Year 11 Mathematics Extension 1

Topic: Further Functions (3 of 5)
Review Questions: Inverse 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, combined 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.

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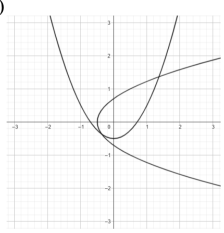
Finding and understanding inverses

1. Deciding whether a function has an inverse

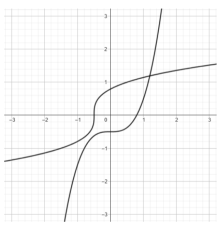
Q1 2025 Baulkham Hills Trial Q2 · **1 mark**

Which of the following best represents the graphs of a function and its inverse function?

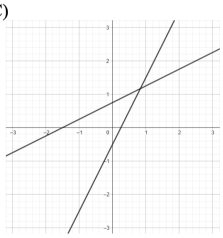
(A)



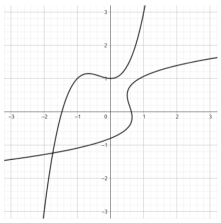
(B)



(C)



(D)



Q2 2023 HSC Q14(a)(i) · **1 mark**

Let $f(x) = 2x + \ln x$, for $x > 0$. Explain why the inverse of $f(x)$ is a function.

Q3 2021 North Sydney Boys Trial Q7 · **1 mark**

The function $f(x) = 2x^3 - 9x^2 - 168x$ will have an inverse function with which restriction of its domain?

(A) $D = (7, \infty)$

(B) $D = (-4, 8)$

(C) $D = (-\infty, 0)$

(D) $D = \left[-\frac{1}{2}, \infty\right)$

Q4 2025 Baulkham Hills Prelim Q13(d) · **5 marks**

Consider the function $f(x) = ax^3 + bx^2 + cx + d$, where a, b, c and d are real numbers.

(i) Write down the expression for $f'(x)$. (1 mark)

(ii) Given that the inverse of $f(x)$ is not a function, use part (i) to show that $b^2 - 3ac > 0$. (2 marks)

(iii) Consider $g(x) = \frac{1}{2}x^3 - 3x^2 + 6x - 8$. Use the result in part (ii) to show that the inverse of $g(x)$ is a function. (2 marks)

Q5 2025 North Sydney Girls Trial Q14(b) · **3 marks**

The function $f(x) = \dfrac{1 + kx}{x^2 + 1}$ is continuous in the domain $-1 < x < 1$. Find the values of k such that the inverse function $f^{-1}(x)$ exists.

2. Domain and range of an inverse

Q6 2020 HSC Q2 · **1 mark**

Given $f(x) = 1 + \sqrt{x}$, what are the domain and range of $f^{-1}(x)$?

(A) $x \geq 0, y \geq 0$

(B) $x \geq 0, y \geq 1$

(C) $x \geq 1, y \geq 0$

(D) $x \geq 1, y \geq 1$

Q7 2021 Knox Trial Q3 · **1 mark**

Given that $h(x) = \sqrt{2 - x}$, what are the domain and range of $h^{-1}(x)$?

(A) $x \leq 2, y \geq 0$

(B) $x \leq 2, y \leq 0$

(C) $x \geq 0, y \leq 2$

(D) $x \geq 0, y \leq -2$

Q8 2023 Abbotsleigh Trial Q1 · **1 mark**

Given $f(x) = \sqrt{x-3}$, what are the domain and range of $f^{-1}(x)$?

(A) $x \geq -3$, $y \geq 0$

(B) $x \geq -3$, $y \geq -3$

(C) $x \geq 0$, $y \geq 0$

(D) $x \geq 0$, $y \geq 3$

Q9 2023 Sydney Tech Trial Q6 · **1 mark**

Given that $f(x) = \ln(x-2)$, what are the domain and range of $f^{-1}(x)$?

(A) $x > 2$, all real y

(B) $x < 2$, all real y

(C) all real x, $y > 2$

(D) all real x, $y < 2$

Q10 2022 St George Girls Trial Q2 · **1 mark**

Given that $f(x) = \ln(2-x)$, what is the range of $f^{-1}(x)$?

