This worksheet focuses on the differentiation of exponential functions, including functions with the base e. Students will learn to apply differentiation rules such as the constant multiple rule, sum/difference rules, product rule and chain rule to functions like e^x, e^{kx}, and combinations with polynomials and trigonometric functions.

Easy Questions

1. Differentiate $f(x) = e^x$.

2. Differentiate $f(x) = e^{3x}$.

3. Differentiate $f(x) = 2e^x$.

4. Differentiate $f(x) = e^x + 7$.

5. Differentiate $f(x) = e^{2x}$.

Intermediate Questions

6. Differentiate $f(x) = 4e^{5x}$.

7. Differentiate $f(x) = e^{2x} - e^x$.

8. Differentiate $f(x) = 3 + 2e^{4x} - 5e^x$.

9. Differentiate $f(x) = e^x + xe^x$.

10. Differentiate $f(x) = xe^{3x}$.

11. Differentiate $f(x) = e^{kx}$, where k is constant, and then write the derivative for $k = -2$.

12. Differentiate $f(x) = e^{2x}\cos(x)$.

13. Differentiate $f(x) = \dfrac{e^x}{x}$.

14. Differentiate $f(x) = e^{x^2}$.

15. Given $P(t) = P_0 e^{rt}$, differentiate to find $\dfrac{dP}{dt}$.

16. Given $A(t) = A_0 e^{rt}$, differentiate with respect to t.

17. Differentiate $f(x) = 5e^{3x} + 7e^{2x}$.

18. Differentiate $f(x) = e^x \sin(x)$.

19. Differentiate $f(x) = (x+2)e^x$.

20. Differentiate $f(x) = 2e^x + 3$.

Hard Questions

21. Differentiate $f(x) = e^{3x} + xe^{2x}$.

22. Differentiate $f(x) = x^2 e^x$.

23. Differentiate $f(x) = (3x^2 + 2x + 1)e^{5x}$.

24. Differentiate $f(x) = e^x(x^3 - 4x + 2)$.

25. Differentiate $f(x) = xe^{x^2}$.

26. The temperature of an object is given by $T(t) = T_0 e^{-kt}$, where T_0 and k are positive constants. Differentiate to find $\dfrac{dT}{dt}$.

27. Differentiate $f(x) = e^{\sin(x)}$.

28. Differentiate $f(x) = (2x + 1)e^{-3x}$.

29. Find the second derivative of $f(x) = e^{2x}$.

30. Differentiate $f(x) = (x^2 + 1)e^{-x}$ and simplify your answer.