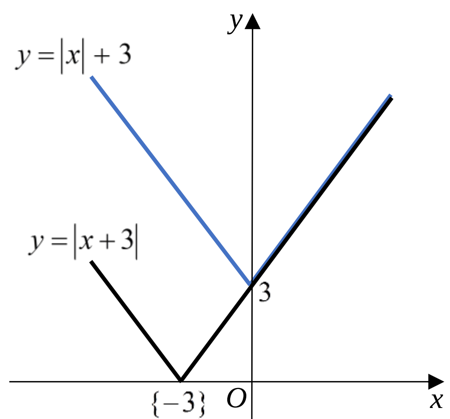
Question	Scheme		Marks	AOs
3	Statement: "If m and n are irrational numbers, where $m \neq n$, then mn is also irrational."			
(a)	E.g. $m = \sqrt{3},\ n = \sqrt{12}$		M1	1.1b
	$\{mn =\}\ \left(\sqrt{3}\right)\left(\sqrt{12}\right) = 6$ $\Rightarrow$ statement untrue **or** 6 is not irrational or 6 is rational		A1	2.4
			(2)	
(b)(i), (ii) Way 1		V shaped graph {reasonably} symmetrical about the y-axis with vertical interpret $(0, 3)$ or 3 stated or marked on the positive y-axis	B1	1.1b
		Superimposes the graph of $y = \lvert x+3 \rvert$ on top of the graph of $y = \lvert x \rvert + 3$	M1	3.1a
	the graph of $y = \lvert x \rvert + 3$ is either the same or above the graph of $y = \lvert x+3 \rvert$ {for corresponding values of x} **or** when $x \geq 0$, both graphs are equal (or the same) when $x < 0$, the graph of $y = \lvert x \rvert + 3$ is above the graph of $y = \lvert x+3 \rvert$		A1	2.4
			(3)	
(b)(ii) Way 2	<u>**Reason 1**</u> When $x \geq 0$, $\lvert x \rvert + 3 = \lvert x+3 \rvert$	Any one of Reason 1 or Reason 2	M1	3.1a
	<u>**Reason 2**</u> When $x < 0$, $\lvert x \rvert + 3 > \lvert x+3 \rvert$	Both Reason 1 and Reason 2	A1	2.4
			(5 marks)	

Notes for Question 3

(a)	
M1:	States or uses any pair of ***different*** numbers that will disprove the statement. E.g. $\sqrt{3}, \sqrt{12}$; $\sqrt{2}, \sqrt{8}$; $\sqrt{5}, -\sqrt{5}$; $\frac{1}{\pi}, 2\pi$; $3\mathrm{e}, \frac{4}{5\mathrm{e}}$;
A1:	Uses correct reasoning to disprove the given statement, with a correct conclusion
Note:	Writing $(3\mathrm{e})\left(\frac{4}{5\mathrm{e}}\right) = \frac{12}{5} \Rightarrow$ untrue is sufficient for M1A1
(b)(i)	
B1:	See scheme
(b)(ii)	
M1:	For constructing a method of comparing $\lvert x \rvert + 3$ with $\lvert x+3 \rvert$. See scheme.
A1:	Explains fully why $\lvert x \rvert + 3 \geq \lvert x+3 \rvert$. See scheme.
Note:	Do not allow either $x > 0$, $\lvert x \rvert + 3 \geq \lvert x+3 \rvert$ or $x \geq 0$, $\lvert x \rvert + 3 \geq \lvert x+3 \rvert$ as a valid reason
Note	$x = 0$ (or where necessary $x = -3$) need to be considered in their solutions for A1
Note:	Do not allow an incorrect statement such as $x \leq 0$, $\lvert x \rvert + 3 > \lvert x+3 \rvert$ for A1

Notes for Question 3 Continued			
(b)(ii)			
Note:	Allow M1A1 for $x > 0$, $\|x\| + 3 = \|x + 3\|$ and for $x \le 0$, $\|x\| + 3 \ge \|x + 3\| \geqslant$		
Note:	Allow M1 for any of • x is positive, $\|x\| + 3 = \|x + 3\|$ • x is negative, $\|x\| + 3 > \|x + 3\|$ • $x > 0$, $\|x\| + 3 = \|x + 3\|$ • $x \le 0$, $\|x\| + 3 \ge \|x + 3\|$ • $x > 0$, $\|x\| + 3$ and $\|x + 3\|$ are equal • $x \ge 0$, $\|x\| + 3$ and $\|x + 3\|$ are equal • when $x \ge 0$, both graphs are equal • for positive values $\|x\| + 3$ and $\|x + 3\|$ are the same Condone for M1 • $x \le 0$, $\|x\| + 3 > \|x + 3\|$ • $x < 0$, $\|x\| + 3 \ge \|x + 3\|$		
(b)(ii) Way 3	• For $x > 0$, $\|x\| + 3 = \|x + 3\|$ • For $-3 < x < 0$, as $\|x\| + 3 > 3$ and $\{0 <\}\ \|x + 3\| < 3$, then $\|x\| + 3 > \|x + 3\|$ • For $x \le -3$, as $\|x\| + 3 = -x + 3$ and $\|x + 3\| = -x - 3$, then $\|x\| + 3 > \|x + 3\|$	M1 A1	3.1a 2.4