LESSON MAKER PRO

Vector Direction Shift

Scale a vector's size and track which way it points.

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

To find the magnitude of c v, multiply the magnitude of v by the absolute value of c: ||c v|| = |c| ||v||. If c is positive, c v points along v. If c is negative, c v points against v. A zero vector has no direction.

WORKED EXAMPLE

Let v = <2, -1> and c = -11. Find the magnitude and direction of c v.

1. ||v|| = sqrt(2^2 + (-1)^2) = sqrt5.
2. ||-11v|| = |-11| sqrt5 = 11sqrt5.
3. Because -11 is negative, -11v points against v.

Answer: Magnitude: 11sqrt5; direction: against v.

PRACTICE 6 problems

1 For a vector v with ||v|| = 6 and c = 4, find the magnitude and direction of c v.

ANSWER _____

2 For a vector v with ||v|| = 7 and c = -8, find the magnitude and direction of c v.

ANSWER _____

3 Let v = <6, 8> and c = -7. Find the magnitude and direction of c v.

ANSWER _____

4 Let v = <-9, 12> and c = 3. Find the magnitude and direction of c v.

ANSWER _____

5 For a vector v with ||v|| = 0 and c = -9, find the magnitude and direction of c v.

ANSWER _____

6 For a vector v with ||v|| = 13 and c = 0, find the magnitude and direction of c v.

ANSWER _____

APPLY IT Show your work

1 A camera drone has a velocity vector v with magnitude 15 m/s. Replay software multiplies the vector by -4/3 to create a reverse-motion effect. What are the magnitude and direction of the new velocity vector?

WORK SPACE

ANSWER _____

2 At a robotics competition, a robot has a push-force vector f with magnitude 18 N. Its control program scales the force by 7/6. What are the magnitude and direction of the scaled force vector?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A vector v = <9, 12> is multiplied by a negative scalar c. The magnitude of c v is 60. Find c, then state the direction of c v relative to v.

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ANSWER KEY

Vector Direction Shift

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For a vector v with ‖v‖ = 6 and c = 4, find the magnitude and direction of c v.	**Magnitude: 24; direction: along v.**
2	For a vector v with ‖v‖ = 7 and c = -8, find the magnitude and direction of c v.	**Magnitude: 56; direction: against v.**
3	Let v = <6, 8> and c = -7. Find the magnitude and direction of c v.	**Magnitude: 70; direction: against v.**
4	Let v = <-9, 12> and c = 3. Find the magnitude and direction of c v.	**Magnitude: 45; direction: along v.**
5	For a vector v with ‖v‖ = 0 and c = -9, find the magnitude and direction of c v.	**Magnitude: 0; direction: undefined.**
6	For a vector v with ‖v‖ = 13 and c = 0, find the magnitude and direction of c v.	**Magnitude: 0; direction: undefined.**

PART 2 · APPLY IT

1. **Magnitude: 20 m/s; direction: against v.** Compute |-4/3| x 15 = 20. The negative scalar reverses the direction.
2. **Magnitude: 21 N; direction: along f.** Compute |7/6| x 18 = 21. The positive scalar keeps the force pointing along f.

CHALLENGE

c = -4; c v points against v.

Accept “same direction” for along v and “opposite direction” for against v. For a zero result, accept “no direction” or “undefined direction.”