

$$\textcircled{8} \text{ (a)} \quad \begin{aligned} f(g(x)) &= f(x+1) \\ &= 2(x+1)^2 - 18 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{1}{f(g(x))} \quad &\text{is undefined when} \quad f(g(x)) = 0 \\ &\text{i.e. when} \quad (x+1)^2 = 9 \\ &\quad x+1 = \pm\sqrt{9} \\ &\quad x+1 = -3 \quad \text{or} \quad x+1 = 3 \\ &\quad x = -4 \quad \quad \text{or} \quad x = 2 \end{aligned}$$

Question			Generic scheme	Illustrative scheme	Max mark
8.	(a)		•¹ interpret notation •² state expression for $f(g(x))$	•¹ $f(x+1)$ or $2g(x)^2 - 18$ •² $2(x+1)^2 - 18$	2
Notes:					
1. For $2(x+1)^2 - 18$ without working, award both • ¹ and • ² .					
Commonly Observed Responses:					
Candidate A - $g(f(x))$			Candidate B - beware of two “attempts”		
$2x^2 - 17$ •¹ ✗ •² ✓₁			$f(g(x)) = 2x^2 - 18$ •¹ ✗ •² ✗ $f(x+1) = 2(x+1)^2 - 18$		
	(b)		•³ apply condition •⁴ state values of x	•³ $2(x+1)^2 - 18 = 0$ •⁴ -4 and 2	2
Notes:					
2. Working at • ³ must be consistent with working at • ² .					
3. Accept $2(x+1)^2 - 18 \neq 0$ for • ³ only when $x = -4$ and $x = 2$ are stated explicitly at • ⁴ . See Candidate H					
4. • ⁴ is only available for finding the roots of a quadratic.					
5. For subsequent incorrect working, the final mark is not available. For example $-4 < x < 2$.					
Commonly Observed Responses:					
Candidate C - expanding brackets in (a)			Candidate D - expanding brackets in (a)		
Part (a)			Part (a)		
$f(g(x)) = 2(x+1)^2 - 18$ •¹ ✓ •² ✓			$f(g(x)) = 2(x+1)^2 - 18$ •¹ ✓ •² ✓		
$f(g(x)) = 2x^2 + 4x - 16$			$f(g(x)) = 2x^2 - 16$		
Part (b)			Part (b)		
$2x^2 + 4x - 16 = 0$ •³ ✓			$2x^2 - 16 = 0$ •³ ✗		
$x = -4$ and $x = 2$ •⁴ ✓			$x = \pm\sqrt{8}$ •⁴ ✓₁		
Candidate E - $g(f(x))$			Candidate F - equivalent condition		
Part (a)					
$f(g(x)) = 2x^2 - 17$ •¹ ✗ •² ✓₁			$2(x+1)^2 = 18$ •³ ✓		
Part (b)					
$2x^2 - 17 = 0$ •³ ✓₁					
$x = \pm\sqrt{\frac{17}{2}}$ •⁴ ✓₁					
Candidate G - use of $\neq$			Candidate H - use of $\neq$		
$2(x+1)^2 - 18 \neq 0$ •³ ✗			$2(x+1)^2 - 18 \neq 0$		
$x \neq -4, x \neq 2$ •⁴ ✓₁			$x \neq -4, x \neq 2$		
			$x = -4, x = 2$ •³ ✓		
			•⁴ ✓		