# Year 11 Mathematics Advanced

**Topic: Working with Functions (9 of 12)**
**Review Questions: Properties of Functions, Relations and Graphs**
**Term 3, 2026**

**How to use this review set**

These are real past-paper questions, grouped by question pattern. The grey label on each question shows where it is from and its marks.

- The questions are grouped by the pattern that keeps coming up in exams, a few of each in a row, running from the plainer patterns into the harder ones near the end. Work through them and you will meet every type an exam can throw at you.
- This set **is your diagnostic**. Working through it shows you exactly which patterns are solid and which need work. Attempt every question properly in your own book, and go back to your notes to help you work through tough questions if needed.
- Every question you get wrong, need help with or struggle with goes in your **Mistakes Log**, which you should be working on daily to get you exam-ready.

## Contents

**Domain, range and symmetry**

1. Domain and range in interval notation (functions, relations, from graphs)
2. Classifying relations and functions (one-to-one, many-to-one, is-it-a-function)
3. Even and odd functions: algebraic tests
4. Even and odd functions from a graph, and even/odd problem-solving

**Composite functions**

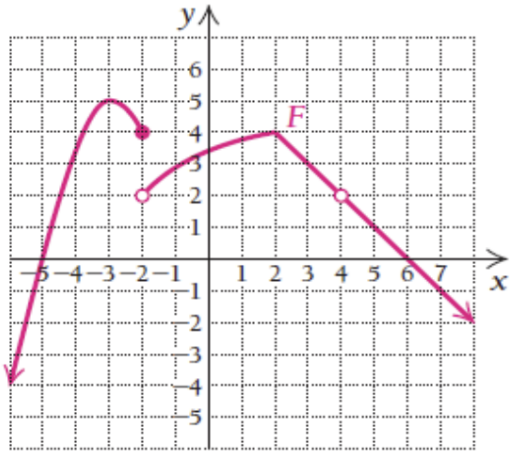
5. Evaluate a composite function (numeric, from tables or graphs)
6. Form and simplify the composite function f(g(x))
7. Domain and range of a composite function
8. Determine the equation of a composite / solve composite equations
9. Sketch or identify the graph of a composite function

# Domain, range and symmetry

## 1. Domain and range in interval notation (functions, relations, from graphs)

### Q1 Sydney Girls 2020 Trial Q14 · **2 marks**

Consider the function shown below.




Write down the domain and range using interval notation.

### Q2 Normanhurst Boys 2020 Trial Q13(b) · **2 marks**

A function is defined as

$$f(x) = \begin{cases} \log_2(x+4) & -4 < x \leq 4 \\ 2\,|x-5|+1 & 4 < x < 7 \\ 5 & x \geq 7. \end{cases}$$

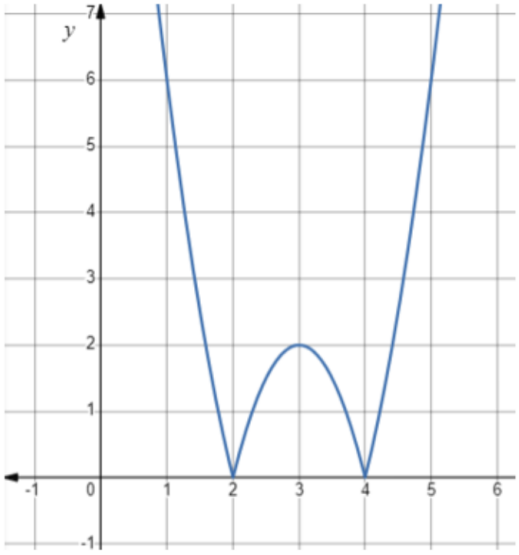
Using interval notation, state the domain and range of $f(x)$.

### Q3 Gosford 2020 Trial Q23(a) · **3 marks**

The function $f$ is defined by $f(x) = 2 + \sqrt{x-3}$ for $x \geq 3$. Write the domain and range of the function $f$ using interval notation.

