ILLAWARRA TUTORING

This worksheet is designed to help you master the chain rule in differentiating composite functions. You will practise differentiating functions where one function is applied to the result of another function. Read each question carefully and show all your working steps.

Easy Questions

1. Differentiate the function $f(x) = (3x + 2)^5$. Express your answer in its simplest form.
2. Differentiate the function $f(x) = \sqrt{2x + 1}$, writing your answer with rational exponents.
3. Differentiate the function $f(x) = (x^2 + 1)^3$. Simplify your answer where possible.
4. Differentiate the function $f(x) = e^{2x}$. Write your final answer clearly.
5. Differentiate the function $f(x) = \sin(4x)$. Provide your answer in a simplified form.

Intermediate Questions

6. Differentiate the function $f(x) = (2x - 1)^3$. Show all your steps.
7. Differentiate the function $f(x) = \sqrt{5x + 2}$, writing your answer with fractional exponents.
8. Differentiate the function $f(x) = \ln(7x + 4)$. Express your answer in its simplest form.
9. Differentiate the function $f(x) = e^{3x-2}$. Write your answer clearly.
10. Differentiate the function $f(x) = \sin(2x + 1)$. Provide a simplified answer.
11. Differentiate the function $f(x) = \cos(4x - 1)$. Show your working steps.
12. Differentiate the function $f(x) = [\sin(3x)]^2$. Simplify your answer.
13. Differentiate the function $f(x) = \ln(\sin(2x + 3))$. Show all steps in your work.
14. Differentiate the function $f(x) = \sqrt{\ln(5x + 6)}$. Write your answer in a simplified form.
15. Differentiate the function $f(x) = e^{\sin(x+2)}$. Show your full working.

16. Differentiate the function $f(x) = \tan(3x)$. Provide your answer and simplify where possible.
17. Differentiate the function $f(x) = \sqrt{1 - \cos(2x)}$. Clearly show all steps.
18. Differentiate the function $f(x) = [\sin(x)]^3$. Express your answer in simplest form.
19. Differentiate the function $f(x) = \ln\left(1 + e^{2x}\right)$. Show all parts of your calculation.
20. Differentiate the function $f(x) = \sin\left(e^x\right)$. Write your answer clearly.

Hard Questions

21. Differentiate the function $f(x) = [\cos(2x + 1)]^4$. Provide a complete step-by-step solution.
22. Differentiate the function $f(x) = \ln\left((3x + 1)^2 + 5\right)$. Show all working steps.
23. Differentiate the function $f(x) = e^{\ln(x^2+1)}$. Although the expression can be simplified, use the chain rule to show your working.
24. Differentiate the function $f(x) = \sqrt{\sin^2(x + 1) + \cos^2(2x)}$. Provide a detailed solution.
25. Differentiate the function $f(x) = \ln\left(\sqrt{3x + 2} + e^x\right)$. Show all steps in your working.
26. Differentiate the function $f(x) = \sin\left(\ln\left(\sqrt{4x + 1}\right)\right)$. Provide a complete solution.
27. Differentiate the function $f(x) = e^{\cos(\sin(2x))}$. Show all your working steps.
28. Differentiate the function $f(x) = [\tan(x + 1)]^3$. Write your answer in a simplified form.
29. Differentiate the function $f(x) = [1 + \sin(3x + 2)]^5$. Provide a full explanation of each step.
30. Differentiate the function $f(x) = \ln\left(\sin\left(e^{2x+1}\right)\right)$. Write a detailed, step-by-step solution.