LESSON MAKER PRO

Vector Scale Lab

Multiply components, then track direction and length.

HIGH SCHOOL · HSN-VM.B.5a

CCSS.Math.Content.HSN-VM.B.5a "Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c (v x, v y) = (cv x, cv y)."

NAME _____ DATE _____

SCALE A VECTOR

To multiply a vector by a scalar, multiply each component by that scalar. A positive scalar keeps the direction, while a negative scalar reverses it. The scalar's absolute value tells how the vector's length changes.

WORKED EXAMPLE

Find 7(-3, 5).

1. Multiply the x-component: 7 x -3 = -21.
2. Multiply the y-component: 7 x 5 = 35.
3. Write the new vector: (-21, 35).

Answer: 7(-3, 5) = (-21, 35). The direction stays the same, and the length is 7 times as large.

PRACTICE 6 problems

1 Find 4(2, -6).

ANSWER _____

2 Find -2(-4, 9).

ANSWER _____

3 Find 1/2(12, -8).

ANSWER _____

4 Let a = (10, -1). Find -a. State whether the direction reverses.

ANSWER _____

5 Let u = (-2, 11). Find -4u.

ANSWER _____

6 A vector has components (8, 4). Multiply it by -1/2. State the direction and length change.

ANSWER _____

APPLY IT Show your work

1 A robotics team programs a rover to move along vector r = (4, -6) meters. For a longer test, the team programs the rover to use 2r. What is the new movement vector? Describe its direction and length.

WORK SPACE

ANSWER _____

2 In a video game, a character's knockback vector is (12, -8). A power-up applies -1/2 times this vector. What is the new knockback vector? Describe the change in direction and distance.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A vector v satisfies -2v = (8, -12). Find v. Explain what multiplying v by -2 did to v.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find 4(2, -6).	**(8, -24)**
2	Find -2(-4, 9).	**(8, -18)**
3	Find 1/2(12, -8).	**(6, -4)**
4	Let a = (10, -1). Find -a. State whether the direction reverses.	**-a = (-10, 1); the direction reverses.**
5	Let u = (-2, 11). Find -4u.	**(8, -44)**
6	A vector has components (8, 4). Multiply it by -1/2. State the direction and length change.	**(-4, -2); the direction reverses, and the length is half as long.**

PART 2 · APPLY IT

1. **2r = (8, -12) meters. The rover moves in the same direction, twice as far.** Multiply both components of (4, -6) by 2. Because the scalar is positive, the direction stays the same.
2. **(-6, 4). The knockback reverses direction and travels half the distance.** Multiply each component by -1/2. The negative scalar reverses direction, and an absolute value of 1/2 halves the length.

CHALLENGE

v = (-4, 6). Multiplying v by -2 reversed its direction and doubled its length.

Accept equivalent vector notation, such as <8, -24> in place of (8, -24). For direction descriptions, accept "opposite direction" for "reverses direction," and "twice the length" for "doubles its length."