(A) $[0, 2]$

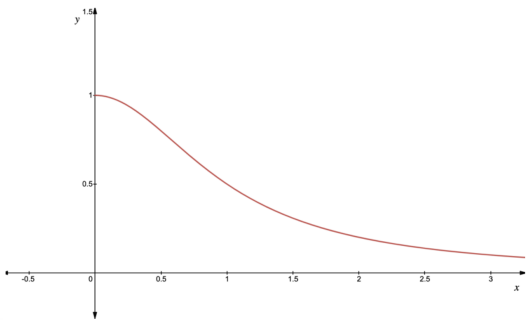
(B) $[0, 2)$

(C) $[2, \infty)$

(D) $(-\infty, 2)$

Q11 2021 Kings Trial Q11(b) · **2 marks**

The function $f(x) = \dfrac{1}{x^2+1}$ is defined for $x \geq 0$. State the domain and range of the inverse function $f^{-1}(x)$.



3. Finding an inverse (exponential and logarithmic)

Q12 2023 North Sydney Boys Trial Q4 · 1 mark

If $f(x) = e^{x+2}$, what is the inverse function $f^{-1}(x)$?

(A) $f^{-1}(x) = e^{y-2}$

(B) $f^{-1}(x) = e^{y+2}$

(C) $f^{-1}(x) = \log_e x - 2$

(D) $f^{-1}(x) = \log_e x + 2$

Q13 2022 North Sydney Girls Trial Q5 · 1 mark

What is the equation of the inverse of $f(x) = \dfrac{5 + e^{2x}}{3}$?

(A) $y = \dfrac{3}{5 + e^{2x}}$

(B) $y = e^{5-3x}$

(C) $y = \dfrac{1}{2}\ln(3x - 5)$

(D) $y = \dfrac{1}{2}\ln(5 - 3x)$

Q14 2025 Killara Trial Q8 · 1 mark

Given $g(x) = e^{2x} + 2$, $g^{-1}(x)$ is given by:

(A) $y = \dfrac{\ln x - 2}{2}$

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

(C) $y = \ln\left(x^2 - 2\right)$

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

Q15 2024 Girraween Trial Q8 · **1 mark**

What is the inverse function of $f(x) = e^{x^3}$?

(A) $f^{-1}(x) = 3e^x$

(B) $f^{-1}(x) = 3\ln x$

(C) $f^{-1}(x) = \sqrt[3]{\ln x}$

(D) $f^{-1}(x) = \sqrt[3]{3\ln x}$

Q16 2024 Hornsby Girls Trial Q12(a) · **6 marks**

Consider the function $f(x) = 2^x - 3$.

(i) On the number plane provided, sketch the graph of $y = f(x)$, showing the x- and y-intercepts in exact values. **(2 marks)**

(ii) Find the equation of the inverse function $f^{-1}(x)$ as a natural logarithm function, and state its domain and range. **(3 marks)**

(iii) On the same number plane as part (i), sketch the graph of $y = f^{-1}(x)$. **(1 mark)**

Q17 2020 Manly Trial Q14(d) · **5 marks**

Consider the function $f(x) = e^x - e^{-x}$.

(i) Show that $f(x)$ is increasing for all values of x. **(1 mark)**

(ii) Find the equation of the inverse function $y = f^{-1}(x)$. **(3 marks)**

(iii) Hence, or otherwise, solve $e^x - e^{-x} = 5$. Give your answer correct to two decimal places. **(1 mark)**

4. Finding the inverse of a rational function

Q18 2023 Hornsby Girls Trial Q2 · **1 mark**

Which of the following is the inverse function of $f(x) = \dfrac{1}{x+2}$, $x > -2$?

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

(B) $y = \dfrac{1}{x} - 2,\ x > 0$

(C) $y = \dfrac{1}{x-2},\ x < -2$

(D) $y = \dfrac{1}{x-2},\ x < 0$

Q19 2025 HSC Q11(a) · **2 marks**

Find the inverse function, $f^{-1}(x)$, of the function $f(x) = 1 - \dfrac{1}{x-2}$.