## Q4 Hurlstone 2024 Prelim Q11 · **1 mark**

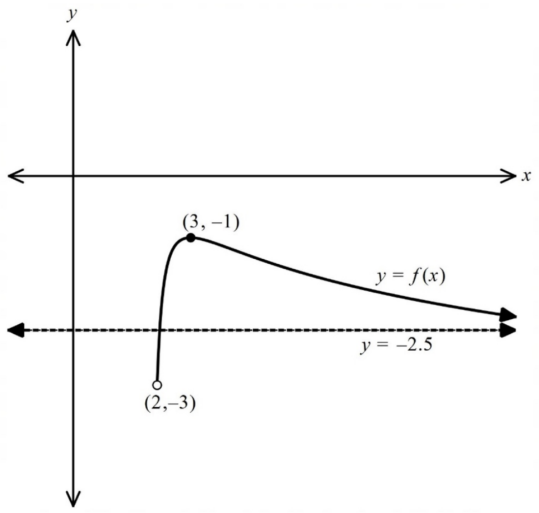
The graph of a function $y = f(x)$ is shown below.




State the range for the function $y = f(-x)$.

## Q5 Barker 2024 Prelim Q8 · **1 mark**

The graph of a function $y = f(x)$ is shown below. It has an asymptote at $y = -2.5$. Which statement correctly describes its domain and range?




(A) Domain: $(2, \infty)$; Range: $[-2.5, -1]$

(B) Domain: $(-3, -1]$; Range: $(2, \infty)$

(C) Domain: $[2, \infty)$; Range: $[-3, -1)$

(D) Domain: $(2, \infty)$; Range: $(-3, -1]$

## Q6 Baulkham Hills 2023 Trial Q8 · **1 mark**

Which of the following is the domain and range of $y = \dfrac{x^2 + 1}{x^2 - 1}$?

(A) Domain: $x \in (-\infty, -1) \cup (-1, 1) \cup (1, \infty)$; Range: $y \in (-\infty, -1) \cup (1, \infty)$

(B) Domain: $x \in (-\infty, -1) \cup (-1, 1) \cup (1, \infty)$; Range: $y \in (0, \infty)$

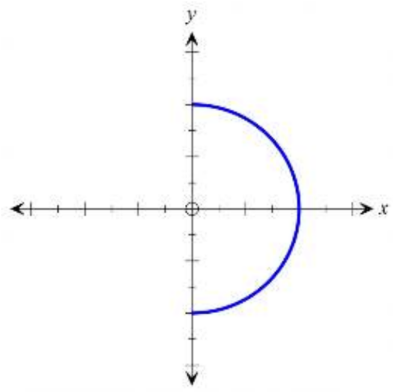
(C) Domain: $x \in (-\infty, -1) \cap (-1, 1) \cap (1, \infty)$; Range: $y \in (-\infty, -1) \cap (1, \infty)$

(D) Domain: $x \in (-\infty, -1) \cap (-1, 1) \cap (1, \infty)$; Range: $y \in (0, \infty)$

## 2. Classifying relations and functions (one-to-one, many-to-one, is-it-a-function)

### Q7 Barker 2021 Prelim Q5 · **1 mark**

What type of relation is the following graph?




(A) One-to-one

(B) One-to-many

(C) Many-to-one

(D) Many-to-many

### Q8 Hunters Hill 2024 Trial Q2 · **1 mark**

Which of the following statements is true of the function $f(x) = -x(x+2)(x-2)$?

(A) $f(x)$ is a parabola that has been reflected and translated

(B) $f(x)$ is a one-to-one function

(C) $f(x)$ is an even function

(D) $f(x)$ is an odd function

## Q9 Hunters Hill 2022 Trial Q9 · **1 mark**

Let $f(x) = x^3 - (k^2 - 4)x + 1$. For which of the values of $k$ below is $f(x)$ many-to-one?

(A) $k = 2$

(B) $k = -2$

(C) $k = 1$

(D) $k = -4$

## Q10 Baulkham Hills 2020 Trial Q9 · **1 mark**

Given a function $f(x) = \dfrac{x}{x^2 - 5}$, which of the following statements is true?

(A) $f(x)$ is even and one-to-one.

