1. (0 pts) Find dy/dx in terms of x and y if $8xy+9x+y=14$.
$\frac{dy}{dx} =$ _____
Answer(s) submitted:

-

(incorrect)

2. (0 pts) Find dy/dx in terms of x and y if $ax^2 - by^5 = c^2$. Assume that a, b and c are constants.
$\frac{dy}{dx} =$ _____
Answer(s) submitted:

-

(incorrect)

3. (0 pts) Find dy/dx in terms of x and y if $(x-a)^2+y^2=a^2$. Assume that a is a constant.
$\frac{dy}{dx} =$ _____
Answer(s) submitted:

-

(incorrect)

4. (0 pts) Find the slope of the tangent to the curve $y^2 = \dfrac{x^3}{xy+6}$ at $(6,3)$
$\frac{dy}{dx} =$ _____
(Enter **undef** *if the slope is not defined at this point.)*
Answer(s) submitted:

-

(incorrect)

5. (0 pts) For the function $f(x) = -3x^3+36x+14$, find all intervals where the function is increasing: f is increasing on _____
(Give your answer as an interval or a list of intervals, e.g., **(-infinity,8]** *or* **(1,5),(7,10)** *.)*
Similarly, find all intervals where the function is decreasing: f is decreasing on _____
(Give your answer as an interval or a list of intervals, e.g., **(-infinity,8]** *or* **(1,5),(7,10)** *.)*
Finally, find all critical points in the graph of $f(x)$
critical points: $x =$ _____
(Enter your x-values as a comma-separated list, or **none** *if there are no critical points.)*
Answer(s) submitted:

-
-
-

(incorrect)

6. (0 pts) Find a formula for a curve of the form $y = e^{-(x-a)^2/b}$ for $b>0$ with a local maximum at $x=-7$ and points of inflection at $x=-9$ and $x=-5$.
$y =$ _____
Answer(s) submitted:

-

(incorrect)

7. (0 pts) Find the exact global maximum and minimum values of the function $f(t) = \frac{3t}{6+t^2}$ if its domain is all real numbers.
global maximum at $t =$ _____
global minimum at $t =$ _____

(Enter **none** *if there is no global maximum or global minimum for this function.)*
Answer(s) submitted:

-
-

(incorrect)

8. (0 pts) A rectangle has one side on the x-axis and two vertices on the curve

$$y = \frac{3}{3+x^2}.$$

Find the vertices of the rectangle with maximum area.
Vertices = _____
Enter your answers as a comma-separated list of ordered (x,y) pairs, e.g., **(1,0),(8,0),(1,4),(8,4)**.
Answer(s) submitted:

-

(incorrect)

9. (0 pts) If you have 80 meters of fencing and want to enclose a rectangular area up against a long, straight wall, what is the largest area you can enclose?
Area = _____ (include **units**)
Answer(s) submitted:

-

(incorrect)

10. (0 pts) A box has a bottom with one edge 9 times as long as the other. If the box has no top and the volume is fixed at V, what dimensions minimize the surface area?
dimensions = _____
Enter the dimensions as a comma-separated list, e.g., **3,sqrt(12),8**. *(Your answer may involve V.)*
Answer(s) submitted:

-

(incorrect)

11. (0 pts) Some airlines have restrictions on the size of items of luggage that passengers are allowed to take with them. Suppose that one has a rule that the sum of the length, width and height of any piece of luggage must be less than or equal to 156 cm. A passenger wants to take a box of the maximum allowable volume. If the length and width are to be equal, what should the dimensions be?
length = width = _____
height = _____
In this case, what is the volume?
volume = _____
(for each, include **units**)

If the length is be twice the width, what should the dimensions be?
length = _____
width = _____
height = _____
In this case, what is the volume?
volume = _____
(for each, include **units**)

Answer(s) submitted:

-
-
-
-
-
-
-

(incorrect)

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12. (0 pts) Consider $f(x) = a(1-e^{-bx})$ for $a > 0$ and $b > 0$.

Find $f'(x)$: $f'(x) =$ _____

Based on your expression for $f'(x)$, is $f(x)$ increasing or decreasing? (Enter **increasing** or **decreasing**.) _____
(Be sure that you can see why this is true for all values of x.)

Find $f''(x)$: $f''(x) =$ _____

Based on your expression for $f''(x)$, is $f(x)$ concave up or concave down? (Enter **up** or **down**.) _____
(Be sure that you can see why this is true for all values of x.)

Answer(s) submitted:

-
-
-
-

(incorrect)

---

13. (0 pts) Let $f(x) = e^{3x} - kx$, for $k > 0$.

Using a calculator or computer, sketch the graph of f for $k = 1/9, 1/6, 1/3, 1/2, 1, 2, 4$. Describe what happens as k changes.

$f(x)$ has a local minimum. Find the location of the minimum.
$x =$ _____

Find the y-coordinate of the minimum.
$y =$ _____

Find the value of k for which this y-coordinate is largest.
$k =$ _____

How do you know that this value of k maximizes the y-coordinate? Find d^2y/dk^2 to use the second-derivative test.
$\frac{d^2y}{dk^2} =$ _____
(Note that the derivative you get is negative for all positive values of k, and confirm that you agree that this means that your value of k maximizes the y-coordinate of the minimum.)

Answer(s) submitted:

-
-
-
-

(incorrect)

---

14. (0 pts) Find all critical numbers of the polynomial

$$f(x) = 6x^3 + 9x^2 - 540x + 5$$

and then list them (separated by commas) in the box below. If there are no critical numbers, enter **None**.

List of critical numbers: _____
Answer(s) submitted:

-

(incorrect)

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15. (0 pts) For $x \in [-12, 10]$ the function f is defined by

$$f(x) = x^5(x+1)^8$$

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? _____
Answer(s) submitted:

-
-
-
-
-
-
-

(incorrect)

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16. (0 pts) The function $f(x) = -2x^3 + 30x^2 - 54x + 10$ 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 _____
Answer(s) submitted:

-
-
-
-

(incorrect)

---

17. (0 pts) Compute the following limits using L'Hospital's rule if appropriate. Use INF to denote ∞ and MINF to denote $-\infty$.

$\lim_{x\to 1} \frac{5^x - 5}{x^2 - 1}$ = _____

$\lim_{x\to\infty} \frac{\tan^{-1}(x)}{(1/x) - 5}$ = _____

Answer(s) submitted:

-
-

(incorrect)

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18. (0 pts)

Evaluate the limit using L'Hopital's rule

$$\lim_{x\to\infty} \frac{9x^3}{e^{10x}}$$

_____

Answer(s) submitted:

-

(incorrect)