ 3, \ \frac{1}{7}$

6. $x = -2, \ 3, \ \frac{1}{7}$

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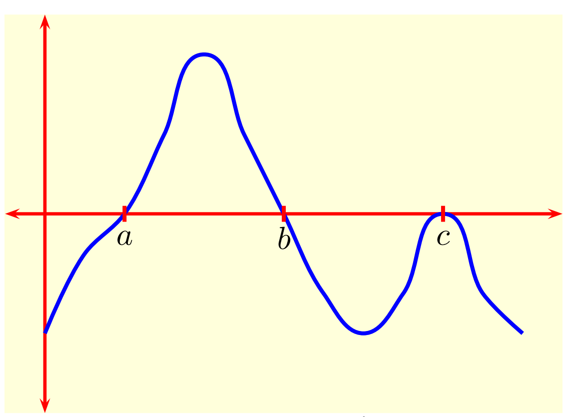
006 10.0 points

The derivative, f', of f has graph



graph of f'

Use it to locate the critical point(s) x_0 at which f has a local minimum?

1. $x_0 = b, c$

2. $x_0 = b$

3. none of a, b, c

4. $x_0 = a$

5. $x_0 = a, b, c$

6. $x_0 = c$

7. $x_0 = a, b$

8. $x_0 = c, a$

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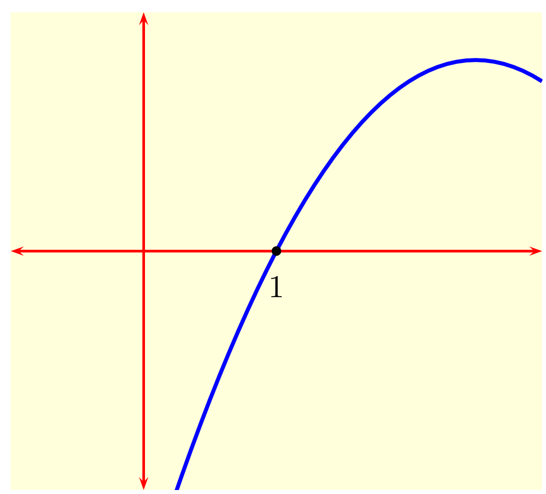
007 10.0 points

The graph of a twice-differentiable function f is shown in



Which one of the following sets of inequalities is satisfied by f and its derivatives at $x = 1$?

1. $f''(1) < f'(1) < f(1)$

2. $f(1) < f''(1) < f'(1)$

3. $f''(1) < f(1) < f'(1)$

4. $f'(1) < f(1) < f''(1)$

5. $f'(1) < f''(1) < f(1)$

6. $f(1) < f'(1) < f''(1)$

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008 10.0 points

Ted makes a chart to help him analyze the continuous function $y = f(x)$:

	y	y'	y''
$x < -1$		$+$	$-$
$x = -1$	2	0	
$-1 < x < 0$		$-$	$-$
$x = 0$	1	-1	
$0 < x < 2$		$-$	$+$
$x = 2$	-2	DNE	
$x > 2$		$+$	$+$

Consider the following statements:

A. f has a local minimum at $x = 2$.

B. f has a local maximum at $x = 0$.

C. f has a local maximum at $x = -1$.

Which are correct?

1. all are true

2. A and B only

3. B and C only

4. C only

5. A and C only

6. B only

7. A only

8. none are true

---

009 10.0 points

When Sue uses first and second derivatives to analyze a particular continuous function $y = f(x)$ she obtains the chart

	y	y'	y''
$x < -3$		$+$	$-$
$x = -3$	4	0	
$-3 < x < 0$		$-$	$-$
$x = 0$	1	-1	
$0 < x < 2$		$-$	$+$
$x = 2$	-1	DNE	
$x > 2$		$+$	$+$

Which of the following can she conclude from her chart?

A. f has a point of inflection at $x = 2$.

B. f is concave up on $(0, 2)$.

C. f is concave up on $(-\infty, 0)$.

1. all of them

2. B only

3. B and C only

4. C only

5. none of them

6. A only

7. A and C only

8. A and B only

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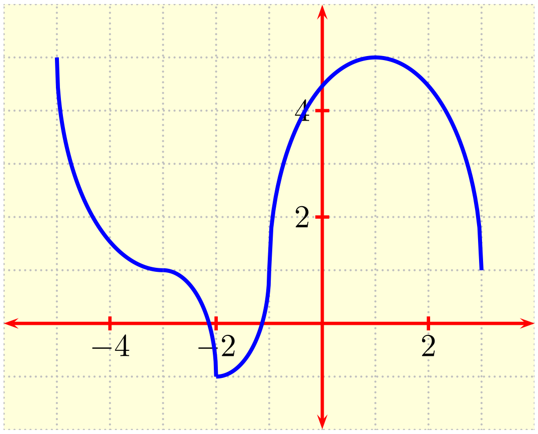
010 10.0 points

If f is a continuous function on $(-5, 3)$ whose graph is



which of the following properties are satisfied?

