1.(1 pt) The function $f(x) = (6x+3)e^{5x}$ has one critical number. Find it.

2.(1 pt) The function $f(x) = 2x^3 - 30x^2 + 144x - 10$ has two critical numbers. The smaller one equals ____ and the larger one equals ____

3.(1 pt) Consider the function $f(x) = 3 - 5x^2, \quad -3 \le x \le 2$.
The absolute maximum value is ____
and this occurs at x equals ____
The absolute minimum value is ____
and this occurs at x equals ____

4.(1 pt) The function $f(x) = 4 - 2x^4$ has an absolute maximum value of ____ and this occurs at x equals ____

5.(1 pt) Consider the function $f(x) = -5x^2 + 6x - 3$. The absolute maximum of $f(x)$ is ____

6.(1 pt) The function $f(x) = 2x^3 - 33x^2 + 60x + 8$ has one local minimum and one local maximum.
This function has a local minimum at x equals ____ with value ____
and a local maximum at x equals ____ with value ____

7.(1 pt) The function $f(x) = -2x^3 + 33x^2 - 168x + 1$ has one local minimum and one local maximum.
This function has a local minimum at x equals ____ with value ____
and a local maximum at x equals ____ with value ____

8.(1 pt) The function $f(x) = 9x + 4x^{-1}$ has one local minimum and one local maximum.
This function has a local minimum at x equals ____ with value ____
and a local maximum at x equals ____ with value ____

9.(1 pt) Consider the function $f(x) = -6x^2 + 6x - 2$. $f(x)$ is increasing on the interval $(-\infty, A]$ and decreasing on the interval $[A, \infty)$ where A is the critical number.
Find A ____
At $x = A$, does $f(x)$ have a local min, a local max, or neither? Type in your answer as LMIN, LMAX, or NEITHER. ____

10.(1 pt) Consider the function $f(x) = 12x^5 + 60x^4 - 100x^3 + 2$. For this function there are four important intervals: $(-\infty, A]$, $[A, B]$,$[B, C]$, and $[C, \infty)$ where A, B, and C are the critical numbers.
Find A ____
and B ____
and C ____
At each critical number A, B, and C does $f(x)$ have a local min, a local max, or neither? Type in your answer as LMIN, LMAX, or NEITHER.
At A ____
At B ____
At C ____

11.(1 pt) A University of Rochester student decided to depart from Earth after his graduation to find work on Mars. Before building a shuttle, he conducted careful calculations. A model for the velocity of the shuttle, from liftoff at t = 0 s until the solid rocket boosters were jettisoned at t = 56.2 s, is given by

$$v(t) = 0.001538667t^3 - 0.085315t^2 + 14.01t - 0.1$$

(in feet per second). Using this model, estimate
the absolute maximum value ____
and absolute minimum value ____
of the **ACCELERATION** of the shuttle between liftoff and the jettisoning of the boosters.

12.(1 pt) Consider the function $f(x) = 3x^2 - 6x + 1, \quad 0 \le x \le 8$. The absolute maximum of $f(x)$ (on the given interval) is ____ and the absolute minimum of $f(x)$ (on the given interval) is ____

13.(1 pt) Consider the function $f(x) = 2x^3 + 12x^2 - 126x + 7, \quad -7 \le x \le 4$. This function has an absolute minimum value equal to ____
and an absolute maximum value equal to ____

14.(1 pt) Consider the function $f(x) = x^4 - 72x^2 + 2, \quad -5 \le x \le 13$. This function has an absolute minimum value equal to ____
and an absolute maximum value equal to ____

15.(1 pt) The function

$$f(x) = 2x^3 - 3x^2 + 0x - 5$$

is decreasing on the interval (____ , ____).
It is increasing on the interval ($-\infty$, ____) and the interval (____ , ∞).
The function has a local maximum at ____ .

16.(1 pt) The function

$$f(x) = -2x^3 - 5.31x^2 + 124.7568x - 6.06$$

is increasing on the interval (____ , ____).
It is decreasing on the interval ($-\infty$, ____) and the interval (____ , ∞).
The function has a local maximum at ____ .

17.(1 pt) For $x \in [-15, 13]$ the function f is defined by

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

On which two intervals is the function increasing (enter intervals in ascending order)?
____ to ____
and
____ to ____
Find the region in which the function is positive: ____ to ____
Where does the function achieve its minimum? ____

18.(1 pt) For $x \in [-12, 14]$ the function f is defined by

$$f(x) = x^4(x-1)^5$$

On which two intervals is the function increasing?

_____ to _____

and

_____ to _____

Find the region in which the function is positive: ___ to ___

Where does the function achieve its minimum? _____

19.(1 pt) Consider the function $f(x) = -2x^3 + 36x^2 - 192x + 7$. For this function there are three important intervals: $(-\infty, A]$, $[A, B]$, and $[B, \infty)$ where A and B are the critical numbers.

Find A _____

and B _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A]$: _____

$[A, B]$: _____

$[B, \infty)$: _____

20.(1 pt) Consider the function $f(x) = 5x + 4x^{-1}$. For this function there are four important intervals: $(-\infty, A]$, $[A, B)$,(B, C), and $[C, \infty)$ where A, and C are the critical numbers and the function is not defined at B.

Find A _____

and B _____

and C _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A]$: _____

$[A, B)$: _____

$(B, C]$: _____

$[C, \infty)$: _____

21.(1 pt) Consider the function $f(x) = x^2 e^{9x}$.

