Linear models and optimisation - Practice test 5

Name: _____ Date: _____

10 questions | 49 marks | 70 minutes

Applied decisions with profit, minimum requirements and sensitivity.

A scientific calculator may be used.

1. A community event pays AUD 160 for a printer setup and AUD 1.20 for each programme. [4 marks]

(a) Write total cost for n programmes and find the cost of 300. [2 marks]

(b) Explain how a fixed AUD 40 delivery fee changes the rule. [2 marks]

2. An event sells 70 tickets: adult tickets are AUD 18 and student tickets AUD 12. Revenue is AUD 1,020. [5 marks]

(a) Find the two ticket counts. [4 marks]

(b) Explain why ticket counts need integer and non-negative conditions. [1 mark]

3. A normal pack sells for AUD 24 and costs AUD 15. A premium pack sells for AUD 34 and costs AUD 20. There is also an AUD 80 fixed operating cost. [4 marks]

(a) Write total profit for x normal and y premium packs. [3 marks]

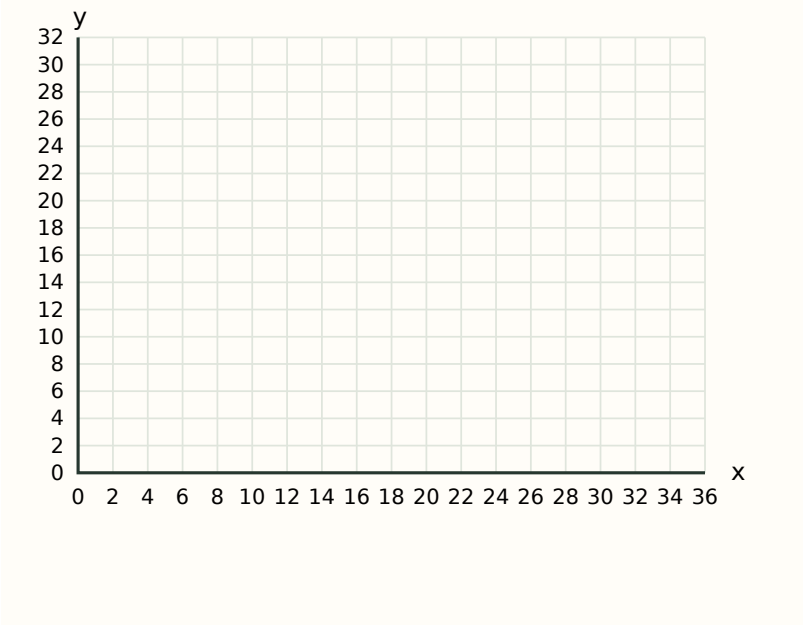
(b) Find profit for 10 normal and 8 premium packs. [1 mark]

4. Each normal pack uses 3 printing units and 2 packing units. Each premium pack uses 2 printing units and 4 packing units. There are 96 printing units and 112 packing units. [5 marks]

(a) Form the resource inequalities. [3 marks]

(b) Is the plan $(20, 16)$ feasible? [2 marks]

5. For the restrictions in Question 4, find the continuous plan maximising $9x + 14y$. [6 marks]



(a) Find the feasible vertices. [3 marks]

(b) Find the maximum contribution and the profit after the fixed AUD 80 cost. [3 marks]

6. A caterer needs at least 18 kilograms of a blend and at least 30 nutrient units. A has 1 unit/kg and B has 3 units/kg. Costs are AUD 4/kg for A and AUD 7/kg for B. [7 marks]

(a) Form a continuous minimum-cost model. [3 marks]

(b) Find and justify the optimum. [4 marks]

7. A club books minivans with 8 seats costing AUD 75 and coaches with 20 seats costing AUD 160. At least 44 seats are required and at most 5 vehicles can be booked. [7 marks]

(a) Form an integer cost model. [3 marks]

(b) Find the cheapest booking. [4 marks]

8. An optimisation model already has $x, y \geq 0$ and $x + y \leq 10$. Someone adds $x \leq 12$. [3 marks]

(a) Explain whether the added constraint changes the feasible region. [2 marks]

(b) Can a redundant constraint change the optimum for an unchanged objective? [1 mark]

9. A feasible triangle has vertices $(0, 0), (10, 0), (0, 8)$. Product profits are p for x and 6 for y, where p is positive. [4 marks]

(a) Find when the two non-zero vertices have equal profit. [2 marks]

(b) Describe the optimum if p=5 and if p=4. [2 marks]

10. The optimal plan uses 18 premium packs, but the supplier sells packing materials only in batches sufficient for 5 premium packs. [4 marks]

(a) Explain why a new practical restriction may be needed. [2 marks]

(b) What information is needed before changing the recommendation? [2 marks]