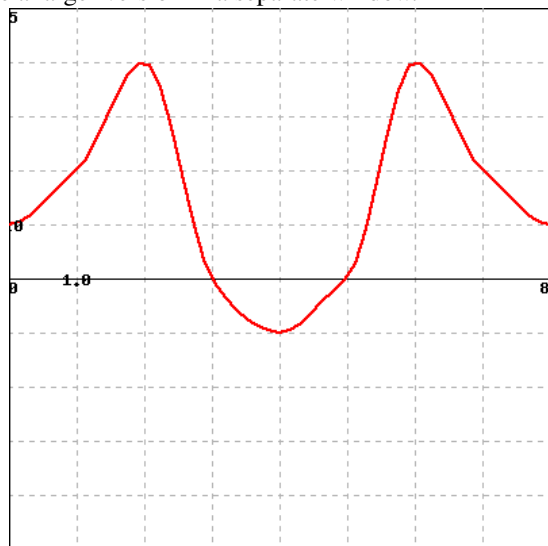**1.** (1 pt) Below is the graph of **the derivative** $f'(x)$ of a function defined on the interval (0,8). You can click on the graph to see a larger version in a separate window.

Refer to the graph to answer each of the following questions. For parts (A) and (B), use interval notation to report your answer. (If needed, you use **U** for the union symbol.)

(A) For what values of x in (0,8) is $f(x)$ increasing? (If the function is not increasing anywhere, enter **None** .)
    Answer: _____
(B) For what values of x in (0,8) is $f(x)$ concave down? (If the function is not concave down anywhere, enter **None** .)
    Answer: _____
(C) Find all values of x in (0,8) is where $f(x)$ has a local minimum, and list them (separated by commas) in the box below. (If there are no local minima, enter **None** .)
    Local Minima: _____
(D) Find all values of x in (0,8) is where $f(x)$ has an inflection point, and list them (separated by commas) in the box below. (If there are no inflection points, enter **None** .)
    Inflection Points: _____

Answer(s) submitted:

- (0,3) U (5,8)
- (2,4) U (6,8)
- 5
- 2,4,6

(correct)
Correct Answers:

- (0,3) U (5,8)
- (2,4) U (6,8)
- 5
- 2, 4, 6

2. (1 pt) Let
$$f(x) = 6(x-4)^{2/3} + 8.$$

(A) Find all critical values and list them below. Note: If there are no critical values, enter 'NONE'.
_____

(B) Use interval notation to indicate where $f(x)$ is increasing.
Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.
Increasing: _____
(C) Use interval notation to indicate where $f(x)$ is decreasing.
Decreasing: _____
(D) List the x values of all local maxima of f. If there are no local maxima, enter 'NONE'.
x values of local maximums = _____
(E) List the x values of all local minima of f. If there are no local minima, enter 'NONE'.
x values of local minimums = _____

Answer(s) submitted:

- 4
- (4, INF)
- (-INF,4)
- NONE
- 4

(correct)
Correct Answers:

- 4
- (4,infinity)
- (-infinity,4)
- NONE
- 4

3. (1 pt) Consider the function
$$f(x) = \frac{x^2}{4x^2 + 2}.$$

List the x values of the inflection points of f. If there are no inflection points, enter 'NONE'.
_____

Answer(s) submitted:

- (-1/sqrt(6)), (1/sqrt(6))

(correct)
Correct Answers:

- -0.408248290463863, 0.408248290463863

4. (1 pt) Consider the function

$$f(x) = \frac{e^x}{5 + e^x}$$

Then $f'(x) =$ _____

The following questions ask for endpoints of intervals of increase or decrease for the function $f(x)$.
Write INF for ∞, MINF for $-\infty$, and NA (ie. not applicable) if there are no intervals of that type.
The interval of increase for $f(x)$ is from _____

to _____

The interval of decrease for $f(x)$ is from _____

to _____

$f(x)$ has a local minimum at _____. (Put NA if none.)

$f(x)$ has a local maximum at _____. (Put NA if none.)

Then $f''(x) =$ _____

The following questions ask for endpoints of intervals of upward and downward concavity for the function $f(x)$.
Write INF for ∞, MINF for $-\infty$, and put NA if there are no intervals of that type.
The interval of upward concavity for $f(x)$ is from _____

to _____

The interval of downward concavity for $f(x)$ is from _____

to _____

$f(x)$ has a point of inflection at _____. (Put NA if none.)
Answer(s) submitted:

- (5e^x)/((5+(e^x))^2)
- MINF
- INF
- NA
- NA
- NA
- NA
- -((5(e^x)((e^x)-5))/(((e^x) + 5)^3))
- MINF
- ln(5)
- ln(5)
- INF
- ln(5)

(correct)

5. (1 pt) Suppose that $f(x) = (12 - 2x)e^x$.

Note: Several parts of this problem require answers entered in **interval notation**. Note, with interval notation, you can enter the empty set as $\{\}$.