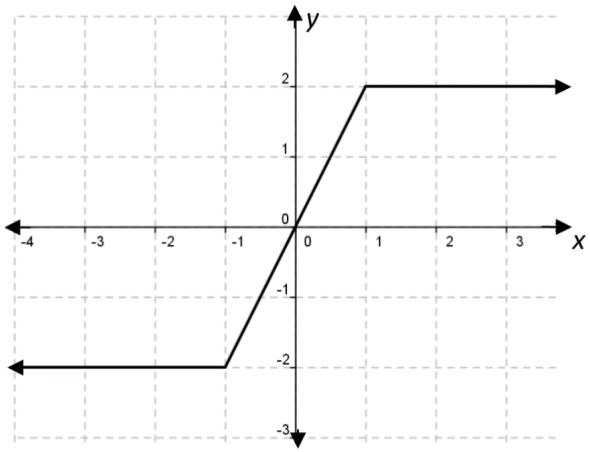
(B) $f(x)$ is even and many-to-one.

(C) $f(x)$ is odd and one-to-one.

(D) $f(x)$ is odd and many-to-one.

## Q11 Hurlstone 2023 Trial Q16(b) · **2 marks**

Consider the graph $y = f(x)$ shown below.




Determine if the graph drawn is even, odd or neither. Justify your answer.

**Q12** James Ruse 2024 Trial Q2 · **1 mark**

Consider the function $f(x) = \ln\left(x + \sqrt{x^2+1}\right)$. Which of the following describes $f(x)$?

(A) An even many-to-one function.

(B) An odd many-to-one function.

(C) An even one-to-one function.

(D) An odd one-to-one function.

## 3. Even and odd functions: algebraic tests

**Q13** Girraween 2023 Prelim Q7(c) · **2 marks**

Test whether $f(x) = x^5 - 21x$ is an even function, odd function or neither.

**Q14** Merewether 2025 Trial Q15(a) · **1 mark**

Consider the function $f(x) = \dfrac{x}{x^2+1}$. Show that $f(x)$ is odd.

**Q15** Pymble 2022 Prelim Q16 · **2 marks**

Show working to determine whether the function $f(x) = \dfrac{x^3}{x^2-1}$ is odd, even or neither.

**Q16** Kambala 2021 Prelim Q8 · **3 marks**

Given $f(x) = x^2 - 2$ and $g(x) = \sqrt{x}$.

(a) Find $g\big(f(x)\big)$.

(b) Determine if $g\big(f(x)\big)$ is odd, even or neither. Use appropriate working to justify your answer.

**Q17** Abbotsleigh 2023 Trial Q13(c)(i) · **1 mark**

Consider the function $f(x) = 3x - \sin x$. Show that $f(x)$ is an odd function.

**Q18** Penrith 2023 Trial Q17 · **3 marks**

Consider the curve given by $f(x) = x^2 \ln|x|$. Is $f(x) = x^2 \ln|x|$ an odd or an even function or neither? Justify your response.

## 4. Even and odd functions from a graph, and even/odd problem-solving

### Q19 Sydney Grammar 2022 Trial Q3 · **1 mark**

Which of the following is an odd function?

(A) $y = x^2 + x$

(B) $y = x^2 + 1$

(C) $y = x^3 + x$

(D) $y = x^3 + 1$

### Q20 Hurlstone 2022 Prelim Q5 · **1 mark**

Which one of the following sets of ordered pairs represents an odd function?

(A) $\{(2,3),(3,2),(5,7),(7,5)\}$

(B) $\{(-2,3),(2,3),(-5,7),(7,5)\}$

(C) $\{(2,3),(-2,-3),(5,7),(-5,-7)\}$

(D) $\{(2,3),(3,5),(5,7),(7,2)\}$

### Q21 Gosford 2023 Prelim Q2 · **1 mark**

Which of the following graphs represents an odd function?

Diagram to be inserted:
`adv-working-with-functions-d9-q21.png`

(A) Graph A

(B) Graph B

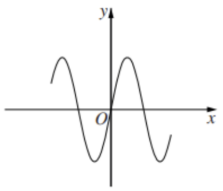
(C) Graph C

(D) Graph D

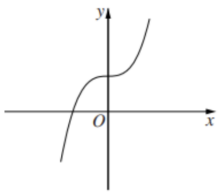
## Q22 Killara 2023 Prelim Q18 · **2 marks**

A part of an odd function $g(x)$ is shown on the diagram below. Complete the diagram for $g(x)$ over the domain $(0, \infty)$.

