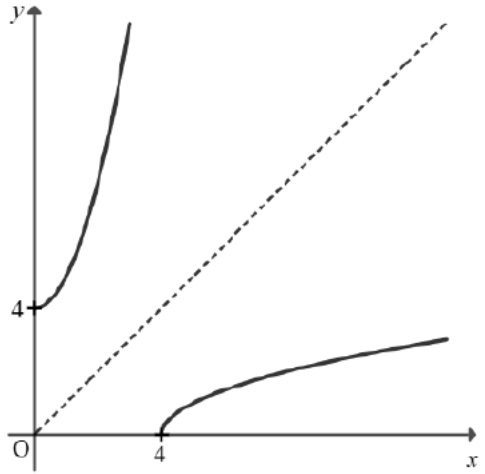
Question		Answer	Marks	AO	Guidance
3	(a)	$\{f(x): f(x) \geq 4\}$	B1 [1]	1.1	• OR $f(x) \geq 4$ • May be in words e.g. "4 or more" but not $x \geq 4$ • Allow e.g. $y \geq 4$ or $f \geq 4$
3	(b)	[g(x)] is a many-to-one function	B1 [1]	2.4	• OR "It is not one-to-one" • OR answer in words which conveys unambiguously that, for an inverse to exist, each y-value (in the range) must come from one, and only one, x-value (in the domain) e.g.: ▪ "It fails the horizontal line test" ▪ "(Some) horizontal lines (through the range) intersect the graph twice/more than once". ▪ "g($-x$) = g(x)" [may be through one numerical example e.g. g(–3) = g(3) (= 13)] • Allow e.g. ▪ "Inverse would be $y = \pm\sqrt{x-4}$ which is one-to-many" ▪ "Its inverse is one-to-many" • Condone mapping instead of function or vice versa • Do **not** allow "it doesn't have an inverse" or "it is one-to-many" alone • Answer must not contradict itself
3	(c)	$x = 4 + y^2$ OR $x^2 = y - 4$ $[f^{-1}(x)] = \sqrt{x-4}$	M1 A1 [2]	1.1 1.1	• Swapping x and y or starting to work through inverse processes. Implied by correct answer. • Final answer • Note **A0** for $\pm\sqrt{x-4}$ • Condone e.g. $y = \sqrt{x-4}$ but not $f(x) = \sqrt{x-4}$

Question		Answer	Marks	AO	Guidance
3	(d)(i)	$x^2 - x + 4 = 0$ "$b^2 - 4ac$"=$1 - 16 = -15$ Negative so no real roots	B1 [1]	2.1	• Showing the discriminant is negative • Allow as part of solution by formula • Allow $1 - 16 < 0$ isw • Allow other correct valid arguments ▪ e.g. completing the square $\left(x - \frac{1}{2}\right)^2 + \frac{15}{4} = 0 \Rightarrow x - \frac{1}{2} = \sqrt{\left(-\frac{15}{4}\right)}$ so no real roots ▪ or minimum turning point of $y = x^2 - x + 4$ is at $y = \frac{15}{4} > 0$ so never zero • **Note:** B0 for finding "$b^2 - 4ac$" $0 - 16 = -16$ from working with $x^2 + 4 = 0$
3	(d)(ii)	[As f(x) is increasing then] if $\mathrm{f}(x) = \mathrm{f}^{-1}(x)$ had a real root, $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$ would cross $y = x$ at the **same** point but (i) shows $y = \mathrm{f}(x)$ does not cross $y = x$ (so they never meet)	B1 [1]	2.4	• Allow e.g. "Neither graph crosses $y = x$ (so they cannot cross each other.)" • B0 for statements **not** involving intersections with $y = x$ (question says 'Hence')

Question		Answer	Marks	AO	Guidance
3	(e)		B1	1.1	• $y = f(x) = 4 + x^2$ sketched for $x \geq 0$ • Must have min at $(0, 4)$ (mark intent and condone slight flick up near y-axis) **and** correct general shape • B0 for curve in 2nd quadrant (mark intent) • For both B marks ignore any additional lines drawn • Ignore labels $f(x)$ and $f^{-1}(x)$ on curves – even if incorrect
			B1FT	2.2a	• Not strict FT, allow B1 for correct curve of $f^{-1}(x)$ • Reflection of *their* $y = 4 + x^2$ in $y = x$ • If *their* $y = 4 + x^2$ has continued into 2nd quadrant then they must only reflect the part of the curve where $x > 0$ for this mark (reflection must be one-to-one) • $y = x$ may not be seen • *their* 2 graphs must not meet or intersect in 1st quadrant • Condone 4 not indicated on x-axis • Mark intention
			[2]		