LESSON MAKER PRO

Slope Line-Up

Use slopes to build parallel and perpendicular lines.

HIGH SCHOOL · HSG-GPE.B.5

CCSS.Math.Content.HSG-GPE.B.5 "Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point)."

NAME _____ DATE _____

SLOPE CONNECTIONS

Nonvertical parallel lines have equal slopes. Nonvertical perpendicular lines have slopes whose product is -1, so their slopes are negative reciprocals. A vertical line is perpendicular to a horizontal line.

WORKED EXAMPLE

Find the equation of the line parallel to $y = -13/17x + 19$ that passes through (23, 29).

1. Parallel lines have the same slope, so use $y = -13/17x + b$.
2. Substitute (23, 29): $29 = -13/17(23) + b$.
3. Add 299/17 to both sides: $b = 792/17$.

Answer: $y = -13/17x + 792/17$

PRACTICE 6 problems

1 Classify the lines $y = 2x - 8$ and $y = 2x + 9$ as parallel, perpendicular, or neither.

ANSWER _____

2 Find the equation of the line perpendicular to $y = -6x + 10$ that passes through (12, -2).

ANSWER _____

3 Determine whether the line through (-10, 2) and (6, -6) is perpendicular to $y = 2x + 8$. Show the slope of the line through the points.

ANSWER _____

4 Find the equation of the line parallel to $3x + 2y = 18$ that passes through (8, 6). Write the equation in slope-intercept form.

ANSWER _____

5 Find the equation of the line perpendicular to x = -7 that passes through (10, 12).

ANSWER _____

6 Prove both directions for finite slopes m and n. Use direction vectors(1,m)and(1,n) and the fact that nonzero vectors are perpendicular exactly when their dot product is zero. What equation on m,n results? Explain the horizontal/vertical case separately.

ANSWER _____

APPLY IT Show your work

1 For a student council floor-art design, one painted guide path follows y = 3/4x - 2 on a coordinate floor plan. A second guide path must be parallel and pass through the checkpoint (8, 10). What is the equation of the second path?

2 A robotics team maps a cable route on a coordinate floor plan with the equation y = -2x + 12. A safety-check route must cross the cable route at a right angle and pass through (4, 1). What is the equation of the safety-check route?

CHALLENGE One step up

Prove the parallel slope criterion. Suppose two nonvertical lines are y = mx + b and y = mx + c, where b is not equal to c. Assume the lines intersect, compare their equations, and explain why this proves the lines are parallel. Prove the converse: if slopes m and n differ, solve mx+b=nx+c to show a unique intersection. Explain why equal slope and equal intercept describes the same line.

ANSWER KEY

Slope Line-Up

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Classify the lines y = 2x - 8 and y = 2x + 9 as parallel, perpendicular, or neither.	**parallel**
2	Find the equation of the line perpendicular to y = -6x + 10 that passes through (12, -2).	**y = 1/6x - 4**
3	Determine whether the line through (-10, 2) and (6, -6) is perpendicular to y = 2x + 8. Show the slope of the line through the points.	**Yes. The slope through the points is -1/2, and (-1/2)(2) = -1.**
4	Find the equation of the line parallel to 3x + 2y = 18 that passes through (8, 6). Write the equation in slope-intercept form.	**y = -3/2x + 18**
5	Find the equation of the line perpendicular to x = -7 that passes through (10, 12).	**y = 12**
6	Prove both directions for finite slopes m and n. Use direction vectors(1,m)and(1,n) and the fact that nonzero vectors are perpendicular exactly when their dot product is zero. What equation on m,n results? Explain the horizontal/vertical case separately.	**Dot product=1+mn. It is zero iff mn=−1, proving both directions for nonvertical lines. A horizontal line(m=0)is perpendicular to a vertical line, whose slope is undefined; no finite n makes0n=−1.**

PART 2 · APPLY IT

1. **y = 3/4x + 4** A parallel path has slope 3/4. Substitute (8, 10) into y = 3/4x + b to get b = 4.
2. **y = 1/2x - 1** A perpendicular route has slope 1/2. Substituting (4, 1) into y = 1/2x + b gives b = -1.

CHALLENGE

If the lines intersect, then mx + b = mx + c. Subtracting mx gives b = c, which contradicts b not being equal to c. Therefore the distinct nonvertical lines do not intersect, so they are parallel. If m≠n, x=(c−b)/(m−n) gives an intersection, so distinct parallel nonvertical lines must have equal slopes. Equal slope and equal intercept gives coincident lines, not distinct parallels. Distinct vertical lines are parallel and have undefined slopes.

Accept equivalent equations in slope-intercept or standard form. For the proof items, accept logically equivalent reasoning that uses equal slopes for parallel lines and negative reciprocal slopes, or perpendicular direction vectors, for perpendicular lines.