Integer constraints and interpreting an optimal solution

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. Find the greatest integer x with $3x \le 20$ and $x \ge 0$. [2 marks]

$x \le \frac{20}{3}$; choose the largest permitted integer below that bound.

Answer: 6.

2. At least 25 items are packed in boxes of 6. Find the least number of boxes. [2 marks]

$6b \ge 25$, so $b \ge \frac{25}{6}$; round up to meet the minimum.

Answer: 5.

3. Maximise $P = 2x + 3y$ for non-negative integers with $x + y \le 5$, $y \le 3$. [2 marks]

Increasing y in place of x increases profit.

Use $y = 3$ and the remaining capacity for $x = 2$.

Answer: 13 at $(2, 3)$.

4. Is $(2, 4)$ feasible for $2x + y \le 7$, $x + 2y \le 9$? [2 marks]

The resource totals are 8 and 10, exceeding both limits.

Answer: No.

5. Two integer plans share the greatest profit. What should a recommendation explain? [2 marks]

A secondary criterion such as fewer staff hours can break the tie only if it matters in the stated situation.

Answer: Report both optima and any explicitly justified practical preference.

6. For $x = 0, 1, 2, 3$, the largest feasible integer y-values are 4,3,2,0. Maximise $P = 5x + 4y$. [2 marks]

The four objective values are 16,17,18,15.

Answer: 18 at $(2, 2)$.