Decision 1 Linear Programming Answers

4(a)(i)	Max $2x+3y$ at $(30, 70)$ $= 270$	M1 A1		2	Extreme
(ii)	Max $3x+2y$ at $(60, 40)$ $= 260$	M1 A1		2	Extreme
(iii)	Min $-2x+y$ at $(75, 10)$ $= -140$	M1 A1		2	$x = 75$
(b)	$x \geq 20, \quad y \geq 10$ $x+y \leq 100$ $2x+y \leq 160$ OE $y \leq x+40$ OE	B1 B1 M1 A1 M1 A1		 6	OE OE for gradient of -2 for positive gradient
		Total		12	

6(a)	$10 \leq x \leq 80$ $5 \leq y \leq 40$ $x+y \leq 100$ $20x+60y \leq 3000$ OE $(\text{maximise})(P =) \ 2x+y$	B1 B1 B1 B1 B1		 5	Strict inequalities -1 (or using p, c) May be seen in (b) or (c)
(b)		B1 M1A1 M1A1 B1 B1		 7	For "x lines" and "y lines" For each other line M1$-$ve gradient $(0,50)$ M1$-$ve gradient $(100,0)$ Feasible region correct to within 1 square Objective line
(c)	Max at $(80,20)$ $P = £180$	M1 A1		2	Considering an extreme point in their region
(d)	$P = x + 4y$ Max at $(30, 40)$ $P = £190$	 M1 A1		 2	Using $(30,40)$ $(\pm \text{square})$
		Total		16	

6(a)	$1000x + 500y \leq 9000$	B1	1	
	$(2x + y \leq 18)$			
(b)	$x \geq 2,\ y \geq 5$	B1		−1 for strict inequalities
	$y \geq 2x$	B1		−1 for 'w's and 'l's
	$y \leq 3x$	B1	3	
(c)		B1		$x = 2,\ y = 5$
		B1		$2x + y = 18$
		M1		Line $y = mx$
		A1		$y = 2x$
		A1		$y = 3x$
		B1	6	Feasible region
(d)	Considering an extreme point on their f.r.	M1		Extreme point - vertex
	$x = 4.5$	A1		
	$y = 9$	A1	3	
	Total		13	

5(a)	$5x + 10y \leq 1500$ (balloons)			
	$\Rightarrow x + 2y \leq 300$	E1		
	$32x + 8y \leq 4000$ (sweets)	E1		
	$\Rightarrow 4x + y \leq 500$			
	$x \geq 50, y \geq 50$, at least 50 of each	E1		
	$x + y \geq 140$, at least 140 in total	E1	4	

(b)(i)
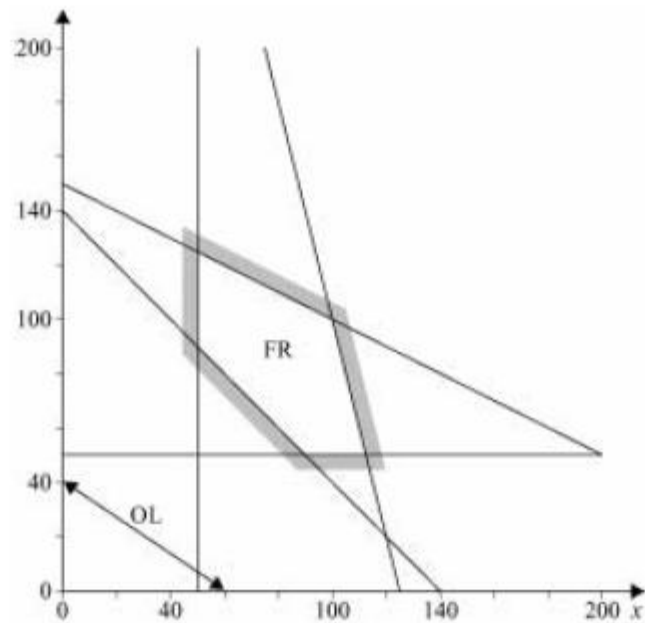
		B1		$x = 50, y = 50$
		B1		$x + y = 140$
		M1		Negative gradient (either)
		A1		$4x + y = 500$
		A1		$x + 2y = 300$
		B1		Feasible region
		M1		Objective line drawn
		A1	8	
(ii)	Maximum $(100, 100)$	M1		Considering extreme point on their region
	$= \pounds 200$	A1	2	
(iii)	Minimum $(90, 50)$	M1		Considering extreme minimum point on their region
	$= \pounds 132$	A1	2	
	Total		**16**	