Question	Scheme	Marks	AOs
7 (i)	For setting up the contradiction: There exists integers p and q such that pq is even and both p and q are odd	B1	2.5
	For example, sets $p = 2m+1$ and $q = 2n+1$ and then attempts $pq = (2m+1)(2n+1) = ...$	M1	1.1b
	Obtains $pq = (2m+1)(2n+1) = 4mn+2m+2n+1$ $= 2(2mn+m+n)+1$ States that this is odd, giving a contradiction so " if pq is even, then at least one of p and q is even" *	A1*	2.1
		(3)	
(ii)			
	$(x+y)^2 < 9x^2 + y^2 \Rightarrow 2xy < 8x^2$	M1	2.2a
	States that as $x < 0 \Rightarrow 2y > 8x$ $\Rightarrow y > 4x$ *	A1*	2.1
		(2)	
			(5 marks)

Notes:

(i)

B1: For using the "correct"/ allowable language in setting up the contradiction.

Expect to see a minimum of

- "assume" or "let" or "there is " or other similar words
- "*pq* is even" and "*p* and *q* are (both) odd"

M1: Uses a correct algebraic form for *p* and *q* and attempting to multiply.

Allow any correct form so $p = 2n+1$ and $q = 2m+3$ would be fine to use

Different variables must be used for *p* and *q*, so $p = 2n+1$ and $q = 2n-1$ would be M0

A1*: Full argument .

This requires (1) a correct calculation for their *pq*

(2) a correct reason and conclusion that it is odd

E.g. $(2m+1)(2n+1) = 4mn+2m+2n+1 = 2\left(2mn+m+n\right)+1 = \text{odd}$

E.g. $(2m-1)(2n+1) = 4mn+2m-2n-1 = \text{even + even} - \text{even} - 1 = \text{odd}$

and (3) a minimal statement implying that they have proven what was required which could be QED, proven etc

Note that B0 M1 A1 is possible

(ii)

M1: For multiplying out and cancelling terms before proceeding to a correct intermediate line such as $2xy < 8x^2$ o.e. such as $2x\left(4x-y\right) > 0$

A1*: Full and rigorous proof with reason shown as to why inequality reverses. The point at which it reverses must be correct and a correct reason given

See scheme

Alt: $2xy < 8x^2 \Rightarrow xy - 4x^2 < 0 \Rightarrow x\left(y-4x\right) < 0$

as $x < 0$, $\left(y-4x\right) > 0 \Rightarrow y > 4x$ scores M1 A1

So, the following should be scored M1 A0 as line 3 is incorrect

$2xy - 8x^2 < 0$

$\Rightarrow 2xy < 8x^2$

$\Rightarrow y < 4x$

$\Rightarrow y > 4x$ as $x < 0$

There should be no incorrect lines in their proof