Q3) a) Start by proving the contrapositive, the statement becomes:

$c \mid 5a + 11b$ and $c \mid 6a + 13b$ then $c \mid b$

We know that $c \mid a$ and $c \mid b$ then $c \mid (ax + by)$ for any integers x, y
(this is from DIC)

$\Rightarrow c \mid ((5a + 11b)x + (6a + 13b)y)$ ← from DIC
$\Rightarrow c \mid ((5a + 11b)6 + (6a + 13b)\cdot(-5))$ ← pick $y = -5$ and $x = 6$
$\Rightarrow c \mid (30a - 30a + 66b - 65b)$
$\Rightarrow c \mid b$ ← from simplification

b) the converse is:

if $c \nmid (5a + 11b)$ or $c \nmid (6a + 13b)$ then $c \nmid b$

c) the converse is false
d) We will disprove the universal quantifier with a counter example

if c and $b = 7$, and $a = 1$ we get:
$= 7 \nmid (5\cdot 1 + 7\cdot 11)$ or $7 \nmid (6 + 91)$ then $7 \nmid 7$
$7 \nmid 82$ or $7 \nmid 97$ $7 \nmid 7$
true true false

∴ Since our hypothesis is true but our conclusion is false, there exists a integer set of a, b, c where the statement is false. This means the converse is false.