LESSON MAKER PRO

Corner Point Choices

Use constraints and corner points to optimize a linear model.

HIGH SCHOOL · MA.912.AR.9.8

MA.912.AR.9.8 "Solve real-world problems involving linear programming in two variables."

NAME _____ DATE _____

THE BIG IDEA

Write each limit as an inequality, then graph the boundary lines and shade the feasible region. Test the objective function at every corner point of that region. The greatest or least value at a corner is the optimum.

WORKED EXAMPLE

Maximize P = 11x + 13y subject to x + y <= 17, x <= 7, y <= 15, and x, y >= 0.

1. Graph the boundary lines and identify the feasible-region corners: (0, 0), (7, 0), (7, 10), (2, 15), and (0, 15).
2. Evaluate P at the corners: 0, 77, 207, 217, and 195.
3. The greatest value is 217.

Answer: Maximum P = 217 at (2, 15).

PRACTICE 4 problems

1 Find the minimum value of C = 8x + 2y subject to x + y >= 9, x >= 1, and y >= 2. Give the corner point and the minimum.

ANSWER _____

2 Maximize R = 9x + 5y subject to x + 2y <= 16, 3x + y <= 18, and x, y >= 0.

ANSWER _____

3 Maximize Q = 6x + 8y subject to x + y <= 10, x <= 4, y <= 8, and x, y >= 0.

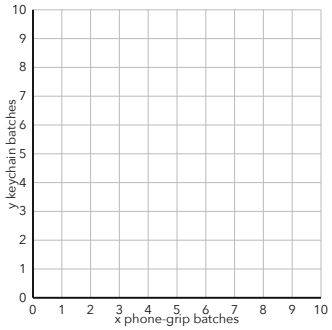
ANSWER _____

4 The feasible region has corner points (1, 9), (4, 4), and (10, 1). Find the minimum of D = 6x + 8y.

ANSWER _____

APPLY IT Show your work

1 At a school pop-up, x batches of phone grips and y batches of keychains can be made. Materials allow at most 8 total batches, so x + y <= 8. Assembly time allows 2x + y <= 12. Each phone-grip batch earns $5 profit, and each keychain batch earns $4 profit. Graph the constraints and find the production plan with the greatest profit.



ANSWER _____

2 A student media club buys x basic ad packages and y premium ad packages. It needs at least 10 total packages and at least 18 reach points. A basic package gives 1 reach point and costs $5. A premium package gives 3 reach points and costs $9. Find the least cost.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For this linear model, x and y may be nonnegative real numbers. Maximize P = 8x + 9y subject to 3x + 2y <= 24 and x + 4y <= 20. State the best point and maximum value. Explain why checking the corner points is enough.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the minimum value of C = 8x + 2y subject to x + y >= 9, x >= 1, and y >= 2. Give the corner point and the minimum.	**Minimum C = 24 at (1, 8).**
2	Maximize R = 9x + 5y subject to x + 2y <= 16, 3x + y <= 18, and x, y >= 0.	**Maximum R = 66 at (4, 6).**
3	Maximize Q = 6x + 8y subject to x + y <= 10, x <= 4, y <= 8, and x, y >= 0.	**Maximum Q = 76 at (2, 8).**
4	The feasible region has corner points (1, 9), (4, 4), and (10, 1). Find the minimum of D = 6x + 8y.	**Minimum D = 56 at (4, 4).**

PART 2 · APPLY IT

1. **Make 4 phone-grip batches and 4 keychain batches. Maximum profit = $36.** Maximize P = 5x + 4y at the feasible corners (0, 0), (6, 0), (4, 4), and (0, 8). The largest objective value is 36 at (4, 4).
2. **Buy 6 basic packages and 4 premium packages. Minimum cost = $66.** Minimize C = 5x + 9y subject to x + y >= 10 and x + 3y >= 18. The boundary lines meet at (6, 4), where the cost is 66.

CHALLENGE

The best point is (28/5, 18/5), and the maximum is P = 386/5. A linear objective function reaches its maximum on a bounded feasible region at a corner point, so testing all corners is enough.

Accept equivalent coordinate and value forms, including 77.2 for 386/5. For graphing items, accept a correct feasible region and correct corner-point evaluations.