ILLAWARRA TUTORING

This worksheet is designed to help you master the chain rule in order to differentiate composite functions effectively. Make sure you show all your working and remember to apply the chain rule carefully.

Easy Questions

1. Differentiate $f(x) = (3x + 2)^2$. Write your answer in simplest form.
2. Differentiate $f(x) = \sqrt{2x + 1}$ with respect to x.
3. Differentiate $f(x) = \sin(5x)$. Clearly indicate the application of the chain rule.
4. Differentiate $f(x) = \cos(3x + 1)$. Provide all necessary steps.
5. Differentiate $f(x) = e^{4x}$. Explain how the chain rule is applied.

Intermediate Questions

6. Differentiate $f(x) = (5x - 3)^3$. Show each step of your calculation.
7. Differentiate $f(x) = (2x + 1)^{\frac{1}{2}}$. Explain how the exponent affects the derivative.
8. Differentiate $f(x) = \ln(2x+3)$. Clearly indicate the derivative of the inner function.
9. Differentiate $f(x) = (2x + 3)^{-1}$. Write your answer in simplified form.
10. Differentiate $f(x) = (\sin x)^2$. State how the chain rule is utilised.
11. Differentiate $f(x) = (\cos(2x))^3$. Be sure to highlight both the outer and inner functions.
12. Differentiate $f(x) = (3x^2 + 2x - 1)^4$. Provide a clear step-by-step solution.
13. Differentiate $f(x) = \tan\left(2x + \frac{\pi}{4}\right)$. Include the derivative of the tangent function in your answer.
14. Differentiate $f(x) = e^{\sin x}$. Explain the role of the chain rule in your solution.
15. Differentiate $f(x) = \ln\left(\sqrt{x + 2}\right)$. Rewrite the square root as an exponent and then apply the chain rule.
16. Differentiate $f(x) = (2x + 1)^{\frac{5}{3}}$. Simplify your answer where possible.

17. Differentiate $f(x) = (3x+4)^{-2}$. Show how the chain rule is applied with a negative exponent.

18. Differentiate $f(x) = \sin(\cos x)$. Identify the inner and outer functions.

19. Differentiate $f(x) = e^{2x^2+1}$. Detail all steps in applying the chain rule.

20. Differentiate $f(x) = \sqrt{\sin x}$. Express the square root using exponents and apply the chain rule.

Hard Questions

21. Differentiate $f(x) = \ln\left(e^{3x+1} + 5\right)$. Write a detailed solution explaining each differentiation step.

22. Differentiate $f(x) = \sin\left(x^3 + 2x\right)$. Clearly identify the inner function and apply the chain rule.

23. Differentiate $f(x) = \cos\left(\sqrt{2x+3}\right)$. First rewrite the square root as an exponent, then apply the chain rule.

24. Differentiate $f(x) = e^{\tan x}$. Provide a detailed solution, including the derivative of the tangent function.

25. Differentiate $f(x) = \left(1 + e^x\right)^4$. Identify the inner and outer functions and explain each step.

26. Differentiate $f(x) = \sqrt{\ln(x+3)}$. Express the square root as an exponent and apply the chain rule carefully.

27. Differentiate $f(x) = \ln\left(\sin(3x+2)\right)$. Provide a full explanation of how the chain rule is used.

28. Differentiate $f(x) = \left(\cos(2x)\right)^5$. Clearly state the outer and inner functions and simplify your answer.

29. Differentiate $f(x) = e^{e^x}$. Explain in detail the nested application of the chain rule required for this function.

30. Differentiate $f(x) = \sin\left(\ln(x^2+1)\right)$. Identify all the component functions and show a complete solution highlighting the chain rule.