Please show all of your work in answering the following:

1. Let \( f(x) = 2x^3 - 9x^2 - 60x - 6 \)
   a) Find the intervals on which \( f \) is increasing or decreasing.
   b) Identify all relative extrema.
   c) Find the intervals on which \( f \) is concave up or concave down.
   d) Sketch the curve.

2. Find the absolute maximum and the absolute minimum of
   \( f(x) = 2x^4 + x \) on the interval \([-1, 1]\).

3. Sketch the graph of \( f(x) = \frac{x^2 + 1}{x} \), identifying relative extrema, inflection points, asymptotes, etc.

4. Find \( y' \) when
   a) \( y = 1 - x^2 e^x \)
   b) \( y = 3e^{-5x^2 + 2x} \)
   c) \( y = (e^{2x} + 1)^5 \)
   d) \( y = 5 \ln 3x \)
   e) \( y = \ln \left( \frac{x^2 + 1}{x + 2} \right) \)
   f) \( y = 8^{3x} \)
   g) \( y = x^4 4^x \)
   h) \( y = \frac{\ln(x^3 - 4x)}{3^{2x-1}} \)

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5. The half life of lead is 22 years.
   a) Find its decay rate.
   b) If you initially have 15 grams of lead, how long until only 10 grams remain?

6. An open box is to be constructed from a piece of cardboard that is 18 in. by 18 in. by cutting a square out of each corner and folding up the sides. What are the dimensions of the box that will yield the maximum volume?

7. A commuter train line charges $1.50 per ride and averages 6000 passengers per day. They are contemplating a fare increase to maximize revenue. Study shows that each $.25 increase in price results in a loss of 1000 passengers. What should the new fare be in order to maximize revenue?

8. Suppose that a population that is exhibiting exponential growth triples after 8 years. What will the population be after 12 years if the original population was 5000?

9. Find the present value of $50000 due 16 years later at 14% compounded continuously.