It's good to see you using the geometry of the situation but the question is asking you to use the fact that

$$z-1-2i = (z-3i)+(i-1).$$

(A) $|z-1-2i| = |(z-3i)+(i-1)|$

$\leq |z-3i|+|i-1|$ by Triangle Inequality

$< 4+\sqrt{2}$ for $z \in A$

since $|z-3i|<4$ and $|i-1|=\sqrt{2}$

(B) $|z-1-2i| = |(z-3i)-\,-(i-1)|$

$\geq \big|\,|z-3i|-|i-1|\,\big|$ by Backwards form of Triangle Inequality

$= |z-3i|-\sqrt{2}$ since for $z \in A$ $|z-3i|>3>\sqrt{2}$

For $z \in A$:

$\therefore |z-1-2i| > 3-\sqrt{2}$ since for $z \in A$ $|z-3i|>3$