In this worksheet you will practise forming and evaluating composite functions so you can understand how functions interact with one another. Work through the questions carefully and show all your workings.

Easy Questions

1. The functions are given by $f(x) = 2x$ and $g(x) = x + 3$. Form the composite function $(f \circ g)(x)$.

2. The functions are $f(x) = x^2$ and $g(x) = 3x$. Evaluate $(f \circ g)(2)$.

3. Given $f(x) = x - 4$ and $g(x) = 5x$, form and simplify the composite function $(g \circ f)(x)$.

4. With $f(x) = x + 1$ and $g(x) = 2x - 3$, evaluate $(f \circ g)(0)$.

5. Let $f(x) = -x$ and $g(x) = x^2 + 1$. Find the value of $(f \circ g)(2)$.

Intermediate Questions

6. The functions are $f(x) = 3x + 2$ and $g(x) = x - 1$. Form and simplify both $(f \circ g)(x)$ and $(g \circ f)(x)$.

7. With $f(x) = x^2$ and $g(x) = 2x + 1$, find and simplify $(f \circ g)(x)$.

8. Given $f(x) = x + 6$ and $g(x) = 4x - 7$, compute $(g \circ f)(3)$.

9. Let $f(x) = \sqrt{x}$ and $g(x) = x^2 + 2$. Evaluate $(f \circ g)(9)$.

10. If $f(x) = \dfrac{1}{x}$ (with $x \neq 0$) and $g(x) = x + 5$, evaluate $(f \circ g)(2)$.

11. Given $f(x) = 2x - 3$ and $g(x) = x^2$, form the composite function $(f \circ g)(x)$.

12. Let $f(x) = \dfrac{x}{2}$ and $g(x) = 5x + 1$. Find the value of x such that $(f \circ g)(x) = 20$.

13. With $f(x) = x^2$ and $g(x) = x - 2$, first form $(f \circ g)(x)$ and then compute $(f \circ g)(4)$.

14. Given $f(x) = 1 - x$ and $g(x) = 2x + 3$, form the composite function $(g \circ f)(x)$.

15. If $f(x) = 4 - x$, determine $(f \circ f)(x)$.

16. Let $f(x) = x^2 + 1$ and $g(x) = \sqrt{x + 3}$. Form $(f \circ g)(x)$, simplify it, and state its domain.

17. Given $f(x) = \dfrac{x+2}{x-1}$ and $g(x) = x - 2$, form and simplify $(f \circ g)(x)$. State any restrictions on the domain.

18. With $f(x) = \dfrac{3}{x}$ and $g(x) = x + 4$, form $(g \circ f)(x)$.

19. Let $f(x) = x^3$ and $g(x) = 2x - 1$. Determine $(f \circ g)(x)$.

20. Given $f(x) = |x|$ and $g(x) = x - 5$, evaluate $(f \circ g)(3)$.

Hard Questions

21. Show that for $f(x) = 2x + 1$ and $g(x) = x^2 - x + 3$, the composite function $(f \circ g)(x)$ simplifies to $2x^2 - 2x + 7$.

22. Let $f(x) = x^2$ and $g(x) = \dfrac{3}{x+1}$ (with $x \neq -1$). Form $(g \circ f)(x)$ and state its domain.

23. Given $f(x) = \sqrt{x-2}$ and $g(x) = x^2 + 1$, form and simplify $(f \circ g)(x)$. Then determine the values of x for which the composite is defined.

24. Let $f(x) = x + 2$ and $g(x) = 2x$. Find all values of x for which $(f \circ g)(x) = (g \circ f)(x)$.

25. If $f(x) = \dfrac{1}{2x-1}$ and $g(x) = x + 3$, form and simplify $(g \circ f)(x)$. Also, state any restrictions on x.

26. Let $f(x) = \ln(x)$ and $g(x) = e^x$. Form both $(f \circ g)(x)$ and $(g \circ f)(x)$. Explain your answer for $x > 0$.

27. Given $f(x) = (x-1)^2$ and $g(x) = \sqrt{x}$ (with $x \geq 0$), form $(g \circ f)(x)$. Then solve $(g \circ f)(x) = 3$.

28. Let $f(x) = 2x^2 - 3$ and $g(x) = x - 1$. Express $(f \circ g)(x)$ in fully expanded form.

29. If $f(x) = \sqrt[3]{x}$ and $g(x) = 4x + 8$, form $(f \circ g)(x)$.

30. Let $f(x) = \dfrac{1}{x+2}$ and $g(x) = \dfrac{3}{x-1}$. Form $(f \circ g)(x)$, simplify your answer, and state all necessary restrictions on the domain.