Year 11 Mathematics Advanced

Topic: Working with Functions (5 of 12)
Review Questions: Reciprocal Functions
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.
- A question marked ★ has one part that reaches into a **Year 12** topic (calculus); it is flagged, and the grey note under the question says which part.

Contents

Reciprocal graphs

1. Domain, range and asymptotes of a reciprocal function
2. Match / describe a hyperbola from its graph (equation and parameters)
3. Sketch a transformed hyperbola k/(x-a)+c from its equation

Solving and combining

4. Intersections of a hyperbola with a line and solving rational equations / inequalities
5. Reciprocal graphs via composition and combined curves

Reciprocal graphs

1. Domain, range and asymptotes of a reciprocal function

Q1 St George Girls 2022 Prelim Q24(a) · 1 mark

A function is defined by $f(x) = \dfrac{2x-1}{3x+2}$. Find $f(-1)$.

Q2 Presbyterian 2023 Prelim Q20 · 2 marks

State the domain and range of $f(x) = \dfrac{1}{2x+1}$.

Q3 North Sydney Girls 2022 Prelim Q12 · 2 marks

State the domain and range of $f(x) = 3 - \dfrac{2}{x+4}$.

Q4 Sydney Grammar 2022 Trial Q27 · 1 mark

The graph of the function $y = \dfrac{x^2+3x}{x^2+3}$ has a horizontal asymptote. Find the equation of this asymptote, clearly showing your working.

Q5 North Sydney Boys 2020 Trial Q2 · 1 mark

If $f(x) = \dfrac{x^2+1}{4-x^2}$ then the vertical and horizontal asymptotes are respectively:

(A) $x = -2,\ x = 2,\ y = \frac{1}{2}$

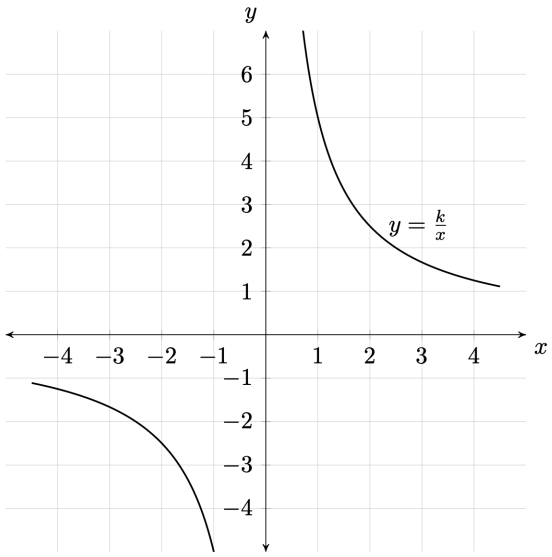
(B) $x = -2,\ x = 2,\ y = -1$

(C) $x = -2,\ x = 2,\ y = 1$

(D) $x = -2,\ x = 2,\ y = 0$

Q6 Kambala 2024 Prelim Q22 · **2 marks**

The graph of $y = \dfrac{k}{x}$ is shown on the axes below.



Find the value of k and solve the equation $\dfrac{k}{x} = 4$.

★

Q7 Barker 2025 Trial Q7 · **1 mark**

The function $f(x) = \dfrac{1}{x}$ has a restricted domain of $[a, b)$, where a and b are positive real numbers. The range of $f(x) = \dfrac{1}{x}$ is:

(A) $\left(\dfrac{1}{a}, \dfrac{1}{b}\right)$

(B) $\left[\dfrac{1}{a}, \dfrac{1}{b}\right)$

(C) $\left(\dfrac{1}{b}, \dfrac{1}{a}\right)$

(D) $\left(\dfrac{1}{b}, \dfrac{1}{a}\right]$

2. Match / describe a hyperbola from its graph (equation and parameters)

Q8 Sydney Grammar 2024 Trial Q2 · **1 mark**

Which equation best represents the graph drawn below?