Q20 2022 Cheltenham Girls Trial Q11(e) · **4 marks**

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

(i) Find the vertical and horizontal asymptotes for f. **(2 marks)**

(ii) Find the inverse function $f^{-1}(x)$. **(1 mark)**

(iii) State the domain of $f^{-1}(x)$. **(1 mark)**

Q21 2021 Ascham Trial Q13(a) · **3 marks**

Find $f^{-1}(x)$ if $f(x) = \dfrac{x+1}{x-2}$, clearly indicating the domain and range of $f^{-1}(x)$.

Q22 2024 Abbotsleigh Trial Q5 · 1 mark

If $f(x) = \dfrac{4x}{x-2}$, what is the domain of $f^{-1}(x)$?

(A) $x \in [4, \infty)$

(B) $x \in (-\infty, 2) \cup (2, \infty)$

(C) $x \in (-\infty, 4) \cup (4, \infty)$

(D) $x \in (-\infty, \infty)$

Q23 2023 Killara Trial Q9 · 1 mark

Let $g(x) = \dfrac{ax+b}{cx+d}$, where a, b, c and d are positive and $ad \neq bc$. Which of the following can not be in the domain of the inverse function?

(A) $\dfrac{a}{a}$

(B) $\dfrac{a}{b}$

(C) $\dfrac{a}{c}$

(D) $\dfrac{a}{d}$

5. Inverses of restricted-domain quadratics

Q24 2024 North Sydney Girls Trial Q5 · 1 mark

Given that $f(x) = x^2 - 4x + 2$, where $x \geq 2$, which of the following is $f^{-1}(x)$?

(A) $f^{-1}(x) = 2 \pm \sqrt{x+2}$

(B) $f^{-1}(x) = 2 + \sqrt{x+2}$

(C) $f^{-1}(x) = 2 - \sqrt{x+2}$

(D) $f^{-1}(x) = 2 - \sqrt{x-2}$

Q25 2022 Penrith Trial Q12(b) · **4 marks**

Consider the function $f(x) = x^2 - 3x$.

(i) Explain why $f(x) = x^2 - 3x$ does not have an inverse function. (1 mark)

(ii) Find the largest possible domain, that includes $x = 0$, for the inverse of $f(x)$. (1 mark)

(iii) Find an expression for $f^{-1}(x)$. (2 marks)

Q26 2020 Riverview Trial Q11(a) · **7 marks**

Consider the function $f(x) = x^2 - 4x + 6$.

(i) Explain why the domain of $f(x)$ must be restricted if $f(x)$ is to have an inverse function. (1 mark)

(ii) Given that the domain of $f(x)$ is restricted to $x \geq 2$, find an expression for $f^{-1}(x)$. (2 marks)

(iii) Given the restriction in part (ii), state the domain and range of $f^{-1}(x)$. (2 marks)

(iv) The curve $y = f(x)$ with its restricted domain and the curve $y = f^{-1}(x)$ intersect at the point P. Find the coordinates of P. (2 marks)

Q27 2025 Manly Trial Q12(a) · **6 marks**

A function is defined by $f(x) = x^2 + 8x + 10$, for $x \geq -4$.

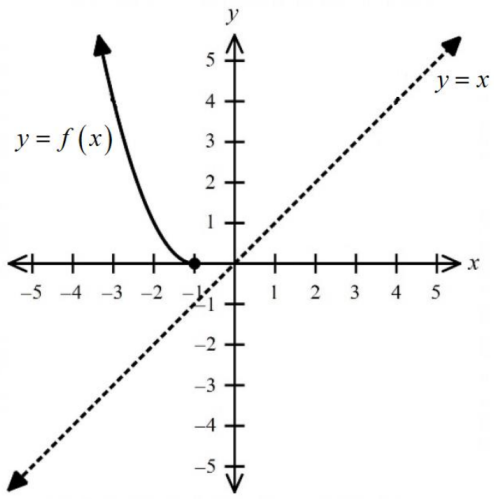
(i) Find the equation of the inverse function $y = f^{-1}(x)$. (2 marks)

(ii) Sketch the graph of $y = f^{-1}(x)$. Clearly show the coordinates of the endpoint and the x-intercept. (2 marks)

(iii) Find the point(s) of intersection of the graphs of $y = f(x)$ and $y = f^{-1}(x)$. (2 marks)

Q28 2024 Penrith Prelim Q12(b) · **4 marks**

The function $f(x) = (x+1)^2$ has domain $(-\infty, -1]$.