A. f has exactly 2 inflection points,

B. f has exactly 1 local maximum,

C. $f'(x) < 0$ on $(-1, 1)$.

1. B only

2. C only

3. none of them

4. A and C only

5. A and B only

6. all of them

7. B and C only

8. A only

---

011 10.0 points

On which interval(s) is

$$f(x) = x^4 + 2x^2 - 5$$

decreasing?

1. $(-\infty, -1), \quad (1, \infty)$

2. $(0, \infty)$

3. $(-\infty, 0)$

4. $(-1, 1)$

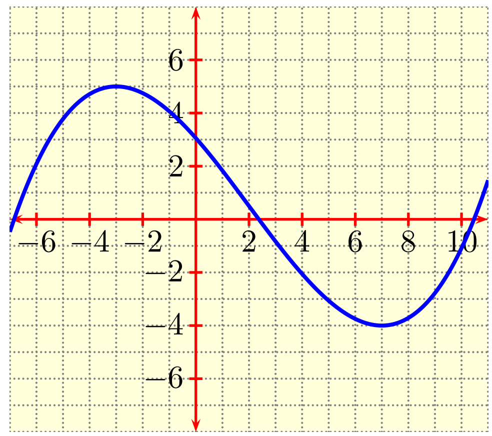
5. $(-\infty, -1), \quad (0, 1)$

6. $(-1, 0), \quad (1, \infty)$

---

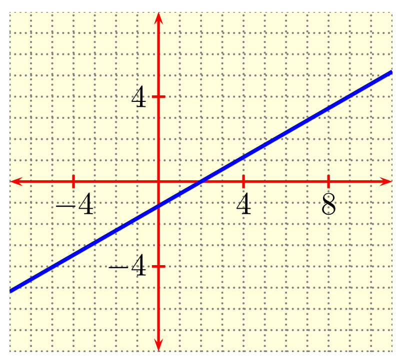
012 10.0 points

When the graph of f is

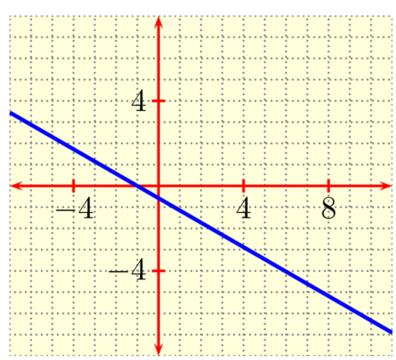


which of the following is the graph of f''?

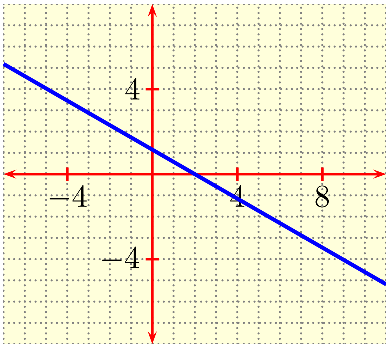
1.



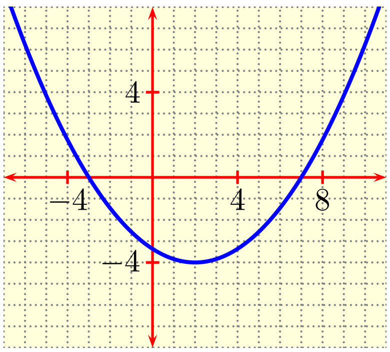
2.



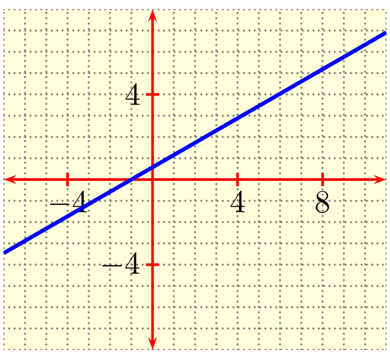
3.



4.



5.



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013 10.0 points

If the graph of

$$f(x) = ax^3 + bx^2 + cx + d$$

has a local maximum at $(0, 1)$ and a local minimum at $(2, -7)$, compute the value of $f(1)$.

1. $f(1) = -4$

2. $f(1) = -3$

3. $f(1) = -1$

4. $f(1) = -5$

5. $f(1) = -2$

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014 10.0 points

Find all values of x at which the graph of

$$f(x) = \frac{1}{3}x^3 + 3x^2 + 7$$

has a point of inflection.

