In this worksheet you will master the chain rule to differentiate composite functions effectively. You will practise recognising inner and outer functions and apply the chain rule repeatedly when necessary.

Easy Questions

1. Differentiate $f(x) = (3x + 2)^2$ with respect to x.

2. Differentiate $g(x) = \sqrt{2x + 5}$ with respect to x.

3. Differentiate $h(x) = \dfrac{1}{\sqrt{x + 1}}$ with respect to x.

4. Differentiate $p(x) = \sin(5x)$ with respect to x.

5. Differentiate $q(x) = \exp(3x + 1)$ with respect to x.

Intermediate Questions

6. Differentiate $y = \cos(2x^2)$ with respect to x.

7. Differentiate $y = \ln(4x + 3)$ with respect to x.

8. Differentiate $y = \tan(x^2)$ with respect to x.

9. Differentiate $y = (5x - 1)^3$ with respect to x.

10. Differentiate $y = \sqrt{1 + 4x}$ with respect to x.

11. Differentiate $y = \sin(3x + 2)$ with respect to x.

12. Differentiate $y = (2 - x)^4$ with respect to x.

13. Differentiate $y = \cos^2(x)$ with respect to x.

14. Differentiate $y = \sqrt{3x^2 + 2}$ with respect to x.

15. Differentiate $y = \ln\left(\sqrt{x + 4}\right)$ with respect to x.

16. Differentiate $y = \exp(\sin x)$ with respect to x.

17. Differentiate $y = \sqrt{\ln(2x + 3)}$ with respect to x.

18. Differentiate $y = \sin^3(2x)$ with respect to x.

19. Differentiate $y = (\cos x)^5$ with respect to x.

20. Differentiate $y = \sqrt{5x + 7} + \sqrt{2x - 3}$ with respect to x.

Hard Questions

21. Differentiate $y = \ln(\sin(3x))$ with respect to x.

22. Differentiate $y = \sin(\ln(2x + 1))$ with respect to x.

23. Differentiate $y = \exp(\cos(4x))$ with respect to x.

24. Differentiate $y = \sqrt{\tan(3x)}$ with respect to x.

25. Differentiate $y = \cos\left(\sqrt{3x + 2}\right)$ with respect to x.

26. Differentiate $y = \ln\left(\sqrt{1 + e^{2x}}\right)$ with respect to x.

27. Differentiate $y = \exp\left(\sqrt{\sin(2x)}\right)$ with respect to x.

28. Differentiate $y = \ln\left(\cos\left(\sqrt{3x}\right)\right)$ with respect to x.

29. Differentiate $y = \sqrt{\ln\left(1 + \tan x\right)}$ with respect to x.

30. Differentiate $y = \sin\left(\sqrt{\ln(2x + 3)}\right)$ with respect to x.