Linear programming

Answers

Further Maths topic practice

This topic online

Q	Answer	Marks
1	$y \geq 1$, $x + y \leq 10$, $y \leq 2x$, $x \leq 7$	3
2	$5x + 2y \leq 200$, $3x + 2y \leq 90$, $y \geq 10$, $2x \geq y$	4
3	**a)** (0, 2), $(\frac{16}{3}, 2)$, (4, 6), (0, 8) **b)** P = 26 at (4, 6)	5
4	**a)** Lines drawn and R labelled (region below $2x + y = 12$ and $x + 3y = 15$, above $x - y = 3$, in the first quadrant) **b)** (0, 0), (3, 0), (5, 2), $(\frac{21}{5}, \frac{18}{5})$, (0, 5)	7
5	Let x = number of hanging baskets, y = number of window boxes. Maximise $P = 6x + 4y$ subject to $3x + 5y \leq 150$, $2x + y \leq 48$, $y \geq 5$, $x \leq 3y$, $x \geq 0$	5
6	**a)** Objective line $4x + 5y = 20$ (gradient -4/5), slid parallel away from O: the first point of R it reaches is the vertex where $x + y = 8$ meets $x + 3y = 12$ **b)** (6, 2); C = 34 **c)** R is unbounded, so x and y can be as large as we like and C has no maximum.	6
7	$x + y \geq 40$, $3y \leq 7x$, $3x \geq y$, $8x + 5y \leq 360$	5
8	**a)** $(\frac{33}{7}, \frac{24}{7})$; $P = \frac{261}{7}$ **b)** P(0, 0) = 0, P(7, 0) = 35, P(0, 5) = 20, all less than 261/7 = 37.3 **c)** x = 5, y = 3; £37	7
9	**a)** (0, 0): 0, (8, 0): 24, (6, 4): 26, (3, 7): 23, (0, 8): 16; optimal vertex (6, 4) **b)** $\frac{1}{2} \leq k \leq 1$	7
10	**a)** Maximise $P = 30x + 55y$ subject to $2x + 5y \leq 60$, $2x + 3y \leq 48$, $y \geq 4$, $x \leq 3y$, $x \geq 0$ **b)** R drawn: vertices (0, 4), (12, 4), $(16, \frac{16}{3})$, (15, 6), (0, 12) **c)** 15 chairs, 6 tables; £780	10
11	**a)** (0, 16), (5, 6), $(\frac{15}{2}, \frac{7}{2})$, (18, 0) **b)** 5 kg of A, 6 kg of B; £27 **c)** 0 kg of A, 16 kg of B; £32	8

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12	**a)** Minimise C = 120x + 400y subject to 8x + 25y ≥ 150, x + y ≤ 12, x ≥ y, y ≥ 0 **b)** R drawn: the triangle above 8x + 25y = 150, below x + y = 12 and below y = x **c)** $(\frac{50}{11}, \frac{50}{11})$: £2363.64; $(\frac{150}{17}, \frac{54}{17})$: £2329.41; (6, 6): £3120 **d)** 7 minibuses, 4 coaches; £2440	10

Full worked solutions, written out by hand, are on the solutions sheet for this topic.

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