Diagram to be inserted:
`adv-working-with-functions-d5-q8.png`

(A) $y = 4x,\ x > 0$

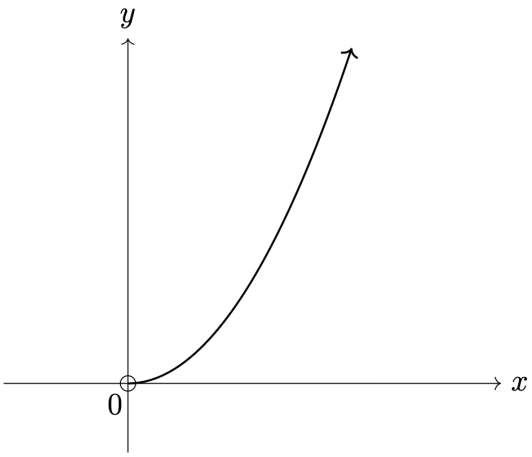
(B) $y = 4^x,\ x > 0$

(C) $y = 4x^2,\ x > 0$

(D) $y = \dfrac{4}{x},\ x > 0$

Q9 Moriah 2021 Prelim Q5 · **1 mark**

A curve has a vertical asymptote at $x = -4$ and a horizontal asymptote at $y = 0$. The curve crosses the y-axis at $y = 2$. Which equation could describe the curve?



(A) $y = \dfrac{8}{x+4}$

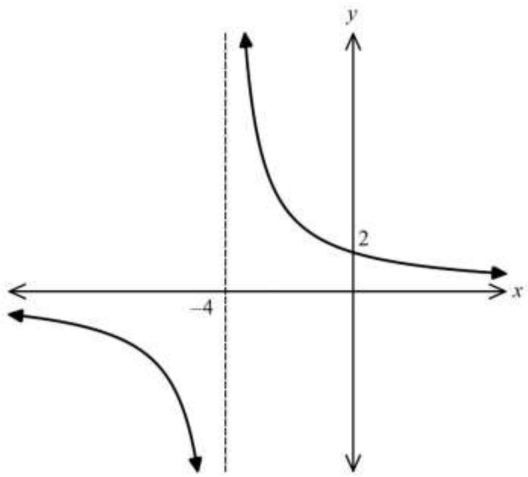
(B) $y = \dfrac{2}{x+4}$

(C) $y = \dfrac{8}{x-4}$

(D) $y = \dfrac{2}{x-4}$

Q10 St George Girls 2020 Trial Q7 · **1 mark**

The diagram below shows the graph of $y = f(x)$, with the point $(-3,\ 2.5)$ marked.



Which of the following statements is *false*?

(A) The horizontal asymptote is $y = 1$.

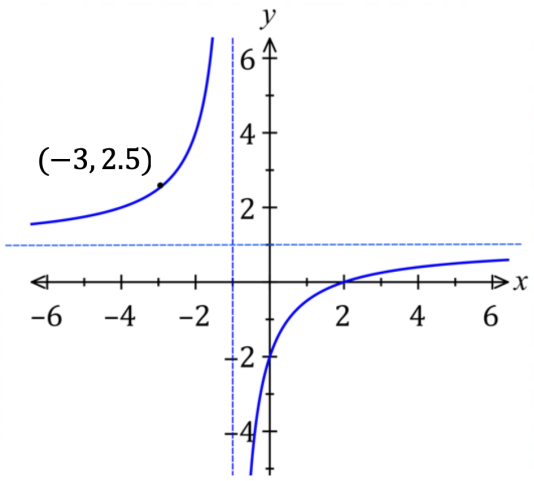
(B) The curve is continuous.

(C) The curve is concave up for $x < -1$.

(D) The equation of the function is $y = \dfrac{x-2}{x+1}$.

