Linear models and optimisation - Practice test 4

Name: _____ Date: _____

10 questions | 44 marks | 70 minutes

Interpretation and error analysis, including empty, unbounded and non-unique solutions.

A scientific calculator may be used.

1. A transport model is $C = 75 + 1.8d$, with C in dollars and d in kilometres. [4 marks]

(a) Interpret the gradient and intercept. [2 marks]

(b) Find d when the quoted charge is AUD 156. [2 marks]

2. Consider $2x + 3y = 12$ and $4x + 6y = k$. [4 marks]

(a) For what k are there infinitely many solutions? [2 marks]

(b) Explain the number of solutions if k=25. [2 marks]

3. A learner claims that solving $9 - 3x \leq 0$ gives $x \leq 3$. [3 marks]

(a) Find and explain the error. [2 marks]

(b) Use a numerical counterexample to disprove the learner's result. [1 mark]

4. A proposed feasible region is formed by shading every point that satisfies at least one of $x + y \leq 6$ and $2x + y \leq 8$. [4 marks]

(a) Explain the modelling error. [2 marks]

(b) Test $(5, 0)$ against both inequalities. [2 marks]

5. The constraints are $x, y \geq 0$, $x + y \leq 5$ and $x + y \geq 8$. [3 marks]

(a) Explain whether a feasible solution exists. [2 marks]

(b) Can a different objective repair the model? [1 mark]

6. The feasible set is $x, y \geq 0$ and $x + y \geq 6$. [5 marks]

(a) Minimise $C = 2x + 5y$. [3 marks]

(b) Maximise the same C. [2 marks]

7. For $x, y \geq 0$ and $x + y \leq 8$, consider $P = 3x + 3y$. [5 marks]

(a) State the maximum and all continuous optimal points. [3 marks]

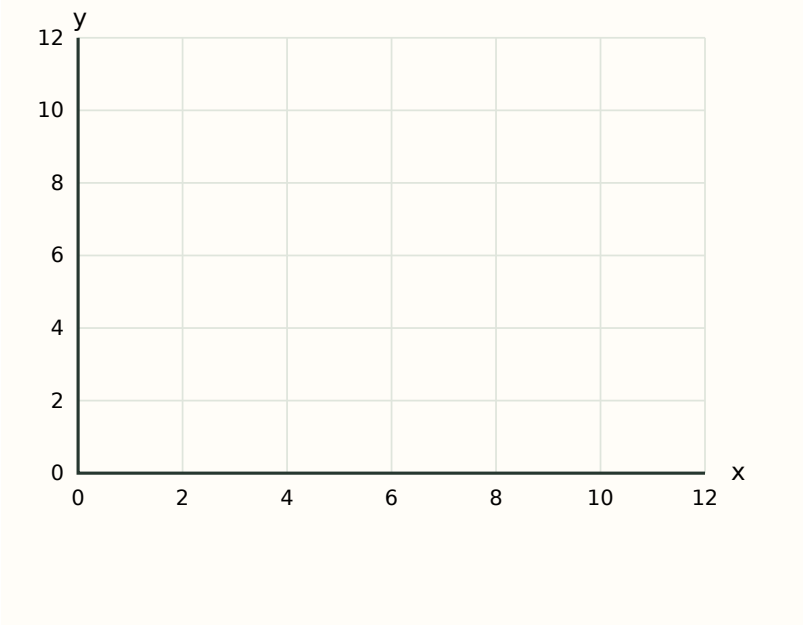
(b) How many whole-number optimal pairs exist? [2 marks]

8. A region has vertices $(0, 0), (6, 0), (4, 4), (0, 6)$. A student evaluates $P = 7x + 5y$ only at the largest x-value. [4 marks]

(a) Find the correct optimum. [3 marks]

(b) Explain why the student's strategy fails. [1 mark]

9. A café prepares x cold packs and y warm packs. Space allows x+y at most 9; preparation allows x+2 y at most 14. Profits are AUD 3 and AUD 5. [8 marks]



(a) State the model, including variable restrictions. [3 marks]

(b) Find and justify the optimal decision. Give the objective value. [5 marks]

10. A report says: “Our model proves that the business will earn exactly AUD 2,000 next week.” Its model assumes constant sales prices and that every unit is sold. [4 marks]

(a) Rewrite the conclusion so it is justified. [2 marks]

(b) Name two sources of uncertainty relevant to that prediction. [2 marks]