

Serial No:

Student No.:

Name:

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| 1. SHOW ALL WORK. NO CREDITS FOR ANSWERS NOT SUPPORTED BY WORK. |
| 2. CALCULATORS ARE NOT ALLOWED. |

1. (15 points) If $f(x) = e^{2x} + 3\sqrt{x+1} + \ln \sqrt{x+1}$ find $f'(x)$.

2. (15 points) Find the slope of the line tangent to the curve $y = \log_2 \sqrt[5]{\frac{1+x^2}{1+x^3}}$ at $x = 1$.

3. (15 points) If $y = (1+e^x)^x$, find y' at $x = 0$.

4. (15 points) Find y' at the point (1,1) if $x^y - y^x = 0$

5. (20 points) Use implicit differentiation to find y'' at (1,1) if $2x + 2xy + y^2 = 5$.

6. (30 points) Consider the function $f(x) = \frac{(x-1)^2}{x^2}$. Given that

$$f'(x) = \frac{2(x-1)}{x^3} \quad \text{and} \quad f''(x) = \frac{2(3-2x)}{x^4}.$$

a) Find all vertical and horizontal asymptotes if any exists.

b) Find the critical numbers if any exists.

c) Find the increasing and decreasing intervals.

d) Find the local and absolute extrema if any exists.

e) Find the concavity intervals.

f) Find the inflection points if any exists.

7. (30 points) Sketch the graph of the function $y = 2x^3 - x^4$. **Clearly indicate all important points on the graph;** such as, extrema, inflection points, and intercepts if any such points exist. Also the concavity must be clear.
(YOU NEED TO FIND ALL ITEMS OF PROBLEM 6 IN ORDER TO SKETCH THE GRAPH)