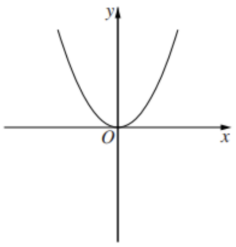
A.



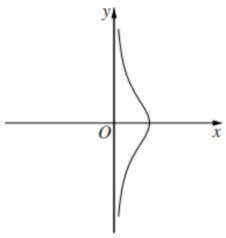

B.




C.




D.




## Q23 Baulkham Hills 2024 Trial Q9 · **1 mark**

It is known that $f(x)$ is an odd function and $g(x)$ is an even function. Given that $f(2) = 2$ and $g(2) = -2$, what is the value of $f\big(g(-2)\big) + g\big(f(-2)\big)$?

(A) $-4$

(B) $-2$

(C) $0$

(D) $4$

## Q24 North Sydney Girls 2022 Prelim Q21 · **2 marks**

Let $f(x) = 1 - x^2$. Determine whether $f\big(f(x)\big)$ is odd, even, or neither. Show all working.

## Q25 Sydney Boys 2025 Trial Q7 · **1 mark**

Let $f(x)$ be a continuous odd function. Given that $f(x - a)$ is an even function, which of the following must be true?

(A) $f(x - a) = f(a - x)$

(B) $f(x - a) + f(x + a) = 0$

(C) $f(0) > 0$

(D) None of the above

# Composite functions

## 5. Evaluate a composite function (numeric, from tables or graphs)

### Q26 Barker 2025 Trial Q3 · **1 mark**

The table shows the function values for $y = f(x)$ and $y = g(x)$.

| $x$ | $-1$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|
| $f(x)$ | 3 | 0 | 3 | 12 | 27 |
| $g(x)$ | 4 | 3 | 2 | 1 | 0 |

What is the value of $y = f\big(g(1)\big)$?

(A) 0

(B) 1

(C) 6

(D) 12

### Q27 Barker 2023 Trial Q12(a) · **1 mark**

Given that $f(x) = 2x + 1$ and $h(x) = x^2 - x$, find $h\big(f(-2)\big)$.

### Q28 Ascham 2020 Trial Q19 · **1 mark**

Consider the functions $f(x)$ and $g(x)$ whose graphs are displayed below.

Diagram to be inserted:
`adv-working-with-functions-d9-q28.png`

Find the value of $g\big(f(-2)\big)$.

### Q29 Knox 2023 Prelim Q18(a) · **2 marks**

A function is defined by $f(x) = 16 - \sqrt{x}$. Find $f\big(f(9)\big)$, leaving your answer in exact form.

### Q30 Newington 2024 Trial Q6 · 1 mark

The table below shows the values of two functions, $f(x)$ and $g(x)$, for various values of $x$. It is known that $f(x)$ is an even function and $g(x)$ is an odd function.

| $x$ | 1 | 2 | 4 | 6 | 7 |
|---|---|---|---|---|---|
| $f(x)$ | 3 | 5 | 6 | 1 | 4 |
| $g(x)$ | 2 | 0 | 1 | 4 | 7 |

What is the value of $f\big(g(-4)\big)$?

(A) 2

(B) 3

(C) 4

(D) 5

### Q31 Caringbah 2022 Trial Q7 · 1 mark

Consider the functions $f(x) = x^2$ and $g(x) = x + 2$. Which of the following expressions is equal to $f\big(g(x)\big) - g\big(f(x)\big)$?

(A) $4x + 2$

(B) $4x + 4$

(C) $x^2 - x - 2$

(D) 2

## 6. Form and simplify the composite function f(g(x))

### Q32 Loreto Kirribilli 2022 Prelim Q23(a) · 1 mark

If $f(x) = x^2 - 1$ and $g(x) = \sqrt{x}$, find the composite function $f(g(x))$.

