

YOUR NAME: \_\_\_\_\_

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Compute the following derivatives:

(a)  $\left[ \frac{9}{\sqrt[3]{x}} - \frac{25\sqrt[5]{x^7}}{7} + 17 \right]' =$

(b)  $[(2x^3 + 1)^5(x^4 - 5x^3)]' =$

2. Find an equation for the tangent line to the graph of

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

3. After  $t$  hours a car is at a distance  $s(t) = 60t + \frac{100}{t + 3}$  miles from its starting point.

(a) Find the car's velocity at  $t = 2$  hours.

(b) Find the car's acceleration at  $t = 1$  hour.

4. Study the function  $f(x) = \frac{1}{x^2 - 1}$  using the first derivative.

(a)  $\text{Dom}(f) =$

(b) Find the asymptotes.

(c)  $f'(x) =$

(d) Find the critical points.

(e) Create the sign table for  $f'$  clearly showing intervals of monotonicity and relative extrema.

(f) Sketch the graph of  $y = f(x)$  base on the information collected above.

5. Study the function  $f(x) = x^3 + 3x^2 + 3x + 6$  using both first and second derivatives.

(a)  $f'(x) =$

(b) Find the critical points.

(c)  $f''(x) =$

(d) Find candidates for inflection points.

(e) Create the combined sign table for  $f'$  and  $f''$ , clearly showing intervals of monotonicity, relative extrema, intervals of concavity and inflection points.

(f) Sketch the graph of  $y = f(x)$  base on the information collected above.