Chapter 4 Review (Sections 4.1, 4.2, 4.4, and 5.6)

For numbers 1-13: Find the derivative of the function.

1. $y = e^{3x-7}$

2. $y = \tan e^x$

3. $y = \sin^3 x$

4. $y = \ln(\csc x)$

5. $s = \cos(1 - 2t)$

6. $s = \cot^2 t$

7. $y = \sqrt{1 + \cos x}$

8. $y = x\sqrt{2x + 1}$

9. $r = \sec(1 + 3\theta)$

10. $r = \tan^2(3 - \theta^2)$
11. \( y = x^2 \csc 5x \)

12. \( y = \ln \sqrt{x} \)

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

14. Let \( xy = 10 \). Find \( \frac{dy}{dt} \) when \( x = 8 \) given that \( \frac{dx}{dt} = 5 \).

15. Let \( y = 2(x^2 - 3x) \). Find \( \frac{dy}{dx} \). Then find \( \frac{dy}{dt} \) when \( x = 3 \) given that \( \frac{dx}{dt} = 2 \).

16. Find \( \frac{d^2y}{dx^2} \) given \( 1 - xy = x - y \).
17. Find $\frac{dy}{dx}$ of the curve $y = \cos^3(x^2)$

18. Find the slope of the curve $y = \sqrt{x^2 + 1} \sin(2x)$

19. Find the velocity of the function if its position is $s(t) = 4x^2 \tan(x^3 - 1)$.

20. Assume $x$ and $y$ are both differentiable functions of time. If $3x - 4y^3 = -32$, find $\frac{dx}{dt}$ when $x = 0$ and $\frac{dy}{dt} = 3$. 
21. Find the equation of the tangent line to \( x^2 y + 3x = y^2 + 1 \) at the point \((1, -1)\).

22. Find \( \frac{dy}{dx} \) for the following curve: \( x^2 y + y^2 x = 2 \).

23. Find the equation of the tangent line to the curve \( y = x \sin 4x \) when \( x = \pi \).

24. Find the slope of the curve \( y^2 + yx + 3x - 6y = -3 \) at the point(s) when \( x = 1 \).