Q11 Hornsby Girls 2025 Trial Q28(a) · **2 marks**

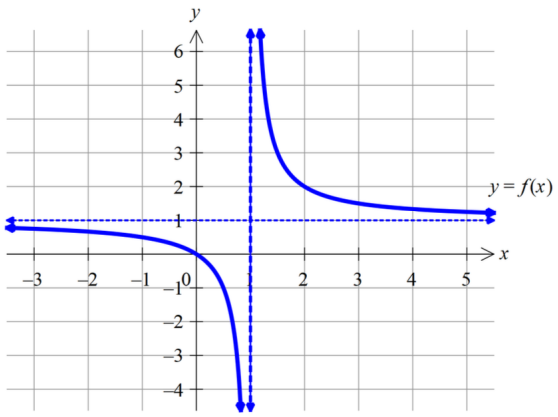
Consider the graph of a hyperbola $y = f(x)$, as shown below.



Justify that the equation of $y = f(x)$ is $f(x) = \dfrac{x}{x-1}$. Show full working.

Q12 Baulkham Hills 2024 Trial Q5 · **1 mark**

Consider the graph of $y = \dfrac{k}{x+b} + c$ below, with y-intercept at $\left(0, -\dfrac{11}{3}\right)$.



Which of the following statements is true?

(A) $k < b < c$

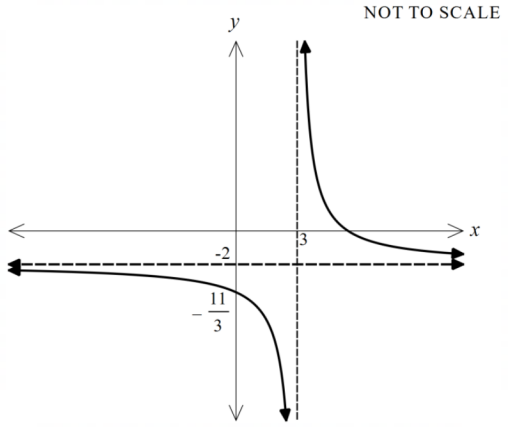
(B) $b < k < c$

(C) $k < c < b$

(D) $b < c < k$

Q13 HSC 2022 Q28(b) · **2 marks**

Part of the hyperbola $y = \dfrac{a}{b-x} - 1$, which passes through the points $(0, 0)$ and $(1, 1)$, is drawn with the circle $x^2 + y^2 = 2$. Show that $a = b = 2$.



3. Sketch a transformed hyperbola k/(x-a)+c from its equation

Q14 Blacktown Boys 2022 Prelim Q13 · 4 marks

Consider the function $f(x) = \dfrac{3}{x+2}$.

(a) Show that $f(x)$ is neither an even nor an odd function.

(b) State the domain of $y = f(x)$.

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

Q15 Sydney Girls 2021 Prelim Q3(c)(ii) · 2 marks

Sketch the graph of $y = 2 - \dfrac{1}{x+1}$, showing all the key features.

Q16 St George Girls 2022 Trial Q17 · 3 marks

Without using calculus, sketch the graph of $y = 2 - \dfrac{1}{x+4}$, showing any intercepts and asymptotes.

Q17 Blacktown Boys 2025 Trial Q15(b) · 2 marks

Given the function $f(x) = \dfrac{3}{2-x} + 1$, sketch the graph of $y = f(x)$, showing all key features.

Q18 Knox 2022 Prelim Q11(g) · 5 marks

Given the function $y = 2 + \dfrac{2}{1-x}$,

(i) determine the equations of any asymptotes and the axis intercepts;

(ii) sketch the curve, showing clearly the features found in part (i).

Q19 Glenwood 2020 Trial Q15 · 3 marks

Consider the function $y = \dfrac{4x-3}{x}$.

(a) Show that $\dfrac{4x-3}{x} = 4 - \dfrac{3}{x}$.

(b) Hence or otherwise, sketch the graph of $y = \dfrac{4x-3}{x}$, showing any asymptotes and the x-intercept.

Q20 Hornsby Girls 2023 Trial Q29(a) · **2 marks**

Sketch $f(x) = \dfrac{1-x}{x-2}$, clearly labelling the asymptotes and the x- and y-intercepts.

