Math 20A, Summer, 2006, Lecture 8

1. Find the derivative \( \frac{d}{dx}(3\ln x - 4x^3) \).
   
   Answer: \( \frac{3}{x} - 12x^2 \)

2. What is the derivative of \( y = \ln(x^2 + 3x) \)?
   
   Answer: \( \frac{2x + 3}{x^2 + 3x} \)

3. What is \( f'(5) \) for \( f(x) = \sqrt{\ln x} \)?
   
   Answer: \( \frac{1}{10\sqrt{\ln(5)}} \)

4. Give an equation of the tangent line to \( y = 3 + 2\ln x - x \) at \( x = 2 \). Generate the curve and the line in the window \(-1 \leq x \leq 9, -3 \leq y \leq 3\) as a partial check of your answer.
   
   Answer: Tangent line: \( y = 1 + 2\ln(2) \) • Figure A4

   ![Figure A4](image)

5. Differentiate \( y = (\ln x)^7 \).
   
   Answer: \( \frac{7(\ln x)^6}{x} \)

6. Find \( y'(x) \) for \( y(x) = x^2\ln x \).
   
   Answer: \( x + 2x\ln x \)

   ![Figure A6](image)

7. Find \( \frac{d}{dx}(e^{2x}) \).
   
   Answer: \( 2e^{2x} \)

8. What is \( \frac{d}{dx}(x^2e^x) \)?
   
   Answer: \( x^2e^x + 2xe^x \)
9. Find \( \frac{dG}{dt} \) for \( G(t) = \frac{1 + e^t}{1 - e^t} \).

\[ \text{Answer:} \quad \frac{2e^t}{(1 - e^t)^2} \]

10. Differentiate \( y = \ln(1 + e^x) \).

\[ \text{Answer:} \quad \frac{e^x}{1 + e^x} \]

11. Give an equation of the tangent line to \( y = \sqrt{e^x + 1} \) at \( x = 0 \). Then generate the curve and line in the window \(-5 \leq x \leq 5, -1 \leq y \leq 5\).

\[ \text{Answer: Tangent line: } y = \sqrt{2} + \frac{x}{2\sqrt{2}} \quad \bullet \quad \text{Figure A11} \]

![Figure A11](image1)

12. Give an equation of the tangent line to \( y = e^x \ln x \) at \( x = 2 \). Then generate the curve and line in the window \(-0.5 \leq x \leq 3, -2 \leq y \leq 15\).

\[ \text{Answer: Tangent line: } y = e^2 \ln(2) + e^2(\ln(2) + \frac{1}{2})(x - 2) \quad \bullet \quad \text{Figure A12} \]

![Figure A12](image2)