LESSON MAKER PRO

Where Lines Meet

Use systems to compare equations and real-world plans.

GRADE 8 · 8.AF.C.12.b

8.AF.C.12.b "Interpret and justify the results of systems of two linear equations in two variables (one solution, no solution, or infinitely many solutions) when applied to real-world and mathematical problems."

NAME _____ DATE _____

THE BIG IDEA

When both equations are written as y = mx + b, compare their slopes and y-intercepts. Different slopes mean one solution, the same slope with different y-intercepts means no solution, and matching slopes and y-intercepts mean infinitely many solutions.

WORKED EXAMPLE

How many solutions does this system have? Find the solution if there is one: y = 11x + 17 and y = -7x + 53.

1. Set the expressions for y equal: 11x + 17 = -7x + 53.
2. Add 7x and subtract 17: 18x = 36, so x = 2.
3. Substitute: y = 11(2) + 17 = 39.

Answer: One solution: (2, 39). Both equations give y = 39 when x = 2.

PRACTICE 6 problems

1 How many solutions does the system have? Find the solution if there is one, and give a reason. y = 3x + 1; y = -x + 9

ANSWER _____

2 How many solutions does the system have? Give a reason. y = 4x - 5; y = 4x + 3

ANSWER _____

3 How many solutions does the system have? Give a reason. 2x + y = 8; y = 8 - 2x

ANSWER _____

4 How many solutions does the system have? Give a reason. 3x + 2y = 12; y = -3/2x + 6

ANSWER _____

5 How many solutions does the system have? Find the solution if there is one, and give a reason. 2x + y = 10; x - y = 2

ANSWER _____

6 How many solutions does the system have? Give a reason. 5x - y = 4; y = 5x - 1

ANSWER _____

APPLY IT Show your work

1 Two game clubs offer payment plans. Club A charges $6 to join and $5 per visit. Club B charges $22 to join and $1 per visit. Let x be the number of visits and y be the total cost in dollars. Write a system. For what number of visits do the plans cost the same? Explain what the solution means.

WORK SPACE

ANSWER _____

2 Ava starts a game with 8 points and earns 3 points per round. Ben starts with 14 points and also earns 3 points per round. Let x be the number of rounds and y be a player's total points. Write a system. How many solutions does it have? Explain what that means in the game.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Consider the system kx + 3y = 12 and 2x + y = 4. Find the value of k that makes the system have infinitely many solutions. For every other value of k, how many solutions does it have? Explain.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	How many solutions does the system have? Find the solution if there is one, and give a reason. y = 3x + 1; y = -x + 9	**One solution: (2, 7). The lines have different slopes.**
2	How many solutions does the system have? Give a reason. y = 4x - 5; y = 4x + 3	**No solution. The lines have the same slope but different y-intercepts.**
3	How many solutions does the system have? Give a reason. 2x + y = 8; y = 8 - 2x	**Infinitely many solutions. Both equations describe the same line.**
4	How many solutions does the system have? Give a reason. 3x + 2y = 12; y = -3/2x + 6	**Infinitely many solutions. Rearranging the first equation gives y = -3/2x + 6.**
5	How many solutions does the system have? Find the solution if there is one, and give a reason. 2x + y = 10; x - y = 2	**One solution: (4, 2). Adding the equations gives 3x = 12, and substitution gives y = 2.**
6	How many solutions does the system have? Give a reason. 5x - y = 4; y = 5x - 1	**No solution. The first equation gives y = 5x - 4, so the lines have the same slope but different y-intercepts.**

PART 2 · APPLY IT

1. **y = 6 + 5x and y = 22 + x. The one solution is (4, 26): after 4 visits, both plans cost $26.** Set the costs equal: 6 + 5x = 22 + x, so x = 4. Substitution gives y = 26.
2. **y = 8 + 3x and y = 14 + 3x. There is no solution: Ben always has 6 more points than Ava, so their totals never match.** The equations have the same slope and different y-intercepts. Subtracting the totals shows that Ben stays 6 points ahead.

CHALLENGE

k = 6 makes the equations describe the same line because multiplying 2x + y = 4 by 3 gives 6x + 3y = 12. For every other value of k, the lines have different slopes and exactly one solution.

Accept equivalent equations and justifications. In the game-club problem, the number of visits must be a nonnegative whole number, and 4 meets that condition.