Q21 Girraween 2021 Trial Q22(i) · **3 marks**

Find the vertical and horizontal asymptotes of the hyperbola $y = \dfrac{x-2}{x-4}$, and hence sketch the graph of $y = \dfrac{x-2}{x-4}$, showing all intercepts with the coordinate axes.

Q22 Barker 2021 Prelim Q12(f) · **3 marks**

Sketch the function $f(x) = 1 - \dfrac{5}{x-2}$, showing all intercepts and other important features.

Solving and combining

4. Intersections of a hyperbola with a line and solving rational equations / inequalities

Q23 Blacktown Boys 2020 Trial Q29(a) · **1 mark**

The diagram shows the graphs of $y = 5 - x$ and $y = \dfrac{4}{2x - 1}$, meeting at the points A and B.

Diagram to be inserted:
`adv-working-with-functions-d5-q23.png`

Show that the x-coordinate values of A and B are 1 and 4.5 respectively.

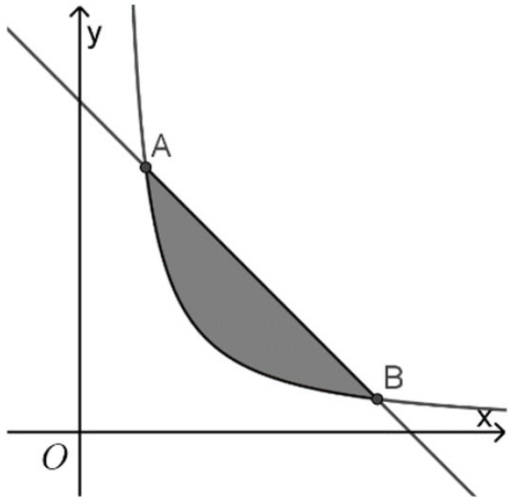
Q24 Caringbah 2020 Trial Q20(a) · **2 marks**

The curves $y = 2 - \dfrac{3}{x}$ and $y = x - 2$ (for $x \geq 0$) intersect at two points P and Q. Find the coordinates of P and Q.

Diagram to be inserted:
`adv-working-with-functions-d5-q24.png`

Q25 Blacktown Boys 2022 Trial Q9 · **1 mark**

The graph of $y = \dfrac{x-2}{x-4}$ is shown below.



The values of x for which $\dfrac{x-2}{x-4} \leq 3$ are:

(A) $x < 4,\ x \geq 5$

(B) $x \leq 3$

(C) $2 \leq x < 4$

(D) $x < 1$

Q26 Gosford 2024 Trial Q27(a) · **4 marks**

Sketch the graphs of $y = \dfrac{4}{x}$ and $y = |x+1| - 4$ on the same number plane. Clearly show their point(s) of intersection and any intercepts on the axes.

Q27 Girraween 2021 Trial Q22(ii) · **2 marks**

The graph of the hyperbola $y = \dfrac{x-2}{x-4}$ (with vertical asymptote $x = 4$ and horizontal asymptote $y = 1$) has been sketched. Hence, or otherwise, find the values of x for which

$$\frac{x-2}{x-4} \leq 3.$$

5. Reciprocal graphs via composition and combined curves

Q28 Caringbah 2020 Trial Q2 · **1 mark**

What are the asymptotes of the graph of $y = \dfrac{1}{x^2 - 9}$?

(A) $x = \pm 3$

(B) $x = \pm 9$

(C) $y = \pm 3$

(D) $y = \pm 9$

Q29 Blacktown Boys 2023 Trial Q14 · **5 marks**

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

(a) Find $f\big(g(x)\big)$ in the simplest form.

(b) Find the domain of $f\big(g(x)\big)$.

(c) Sketch $y = f\big(g(x)\big) + 1$, showing all intercepts and asymptotes.

Q30 Killara 2023 Prelim Q29 · **5 marks**

Let $f(x) = \sqrt{x + 4}$ and $g(x) = -\dfrac{1}{x^2 - 2}$.

(a) Find an expression for $g\big(f(x)\big)$ and state its domain.

(b) Hence sketch $g\big(f(x)\big)$ over its natural domain.