### Q33 Normanhurst Boys 2022 Trial Q11 · 2 marks

Given the functions $f(x) = 2x^2 - 7x + 5$ and $g(x) = 3x + 2$, find $f(g(x))$ in simplest form.

### Q34 Sydney Girls 2021 Prelim Q4(b)(i) · 1 mark

Consider the functions $f(x) = e^x$ and $g(x) = \ln(x - 2)$. Find $f(g(x))$.

**Q35** North Sydney Boys 2024 Prelim Q5 · **1 mark**

The functions $g(x)$ and $h(x)$ are defined as follows:

$$g(x) = \frac{x^2}{8}, \qquad h(x) = \sqrt{2x+3}.$$

Which is the correct expression for $h(g(x))$?

(A) $\frac{x}{2} + 3$

(B) $\frac{x}{2} - 3$

(C) $\sqrt{\frac{2x}{3}}$

(D) $\sqrt{\frac{x}{2} + 3}$

**Q36** Cherrybrook Tech 2021 Prelim Q11 · **2 marks**

Given that $f(x) = 2x^2 - x$ and $g(x) = 2x - 3$, write an expression for $f(g(x))$ in the form $ax^2 + bx + c$, where $a$, $b$ and $c$ are integers.

**Q37** James Ruse 2022 Trial Q13(b) · **2 marks**

Let $f(x) = -x^2 + x + 4$ and $g(x) = x^2 - 2$. Express $f(g(x))$ in the form $ax^4 + bx^2 + c$, where $a$, $b$ and $c$ are non-zero integers.

**Q38** Barker 2021 Prelim Q11(d) · **2 marks**

If $f(x) = \frac{3}{x^2}$, find an expression for $f(f(x))$.

## 7. Domain and range of a composite function

**Q39** Fort St 2022 Prelim Q8(b) · **2 marks**

Given $f(x) = \frac{3}{x}$ and $g(x) = x + 2$, state the domain and range of $f(g(x))$.

**Q40** SCEGGS 2022 Prelim Q17(b) · **1 mark**

Let $f(x) = \sqrt{x}$ and $g(x) = x - 4$, so that $f(g(x)) = \sqrt{x-4}$. State the domain of $f(g(x))$.

**Q41** Penrith 2023 Prelim Q13(c) · **2 marks**

Let $f(x) = x + 2$ and $g(x) = -x^2 + 6x + 7$, so that $g(f(x)) = -x^2 + 2x + 15$. Find the domain and range of $g(f(x))$ in interval notation.

**Q42** Barker 2024 Prelim Q18(c) · **2 marks**

Given that $f(x) = x^2 + 1$ and $g(x) = \sqrt{x - 3}$, determine the equation of $y = f(g(x))$ and state the domain of $f(g(x))$.

**Q43** Killara 2024 Trial Q21 · **3 marks**

Given the two functions $f(x) = x^2 - 3$ and $g(x) = \sqrt{2 - x}$, find the domain and range of $f(g(x))$.

**Q44** Killara 2024 Prelim Q22(a) · **3 marks**

Let $f(x) = \sqrt{x}$ and $g(x) = x^4 + 1$. Let $h(x) = f(g(x))$. State the domain and range of $h(x)$.

**Q45** North Sydney Boys 2024 Trial Q9 · **1 mark**

Let $f(x) = \sqrt{x}$ and $g(x) = \dfrac{1}{x - 1}$. Which is the range of $g(f(x))$?

(A) $[1, \infty)$

(B) $[0, 1) \cup (1, \infty)$

(C) $(-\infty, -1] \cup (0, \infty)$

(D) $(0, \infty)$

### Q46 North Sydney Girls 2023 Prelim Q10 · **1 mark**

The graphs of $y = f(x)$ and $y = g(x)$ are shown.

Diagram to be inserted:
`adv-working-with-functions-d9-q46.png`

What is the domain and range of $y = f(g(x))$?

