

5)

3) i) If $x \in f([0,1] \times [1,2])$
 then $1+0 \leq x \leq 1+2$ where $x = |x_1| + |x_2|$

ii) $f([0,1] \times [1,2]) = \{x \in \mathbb{R} : 1 \leq x \leq 3\}$ ✓

b) $f^{-1}(\{1\}) = \{(x_1, x_2) \in \mathbb{R}^2 : |x_1| + |x_2| = 1\}$ ✓

Since $|x_1| + |x_2| \geq 0$ $f^{-1}(\{1\}) = \emptyset$ ✓

c) $f^{-1}([1,3]) = \{(x_1, x_2) \in \mathbb{R}^2 : 1 \leq |x_1| + |x_2| \leq 3\}$

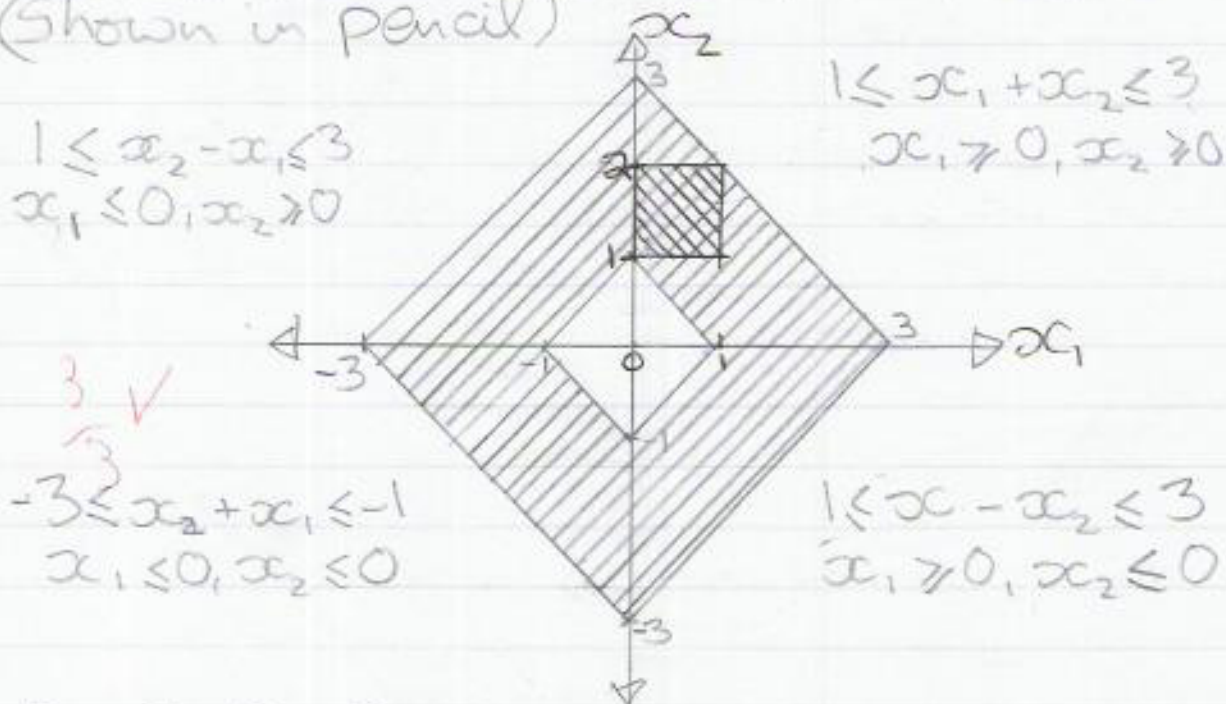
$= \{(x_1, x_2) \in \mathbb{R}^2 : 1 \leq x_1 + x_2 \leq 3, x_1 \geq 0, x_2 \geq 0\}$

$\cup \{(x_1, x_2) \in \mathbb{R}^2 : x_1 \leq 0, x_2 \geq 0, 1 \leq x_2 - x_1 \leq 3\}$

$\cup \{(x_1, x_2) \in \mathbb{R}^2 : x_1 \leq 0, x_2 \leq 0, -3 \leq x_2 + x_1 \leq -1\}$

$\cup \{(x_1, x_2) \in \mathbb{R}^2 : x_1 \geq 0, x_2 \leq 0, 1 \leq x_1 - x_2 \leq 3\}$

(Shown in pencil)



$[0,1] \times [1,2]$ shown in pen.

ii) If $g(x_1, x_2) = (x_1, x_2, |x_1| + |x_2|), (x_1, x_2) \in \mathbb{R}^2$

$g^{-1}([0,1] \times [1,3]) = \{(x_1, x_2) \in \mathbb{R}^2 : 0 \leq x_1, x_2 \leq 1, 1 \leq |x_1| + |x_2| \leq 3\}$