(i) Write the equation of the inverse function of $f(x)$ in the form $y = f^{-1}(x)$ and state its domain. (3 marks)

(ii) Hence, sketch the inverse function, including the original function and the line $y = x$ in your sketch. (1 mark)

Q29 2025 Caringbah Prelim Q7(d) · **2 marks**

Consider the function $f(x) = (x-2)^2$ for $0 \leq x \leq 2$. Find the inverse function $f^{-1}(x)$ and state its domain and range.

6. Evaluating an inverse value

Q30 2023 Blacktown Boys Trial Q4 · **1 mark**

If $f(x) = 3 - 6x$, what is the value of $f^{-1}(2)$?

(A) -9

(B) $-\frac{1}{6}$

(C) $\frac{1}{6}$

(D) 9

Q31 2021 North Sydney Boys Trial Q8 · **1 mark**

Given $f(x) = \dfrac{3}{x} - 4$, then $f^{-1}(4)$ equals

(A) $-\dfrac{13}{4}$

(B) $\dfrac{13}{4}$

(C) $\dfrac{3}{8}$

(D) $-\dfrac{3}{8}$

Q32 2024 Girraween Prelim Q2 · **1 mark**

Given $f(x) = \dfrac{1}{4}x^3 + 2$, what is the value of $f^{-1}(4)$?

(A) 2

(B) 5

(C) 8

(D) 18

Q33 2025 Sydney Tech Trial Q11(f) · **2 marks**

Given the function $f(x) = \sqrt{2x+1}$ and that $f^{-1}(x)$ is the inverse function of $f(x)$, find $f^{-1}(5)$.

Q34 2024 Manly Trial Q14(a) · **2 marks**

Given that $f(x) = \dfrac{2}{x^2+1}$, find the value of $f^{-1}\big(f(N)\big)$ for $N < 0$.

Q35 2025 Sydney Girls Trial Q10 · **1 mark**

The function $f(x+a) - b$ is odd, where a and b are positive. When the domain of $f(x)$ is restricted to $x \geq 2a$, $f(x)$ becomes one-to-one. For $f(x)$ subject to this restriction, let $f^{-1}(x)$ be the inverse function. Which of the following is a correct expression for $f^{-1}\big(2b - f(-1)\big)$?

(A) $a+1$

(B) $a-1$

(C) $2a+1$

(D) $2a-1$

7. Self-inverse functions

Q36 Hornsby Girls 2025 Trial Q9 · 1 mark

Which function, $f(x)$, and its inverse function, $f^{-1}(x)$, are equivalent, i.e. $f(x) = f^{-1}(x)$?

(A) $f(x) = \sin x$ for $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(B) $f(x) = x^2$ for $[0, \infty)$

(C) $f(x) = e^x$ for $(-\infty, \infty)$

(D) $f(x) = \frac{1}{x}$ for $(-\infty, 0) \cup (0, \infty)$

Q37 Barker 2025 Trial Q4 · 1 mark

Which function, $f(x)$, and its inverse function, $f^{-1}(x)$, are equivalent?

(A) $f(x) = \sin|x|$ for $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(B) $f(x) = x^2$ for $[0, \infty)$

(C) $f(x) = |e^x|$ for $(-\infty, \infty)$

(D) $f(x) = \frac{1}{x}$ for $(-\infty, 0) \cup (0, \infty)$

Q38 Sydney Boys 2024 Trial Q12(a) · 3 marks

The function f is defined by $f(x) = \dfrac{2x + a}{x - 2}$, where a is a constant, $x > 2$.