1. $x = 0, 6$

2. $x = -3$

3. $x = 0, 2$

4. $x = 0, -6$

5. $x = -2$

6. $x = 3$

---

015 10.0 points

Find all values of x at which the graph of

$$f(x) = 4x^2 - 7x + 3$$

is decreasing faster than the graph of

$$g(x) = \frac{x^3}{3}.$$

1. $(-7, 1)$

2. $(1, 7)$

3. $(-\infty, -1), \quad (7, \infty)$

4. $(-\infty, -7), \quad (1, \infty)$

5. $(-1, 7)$

6. $(-\infty, 1), \quad (7, \infty)$

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016 10.0 points

Find all intervals on which

$$f(x) = \frac{x^2}{(x-3)^3}$$

is decreasing.

1. $[-6,\ 0]$

2. $[0,\ 6]$

3. $(-3,\ 3)$

4. $(-\infty,\ -6],\ \ [0,\ 3),\ \ (3,\ \infty)$

5. $(-\infty,\ -3),\ \ (-3,\ 0],\ \ [6,\ \infty)$

6. $(-\infty,\ 0],\ \ [6,\ \infty)$

7. $(-\infty,\ -6],\ \ [0,\ \infty)$

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017 10.0 points

Determine the interval(s) on which

$$f(x) = \frac{x+1}{(x-1)^3}$$

is decreasing.

1. $(-2,\ 1)\,,\ \ (1,\ \infty)$

2. $(-2,\ 1)$

3. $(-\infty,\ -1)\,,\ \ (-1,\ 1)$

4. $(-\infty,\ -2)$

5. $(-2,\ \infty)$

6. $(-2,\ -1)\,,\ \ (1,\ \infty)$

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018 10.0 points

Find the interval(s) where

$$f(x) = x^3 + 12x^2 + 7$$

is increasing.

1. $(-8,\ 0)$

2. $(-\infty,\ -8)\,,\ \ (8,\ \infty)$

3. $(-\infty,\ -8)\,,\ \ (0,\ \infty)$

4. $(-\infty,\ -4)\,,\ \ (0,\ \infty)$

5. $(-4,\ 0)$

6. $(-\infty,\ -4)\,,\ \ (4,\ \infty)$

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019 10.0 points

Find all points x_0 at which

$$f(x) = \frac{2+x}{(x-1)^2}$$

has a local maximum.

1. $x_0 = -5$

2. $x_0 = 5\,,\ -5$

3. no such x_0 exist

4. $x_0 = -2\,,\ 1$

5. $x_0 = 5$

6. $x_0 = 1\,,\ -5$

7. $x_0 = 1$

8. $x_0 = -2$

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020 10.0 points

Let f be the function defined by

$$f(x) = \tan(x) - 2x$$

on $\left(-\frac{\pi}{2},\ \frac{\pi}{2}\right)$. Find all interval(s) on which f is increasing?

1. $\left(\frac{\pi}{2},\ -\frac{\pi}{4}\right),\ \ \left(0,\ \frac{\pi}{4}\right)$

2. $\left(-\frac{\pi}{2},\ -\frac{\pi}{4}\right),\ \ \left(\frac{\pi}{4},\ \frac{\pi}{2}\right)$

3. $\left(-\frac{\pi}{4},\ 0\right),\ \ \left(\frac{\pi}{4},\ \frac{\pi}{2}\right)$

4. $\left(-\frac{\pi}{2},\ -\frac{\pi}{6}\right),\ \ \left(\frac{\pi}{6},\ \frac{\pi}{2}\right)$

5. $\left(-\frac{\pi}{4},\ \frac{\pi}{4}\right)$

021 10.0 points

Determine the interval(s) in $[-\pi, \pi]$ on which

$$f(x) = x + 2\cos x$$

is decreasing.

1. $\left(-\pi\,,\ \dfrac{\pi}{3}\right), \quad \left(\dfrac{2\pi}{3}\,,\ \pi\right)$

2. $\left(\dfrac{\pi}{6}\,,\ \dfrac{5\pi}{6}\right)$

3. $\left(-\dfrac{5\pi}{6}\,,\ -\dfrac{\pi}{6}\right)$

4. $\left(\dfrac{\pi}{3}\,,\ \dfrac{2\pi}{3}\right)$

5. $\left(-\pi\,,\ \dfrac{\pi}{6}\right), \quad \left(\dfrac{5\pi}{6}\,,\ \pi\right)$

6. $\left(-\pi\,,\ -\dfrac{2\pi}{3}\right), \quad \left(-\dfrac{\pi}{3}\,,\ \pi\right)$