In this worksheet you will practise applying the power rule, the sum rule and the constant multiple rule to differentiate various functions. These questions involve polynomial functions and functions with rational or negative exponents. Ensure that you show all your workings.

## Easy Questions

1. Differentiate the function $f(x) = 3x^2$.

2. Differentiate the function $f(x) = 5x^3 - 4$.

3. Differentiate the function $f(x) = -7x + 10$.

4. Differentiate the function $f(x) = 6x^4 + 3x^2$.

5. Differentiate the function $f(x) = 4x^3 + 5x^2 - x + 8$.

## Intermediate Questions

11. Differentiate the function $f(x) = 7x^4 - 3x^2 + 9$.

12. Differentiate the function $f(x) = -8x^5 + 2x^3 - 6x + 4$.

13. Differentiate the function $f(x) = 12x^6 - 15x^2 + 20x - 5$.

14. Differentiate the function $f(x) = 5 - 3x^7$.

15. Differentiate the function $f(x) = 2x^3 + 4x^2 - 6x + 7$.

16. Differentiate the function $f(x) = -4x^8 + x^2 - 9x$.

17. Differentiate the function $f(x) = \dfrac{1}{2}x^2 + \dfrac{3}{4}x^3 - \dfrac{5}{6}$.

18. Differentiate the function $f(x) = 10x - 6x^4$.

19. Differentiate the function $f(x) = 7\left(x^3 - 2x\right)$.

20. Differentiate the function $f(x) = 4x^5 + 3x^3 - 2x^2 + x - 1$.

21. Differentiate the function $f(x) = -3x^6 + 8x^2 - 10$.

22. Differentiate the function $f(x) = 9x^3 + 2x - 7$.

23. Differentiate the function $f(x) = x^7 - 4x^4 + 3x^2$.

24. Differentiate the function $f(x) = 5x^2 - 11x + 3$.

25. Differentiate the function $f(x) = -2x^9 + 6x^5 - 4x^3 + x$.

## Hard Questions

21. Differentiate the function $f(x) = \dfrac{7}{3}x^{7/3} - \dfrac{5}{2}x^{3/2} + x^{1/3}$.

22. Differentiate the function $f(x) = 4x^{-3} + 6x^{-1}$.

23. Differentiate the function $f(x) = 5x^{4/3} - 3x^{2/3} + 2x^{1/3}$.

24. Differentiate the function $f(x) = -\dfrac{2}{5}x^{5/2} + 7x^{3/2} - \dfrac{3}{2}x^{1/2}$.

25. Differentiate the function $f(x) = 3x^{7/4} - 4x^{5/4} + x^{3/4}$.

26. Differentiate the function $f(x) = 7x^{10} - 4x^5 + 9x^2 - 11$.

27. Differentiate the function $f(x) = \dfrac{1}{3}x^{7/2} - \dfrac{2}{7}x^{5/2} + x^{1/2}$.

28. Differentiate the function $f(x) = 4x^4 - x^{-2} + 3x$.

29. Differentiate the function $f(x) = -6x^{11/3} + 8x^{8/3} - x^{5/3}$.

30. Differentiate the function $f(x) = \dfrac{9}{2}x^{3/2} - 4x^{1/2} + \dfrac{1}{2}x^{-1/2}$.