(A) Domain $(-1, 2]$, Range $[-3, 3]$

(B) Domain $(-1, 2]$, Range $[-1, 2]$

(C) Domain $(-\infty, \infty)$, Range $[-3, 3)$

(D) Domain $(-\infty, \infty)$, Range $(-1, 2]$

## 8. Determine the equation of a composite / solve composite equations

### Q47 Penrith 2023 Prelim Q13(a) · **2 marks**

Let $f(x) = x + 2$ and $g(x) = -x^2 + 6x + 7$.
Show that $g(f(x)) = -x^2 + 2x + 15$.

### Q48 Barker 2024 Prelim Q10 · **1 mark**

Given that $f$ and $g$ are two functions such that $f(x) = 2x$ and $g(x + 2) = 3x + 1$, which function is $f(g(x))$?

(A) $6x - 5$

(B) $6x + 1$

(C) $6x - 10$

(D) $6x + 2$

### Q49 St George Girls 2022 Prelim Q26 · **3 marks**

Consider the functions $f(x) = x^2 - 4$ and $g(x) = 4 - 2x$.
Solve $f(g(x)) = 0$.

**Q50** Girraween 2023 Prelim Q7(e) · **4 marks**

Given $f(x) = 3x + 2$ and $g(x) = 7x + b$, where $b$ is a constant.

(a) Find expressions for

(i) $g(f(x))$.

(ii) $f(g(x))$.

(b) Hence find the value of $b$ so that $g(f(x)) = f(g(x))$ for all $x$.

**Q51** Knox 2023 Prelim Q18(b) · **3 marks**

A function is defined by $f(x) = 16 - \sqrt{x}$.
Solve $f(f(x)) = 14$.

**Q52** Baulkham Hills 2024 Trial Q31 · **3 marks**

Given $f(x) = \dfrac{x+1}{2x-1}$ and $f(g(x)) = \dfrac{3x+2}{3x-5}$, find $g(x)$.

**Q53** North Sydney Girls 2024 Trial Q27(b) · **2 marks**

Consider the function $f\left(\dfrac{x}{3} - 1\right) = \dfrac{1}{x-2} - 6$.
Find the equation of $y = f(x)$.

## 9. Sketch or identify the graph of a composite function

**Q54** Trinity Grammar 2022 Trial Q22(b) · **1 mark**

Let $f(x) = \sqrt{4-x}$ and $g(x) = x^2$. Sketch the graph of $y = f\big(g(x)\big)$.

**Q55** Loreto Kirribilli 2022 Prelim Q23(c) · **2 marks**

Let $f(x) = x^2 - 1$ and $g(x) = \sqrt{x}$, so that $f\big(g(x)\big) = x - 1$ with domain $x \geq 0$. Sketch the graph of $y = f\big(g(x)\big)$, showing any intercepts on the axes.

## Q56 Baulkham Hills 2021 Prelim Q16 · **5 marks**

Consider the functions $f(x) = \sqrt{x+3}$ and $g(x) = x^2 - 2$.

(a) Write a simplified expression for $g(f(x))$.

(b) State the domain and range of $g(f(x))$.

(c) Sketch the graph of $y = g(f(x))$.

## Q57 Killara 2022 Prelim Q33 · **3 marks**

Let $f(x) = \sqrt{x}$ and $g(x) = \dfrac{1}{x^2 - 3}$. By finding an expression for $g\big(f(x)\big)$, sketch the function $y = g\big(f(x)\big)$ over its natural domain.

## Q58 Manly 2020 Trial Q22 · **3 marks**

Given the functions $f(x) = x^2 - 1$ and $g(x) = \sqrt{4 - x^2}$, form an expression for $y = f\big(g(x)\big)$ and sketch it over its natural domain.

## Q59 HSC 2022 Q10 · **1 mark**

The graphs of $y = f(x)$ and $y = g(x)$ are shown.

Diagram to be inserted:
`adv-working-with-functions-d9-q59.png`

Which graph best represents $y = g\big(f(x)\big)$?

(A) Graph A

(B) Graph B

(C) Graph C

(D) Graph D

## Q60 Killara 2025 Trial Q19 · **4 marks**

Given the two functions $f(x) = \dfrac{1}{x^2 + 2} - 3$ and $g(x) = \sqrt{x+2}$, sketch $y = f\big(g(x)\big)$ over its natural domain.