For this function there are three important intervals: $(-\infty, A]$, $[A, B]$, and $[B, \infty)$ where A and B are the critical numbers.

Find A _____

and B _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A]$: _____

$[A, B]$: _____

$[B, \infty)$ _____

22.(1 pt) Answer the following questions for the function

$$f(x) = x\sqrt{x^2 + 9}$$

defined on the interval $[-4, 4]$.

A. $f(x)$ is concave down on the region _____ to _____

B. $f(x)$ is concave up on the region _____ to _____

C. The inflection point for this function is at _____

D. The minimum for this function occurs at _____

E. The maximum for this function occurs at _____

23.(1 pt) Answer the following questions for the function

$$f(x) = x\sqrt{x^2 - 8x + 17} - 4\sqrt{x^2 - 8x + 17}$$

defined on the interval $[-1, 10]$.

A. $f(x)$ is concave down on the region _____ to _____

B. $f(x)$ is concave up on the region _____ to _____

C. The inflection point for this function is at _____

D. The minimum for this function occurs at _____

E. The maximum for this function occurs at _____

24.(1 pt) Answer the following questions for the function

$$f(x) = x\sqrt{x^2 - 8x + 41} - 4\sqrt{x^2 - 8x + 41}$$

defined on the interval $[-3, 10]$.

A. $f(x)$ is concave down on the region _____ to _____

B. $f(x)$ is concave up on the region _____ to _____

C. The inflection point for this function is at _____

D. The minimum for this function occurs at _____

E. The maximum for this function occurs at _____

25.(1 pt) Answer the following questions for the function

$$f(x) = \frac{x^3}{x^2 - 9}$$

defined on the interval $[-19, 16]$.

Enter points, such as inflection points in ascending order, i.e. smallest x values first.

Enter intervals in ascending order also.

A. The function $f(x)$ has vertical asympototes at___ and _____

B. $f(x)$ is concave up on the region ___ to ___ and ___ to _____

C. The inflection points for this function are ____ , ____ and _____

26.(1 pt) Answer the following questions for the function

$$f(x) = \frac{x^3 - 3x^2 + 3x - 1}{x^2 - 2x + 0}$$

defined on the interval $[-14, 18]$.

Enter points, such as inflection points in ascending order, i.e. smallest x values first.

A. The function $f(x)$ has vertical asympototes at ___ and _____

B. $f(x)$ is concave down on the region ___ to ___ and _____ to _____

27.(1 pt) Answer the following questions for the function

$$f(x) = \sin^2(\frac{x}{6})$$

defined on the interval $[-18.0495556, 3.7123889]$.

Enter points, such as inflection points in ascending order, i.e. smallest x values first.

Rememer that you can enter "pi" for π as part of your answer.

A. $f(x)$ is concave down on the region _____ to _____

B. A global minimum for this function occurs at _____

C. A local maximum for this function which is not a global maximum occurs at_____

D. The function is increasing on ___ to ___ and on ___ to _____ .

28.(1 pt) Consider the function $f(x) = 12x^5 + 45x^4 - 200x^3 + 3$.

$f(x)$ has inflection points at (reading from left to right) $x = D$, E, and F

where D is _____

and E is _____

and F is _____

For each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).

$(-\infty, D]$: _____

$[D, E]$: _____

$[E, F]$: _____

$[F, \infty)$: _____

29.(1 pt) Consider the function $f(x) = \frac{2x+6}{3x+2}$. For this function there are two important intervals: $(-\infty, A)$ and (A, ∞) where the function is not defined at A.

Find A _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A)$: _____

(A, ∞) _____

Note that this function has no inflection points, but we can still consider its concavity. For each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).

$(-\infty, A)$: _____

(A, ∞) _____

30.(1 pt) Consider the function $f(x) = 8(x-3)^{2/3}$. For this function there are two important intervals: $(-\infty, A)$ and (A, ∞) where A is a critical number.

Find A _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A)$: _____

(A, ∞): _____

For each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).

$(-\infty, A)$: _____

(A, ∞): _____

31.(1 pt) Consider the function $f(x) = -2x^3 + 21x^2 - 36x + 6$. For this function there are three important intervals: $(-\infty, A]$, $[A, B]$, and $[B, \infty)$ where A and B are the critical numbers.

Find A _____

and B _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A]$: _____

$[A, B]$: _____

$[B, \infty)$ _____

$f(x)$ has an inflection point at $x = C$

where C is _____

Finally for each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).

$(-\infty, C]$: _____

$[C, \infty)$ _____

32.(1 pt) Consider the function $f(x) = 7x + 9x^{-1}$. For this function there are four important intervals: $(-\infty, A]$, $[A, B)$,$(B, C]$, and $[C, \infty)$ where A, and C are the critical numbers and the function is not defined at B.

Find A _____

and B _____

and C _____

For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).

$(-\infty, A]$: _____

$[A, B)$: _____

$(B, C]$: _____

$[C, \infty)$ _____

Note that this function has no inflection points, but we can still consider its concavity. For each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).

$(-\infty, B)$: _____

(B, ∞): _____

33.(1 pt) Consider the function $f(x) = x^2 e^{7x}$.

$f(x)$ has two inflection points at x = C and x = D with $C \leq D$

where C is _____

and D is _____

Finally for each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).

$(-\infty, C]$: _____

$[C, D]$: _____

$[D, \infty)$ _____

34.(1 pt) Consider the function

$$f(x) = \frac{e^x}{4 + e^x}$$

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.)