LESSON MAKER PRO

Scale and Turn Vectors

Find a scaled vector's magnitude and direction.

HIGH SCHOOL · HSN-VM.B.5b

CCSS.Math.Content.HSN-VM.B.5b "Compute the magnitude of a scalar multiple c v using || c v || = | c | v. Compute the direction of c v knowing that when | c | v ≠ 0, the direction of c v is either along v (for c > 0) or against v (for c < 0)."

NAME _____ DATE _____

MAGNITUDE AND DIRECTION RULE

For any scalar c and vector v, ||cv|| = |c| ||v||. When cv is not the zero vector, a positive scalar keeps the direction along v, and a negative scalar reverses it against v. The zero vector has no direction.

WORKED EXAMPLE

Let v = <6, 8> and c = -11. Find the magnitude and direction of cv.

1. Find ||v||: sqrt(6^2 + 8^2) = sqrt(100) = 10.
2. Find the scalar's absolute value: |-11| = 11.
3. Compute the magnitude: ||cv|| = |c| ||v|| = 11(10) = 110.
4. Because c is negative, cv points against v.

Answer: Magnitude: 110; direction: against v.

PRACTICE 6 problems

1 Vector a has magnitude 7. Find the magnitude and direction of 3a.

ANSWER _____

2 Vector b has magnitude 9. Find the magnitude and direction of -4b.

ANSWER _____

3 Let d = <5, 12>. Find the magnitude and direction of 2d.

ANSWER _____

4 Vector p has magnitude 14. Find the magnitude and direction of (-1/2)p.

ANSWER _____

5 Vector q has magnitude 15. Find the magnitude and direction of 0q.

ANSWER _____

6 Let r = <-7, 24>. Find the magnitude and direction of -3r.

ANSWER _____

APPLY IT Show your work

1 A robotics club programs a camera drone to move along displacement vector d, where ||d|| = 18 meters. For a retake, the drone uses the displacement (-2/3)d. What is the magnitude of the retake displacement, and does it point along or against d?

WORK SPACE

ANSWER _____

2 In a video game, an avatar's movement vector is s = <9, 12> tiles. A replay effect uses the movement vector (-5/4)s. Find the magnitude of the replay movement and its direction compared with s.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A nonzero vector t has magnitude 14. The vector kt has magnitude 35 and points against t. Find k and explain how you know.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Vector a has magnitude 7. Find the magnitude and direction of 3a.	**Magnitude: 21; direction: along a.**
2	Vector b has magnitude 9. Find the magnitude and direction of -4b.	**Magnitude: 36; direction: against b.**
3	Let d = <5, 12>. Find the magnitude and direction of 2d.	**Magnitude: 26; direction: along d.**
4	Vector p has magnitude 14. Find the magnitude and direction of (-1/2)p.	**Magnitude: 7; direction: against p.**
5	Vector q has magnitude 15. Find the magnitude and direction of 0q.	**Magnitude: 0; direction: no direction.**
6	Let r = <-7, 24>. Find the magnitude and direction of -3r.	**Magnitude: 75; direction: against r.**

PART 2 · APPLY IT

1. **Magnitude: 12 meters; direction: against d.** Use ||(-2/3)d|| = |-2/3|(18) = 12. The negative scalar reverses the direction.
2. **Magnitude: 75/4 tiles; direction: against s.** First, ||s|| = sqrt(9^2 + 12^2) = 15. Then ||(-5/4)s|| = 5/4(15) = 75/4, and the negative scalar reverses the direction.

CHALLENGE

k = -5/2. Since |k|(14) = 35, |k| = 5/2. Because kt points against t, k must be negative.

Accept "same direction" for along and "opposite direction" for against. For 0q, accept "undefined direction" or "no direction."