(A) List all the critical values of $f(x)$. Note: If there are no critical values, enter *NONE* .
_____

(B) Use interval notation to indicate where $f(x)$ is increasing.
Increasing: _____

(C) Use interval notation to indicate where $f(x)$ is decreasing.
Decreasing: _____

(D) List the x values of all local maxima of $f(x)$. If there are no local maxima, enter *NONE* .
x values of local maximums = _____

(E) List the x values of all local minima of $f(x)$. If there are no local minima, enter *NONE* .
x values of local minimums = _____

(F) Use interval notation to indicate where $f(x)$ is concave up.
Concave up: _____

(G) Use interval notation to indicate where $f(x)$ is concave down.
Concave down: _____

(H) List the x values of all the inflection points of f. If there are no inflection points, enter *NONE* .
x values of inflection points = _____

(I) Use all of the preceding information to sketch a graph of f. Include all vertical and/or horizontal asymptotes. When you're finished, enter a "1" in the box below.
_____

Answer(s) submitted:

- 5
- (MINF,5)
- (5,INF)
- 5
- NONE

- `(MINF,4)`
- `(4,INF)`
- `4`
- `1`

(correct)
Correct Answers:

- `5`
- `(-infinity,5)`
- `(5,infinity)`
- `5`
- `none`
- `(-infinity,4)`
- `(4,infinity)`
- `4`
- `1`

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6. (1 pt) Suppose that

$$f(x) = 10 - 4e^{-x}.$$

(A) List all critical numbers of f. If there are no critical numbers, enter 'NONE'.
Critical numbers = _____

(B) Use interval notation to indicate where $f(x)$ is increasing.
Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.

Increasing: _____

(C) List the x-coordinates of all local maxima of f. If there are no local maxima, enter 'NONE'.
x values of local maxima = _____

(D) Find the x-coordinates of all local minima of f. If there are no local minima, enter 'NONE'.
x values of local minima = _____

(E) Use interval notation to indicate where $f(x)$ is concave down.
Concave down: _____

(F) List the x values of all inflection points of f. If there are no inflection points, enter 'NONE'.
x values of inflection points = _____

(G) List the horizontal asymptotes of f. If there are no horizontal asymptotes, enter 'NONE'.
Horizontal asymptotes $y =$ _____

(H) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.

Graph Complete: _____
Answer(s) submitted:

- `NONE`
- `(-INF,INF)`
- `NONE`
- `NONE`
- `(-INF,INF)`
- `NONE`
- `10`

- `1`

(correct)
Correct Answers:

- `NONE`
- `(-infinity,infinity)`
- `NONE`
- `NONE`
- `(-infinity,infinity)`
- `NONE`
- `10`
- `1`

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7. (1 pt) Suppose that

$$f(x) = 7x^2 - x^3 - 2.$$

(A) Find all critical numbers of f. If there are no critical numbers, enter 'NONE'.
Critical numbers = _____

(B) Use interval notation to indicate where $f(x)$ is increasing.
Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.

Increasing: _____

(C) Use interval notation to indicate where $f(x)$ is decreasing.
Decreasing: _____

(D) List the x-coordinates of all local maxima of f. If there are no local maxima, enter 'NONE'.
x values of local maxima = _____

(E) List the x-coordinates of all local minima of f. If there are no local minima, enter 'NONE'.
x values of local minima = _____

(F) Use interval notation to indicate where $f(x)$ is concave up.
Concave up: _____

(G) Use interval notation to indicate where $f(x)$ is concave down.
Concave down: _____

(H)List the x values of all inflection points of f. If there are no inflection points, enter 'NONE'.
x values of inflection points = _____

(I) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.
Graph Complete: _____
Answer(s) submitted:

- `0,(14/3)`
- `(0,14/3)`
- `(-INF,0) U (14/3,INF)`
- `14/3`
- `0`
- `(-INF, 7/3)`
- `(7/3,INF)`
- `7/3`

3

- 1

(correct)

Correct Answers:

- 0, 4.66666666666667
- (0,4.66666666666667)
- (-infinity,0) U (4.66666666666667,infinity)
- 4.66666666666667
- 0
- (-infinity,2.33333333333333)
- (2.33333333333333,infinity)
- 2.33333333333333
- 1

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8. (1 pt) Answer the following True-False quiz. (Enter "T" or "F".)

___1. A continuous function on a closed interval $[a,b]$ always attains a maximum and a minimum value in $[a,b]$.

___2. If a function has a local maximum at c, then $f'(c)$ exists and is equal to 0.

___3. If $f'(x) < 0$ for all x in $(0,1)$, then $f(x)$ is decreasing on $(0,1)$.

___4. If $f(x)$ and $g(x)$ are increasing on an interval I, then $f(x)g(x)$ is increasing on I.

___5. Differentiable functions are always continuous.

___6. If $f(x) = e^2$, then $f'(x) = 2e$.

___7. $(f(x) + g(x))' = f'(x) + g'(x)$.

Answer(s) submitted:

- T
- F
- T
- F
- T
- F
- T

(correct)

Correct Answers:

- T
- F
- T
- F
- T
- F
- T