(i) Given that f^{-1} exists, state the value that a cannot take, justifying your answer. **(2 marks)**

(ii) A function h is said to be self-inverse if $h(x) = h^{-1}(x)$ for all x in the domain of h. State the range of values of a such that f is a self-inverse function. **(1 mark)**

Graphs and intersections

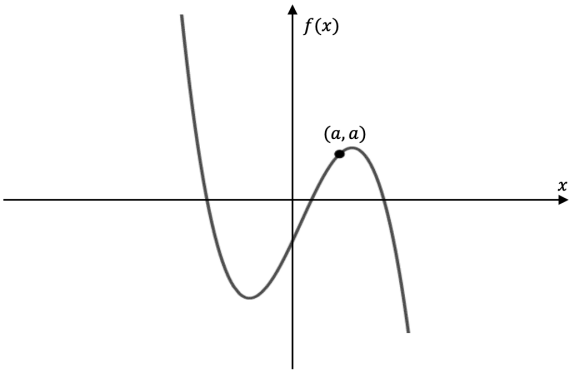
8. Graphing a function and its inverse

Q39 Killara 2021 Trial Q12(e) · **2 marks**

Sketch the inverse $y = f^{-1}(x)$ given the function $f(x) = 2x^3 + 1$.

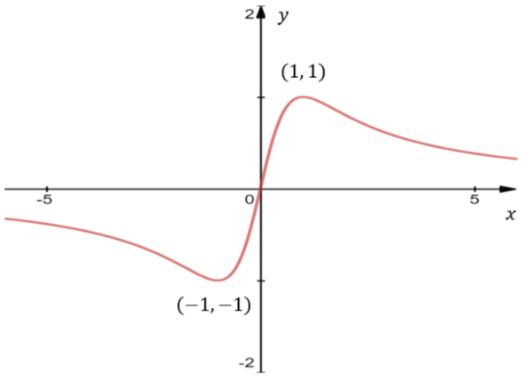
Q40 Hunters Hill 2020 Trial Q11(c) · **2 marks**

The sketch below shows the curve $y = f(x)$, with the point (a, a) shown. Copy or trace this into your writing booklet and sketch the inverse relation, $y = f^{-1}(x)$, on the same axes.



Q41 Blacktown Boys 2022 Trial Q10 · 1 mark

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



What is the domain and range of $y = f^{-1}(x)$?

(A) Domain: all real x; Range: $[-1, 1]$

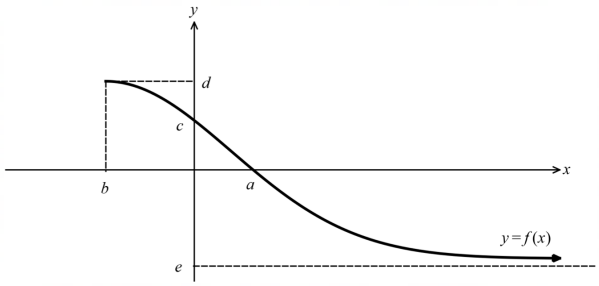
(B) Domain: $[-1, 1]$; Range: all real y

(C) Domain: $[-1, 1]$; Range: $[-1, 1]$

(D) Domain: all real x; Range: all real y

Q42 North Sydney Girls 2023 Trial Q10 · 1 mark

The graph of $y = f(x)$ is given below.



The function $g(x)$ is defined as $g(x) = f^{-1}(x)$. Which of the following gives the range of $g(x)$?

(A) $[b, \infty)$

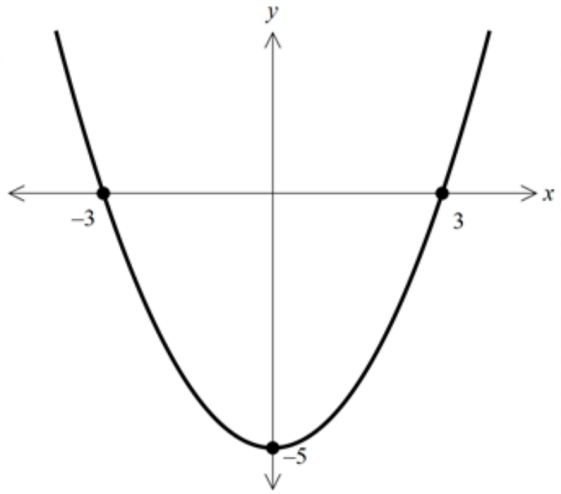
(B) $[b, a]$

(C) $[c, d]$

(D) $(e, d]$

Q43 Cherrybrook Tech 2021 Trial Q11(c)(i) · **2 marks**

The diagram shows the graph of $y = f(x)$. Sketch $y = f^{-1}(x)$ after making an appropriate restriction on the domain of $f(x)$.



