

Slope Proof Lab

Use slope to prove parallel and perpendicular lines.

HIGH SCHOOL • HSG-GPE.B

CCSS.Math.Content.HSG-GPE.B "Use coordinates to prove simple geometric theorems algebraically"

NAME _____

DATE _____

PROVE IT WITH SLOPE

Find each segment's slope using rise/run. Segments with equal slopes are parallel, and segments with negative reciprocal slopes are perpendicular. A horizontal line and a vertical line are also perpendicular.

WORKED EXAMPLE

Show that AB is parallel to CD.

A(-13, 17), B(-9, 24), C(21, -8), and D(25, -1).

$$1. m_{AB} = (24 - 17) / [-9 - (-13)] = 7/4$$

$$2. m_{CD} = [-1 - (-8)] / (25 - 21) = 7/4$$

3. The slopes are equal.

4. Therefore, AB is parallel to CD.

Answer: AB is parallel to CD.

PRACTICE 6 problems

- 1** Are PQ and RS parallel? P(-4, 2), Q(2, 5), R(0, -3), and S(6, 0). Show the slopes.

ANSWER _____

- 2** Are EF and GH perpendicular? E(-3, 4), F(1, 2), G(0, 5), and H(2, 1). Show the slopes.

ANSWER _____

- 3** Find x so that AB is parallel to CD. A(-6, 0), B(2, 12), C(4, -4), and D(4 + x, 2).

ANSWER _____

- 4** Find y so that MN is perpendicular to UV. M(-4, 2), N(2, 5), U(0, 7), and V(2, y).

ANSWER _____

- 5** Triangle JKL has J(-2, -4), K(2, -2), and L(0, 2). Prove that the triangle is a right triangle. Name the vertex with the right angle.

ANSWER _____

- 6** Prove that quadrilateral ABCD is a parallelogram. A(-4, -2), B(0, 1), C(4, -3), and D(0, -6).

ANSWER _____

APPLY IT Show your work

- 1** A skate park designer places one rail from $(-6, 0)$ to $(2, 4)$. A second rail goes from $(1, 7)$ to $(3, 3)$. Are the rails perpendicular? Use slopes to prove your answer.

WORK SPACE

ANSWER _____

- 2** A student council designs a photo booth floor with corners $E(-2, 1)$, $F(4, 4)$, $G(6, 0)$, and $H(0, -3)$. Does the floor form a parallelogram? Use slopes to prove your answer.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Quadrilateral ABCD has $A(-2, 1)$, $B(4, 4)$, $C(6, y)$, and $D(0, -3)$. Find y so that ABCD is a rectangle. Explain using slopes.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Are PQ and RS parallel? P(-4, 2), Q(2, 5), R(0, -3), and S(6, 0). Show the slopes.	Yes. $m_{PQ} = 1/2$ and $m_{RS} = 1/2$, so PQ is parallel to RS.
2	Are EF and GH perpendicular? E(-3, 4), F(1, 2), G(0, 5), and H(2, 1). Show the slopes.	Yes. $m_{EF} = -1/2$ and $m_{GH} = -2$, so EF is perpendicular to GH.
3	Find x so that AB is parallel to CD. A(-6, 0), B(2, 12), C(4, -4), and D(4 + x, 2).	x = 4
4	Find y so that MN is perpendicular to UV. M(-4, 2), N(2, 5), U(0, 7), and V(2, y).	y = 3
5	Triangle JKL has J(-2, -4), K(2, -2), and L(0, 2). Prove that the triangle is a right triangle. Name the vertex with the right angle.	$m_{JK} = 1/2$ and $m_{KL} = -2$. Since the slopes are negative reciprocals, angle K is a right angle.
6	Prove that quadrilateral ABCD is a parallelogram. A(-4, -2), B(0, 1), C(4, -3), and D(0, -6).	$m_{AB} = 3/4$ and $m_{CD} = 3/4$. $m_{BC} = -1$ and $m_{AD} = -1$. Both pairs of opposite sides are parallel, so ABCD is a parallelogram.

PART 2 • APPLY IT

- Yes. The rails are perpendicular.** The first rail has slope $1/2$. The second rail has slope -2 , which is the negative reciprocal of $1/2$.
- Yes. EFGH is a parallelogram.** $m_{EF} = 1/2$ and $m_{GH} = 1/2$. Also, $m_{FG} = -2$ and $m_{HE} = -2$, so both pairs of opposite sides are parallel.

CHALLENGE

y = 0. Then $m_{AB} = 1/2$, $m_{BC} = -2$, $m_{CD} = 1/2$, and $m_{DA} = -2$. Opposite sides are parallel, and adjacent sides are perpendicular, so ABCD is a rectangle.

Accept correctly simplified equivalent slopes, such as $3/6$ for $1/2$. For perpendicular claims, accept either negative reciprocal reasoning or a correct demonstration that the slopes multiply to -1 when both slopes are defined.