9. Intersections of a function and its inverse

Q44 Glenwood 2022 Trial Q5 · **1 mark**

Consider the function $f(x) = x^3 + x + 8$. Which of the following is the point of intersection of the function $f(x)$ and its inverse $f^{-1}(x)$?

(A) $(-1, 6)$

(B) $(-2, -2)$

(C) $(0, 0)$

(D) $(2, 2)$

Q45 Cherrybrook Tech 2022 Trial Q3 · **1 mark**

The function $f(x) = \dfrac{x^2}{x^3 - 6}$ has an inverse $f^{-1}(x)$ for $x \geq 0$. Which of the following represents a point of intersection of $f(x)$ with $f^{-1}(x)$?

(A) $(2, 2)$

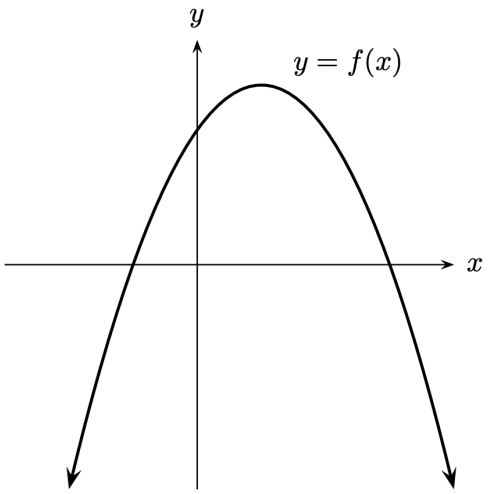
(B) $(1, -0.2)$

(C) $(3, 3)$

(D) $(-0.2, 1)$

Q46 Normanhurst Boys 2025 Trial Q1 · **1 mark**

The graph of $y = f(x)$ is shown, and the x and y axes are both drawn to the same scale. $f(x)$ then has its domain restricted such that it contains the largest possible domain for which $y = f(x)$ has an inverse function $y = f^{-1}(x)$, and the function with the restricted domain is $g(x)$.



How many points of intersection are there between $y = g(x)$ and $y = g^{-1}(x)$?

(A) 1

(B) 2

(C) 3

(D) 4

Q47 Fort St 2020 Trial Q11(e) · 4 marks

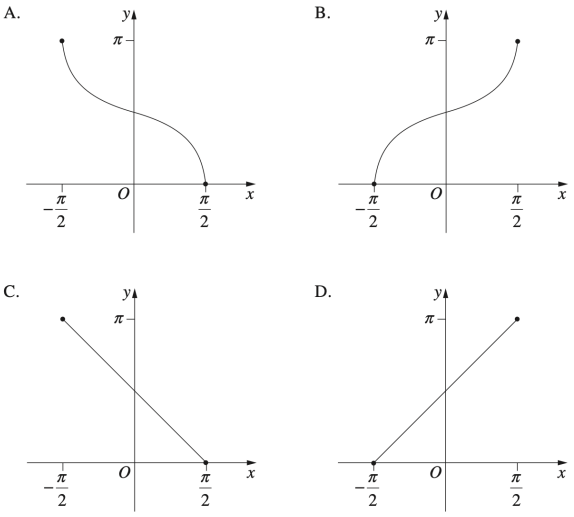
Consider the function $f(x) = 2 - \log_e x$.

(i) Find the equation of the inverse function $f^{-1}(x)$. **(1 mark)**

(ii) Explain why the coordinate of the point of intersection P of the graphs $y = f(x)$ and $y = f^{-1}(x)$ satisfies the equation $e^{2-x} - x = 0$. **(3 marks)**

Q48 2019 HSC Q10 · 1 mark

The function $f(x) = -1 + \sqrt{1+x}$ has inverse $f^{-1}(x)$. The graph of $y = f^{-1}(x)$ forms part of the curve $y = x^4 - 2x^2$. The diagram shows the curve $y = x^4 - 2x^2$.



How many points do the graphs of $y = f(x)$ and $y = f^{-1}(x)$ have in common?

(A) 1

(B) 2

(C) 3

(D) 4