LESSON MAKER PRO

Vector Path Finder

Components, lengths, and directions in the coordinate plane.

HIGH SCHOOL · MA.912.NSO.3.1

MA.912.NSO.3.1 "Apply appropriate notation and symbols to represent vectors in the plane as directed line segments. Determine the magnitude and direction of a vector in component form."

NAME _____ DATE _____

FROM POINTS TO VECTORS

For a vector from A(x1, y1) to B(x2, y2), write vector AB = <x2 - x1, y2 - y1>. For vector <a, b>, the magnitude is sqrt(a^2 + b^2). Measure direction counterclockwise from the positive x-axis, using the signs of a and b to choose the correct quadrant.

WORKED EXAMPLE

Point M is at (-7, 11) and point N is at (5, 27). Write vector MN in component form, then find its magnitude and direction.

1. vector MN = <5 - (-7), 27 - 11> = <12, 16>.
2. |MN| = sqrt(12^2 + 16^2) = sqrt(400) = 20.
3. The vector is in Quadrant I, so its direction is tan^-1(16/12) = tan^-1(4/3).

Answer: vector MN = <12, 16>; magnitude 20; direction tan^-1(4/3) degrees.

PRACTICE 6 problems

1 Points P(-10, 13) and Q(-1, 13) form a directed segment from P to Q. Write vector PQ in component form. Then find its magnitude and direction.

ANSWER _____

2 Points R(9, -2) and S(9, 6) form a directed segment from R to S. Write vector RS in component form. Then find its magnitude and direction.

ANSWER _____

3 For vector u = <-8, 8>, find the magnitude and direction.

ANSWER _____

4 For vector v = <6, -6>, find the magnitude and direction.

ANSWER _____

5 For vector w = <-9, -40>, find the magnitude and direction.

ANSWER _____

6 For vector t = <15, 8>, find the magnitude and direction.

ANSWER _____

APPLY IT Show your work

1 In a game design class, east is positive x and north is positive y. A character moves 9 grid units east and 40 grid units north from its starting point. Write the displacement vector in component form, then find its magnitude and direction.

WORK SPACE

ANSWER _____

2 At a music festival, a volunteer walks 28 meters west and then 45 meters south from the entrance. Write the displacement vector in component form, then find its magnitude and direction.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Point A is (-9, 8). The terminal point B lies on the x-axis. Vector AB has magnitude 17 and points into Quadrant IV. Find B, write vector AB in component form, and find its direction.

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ANSWER KEY

Vector Path Finder

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Points P(-10, 13) and Q(-1, 13) form a directed segment from P to Q. Write vector PQ in component form. Then find its magnitude and direction.	**vector PQ = <9, 0>; magnitude 9; direction 0 degrees.**
2	Points R(9, -2) and S(9, 6) form a directed segment from R to S. Write vector RS in component form. Then find its magnitude and direction.	**vector RS = <0, 8>; magnitude 8; direction 90 degrees.**
3	For vector u = <-8, 8>, find the magnitude and direction.	**Magnitude 8sqrt(2); direction 135 degrees.**
4	For vector v = <6, -6>, find the magnitude and direction.	**Magnitude 6sqrt(2); direction 315 degrees.**
5	For vector w = <-9, -40>, find the magnitude and direction.	**Magnitude 41; direction 180 degrees + tan^-1(40/9) degrees.**
6	For vector t = <15, 8>, find the magnitude and direction.	**Magnitude 17; direction tan^-1(8/15) degrees.**

PART 2 · APPLY IT

1. **<9, 40>; magnitude 41; direction tan^-1(40/9) degrees.** Use east and north as positive components to write <9, 40>. Apply the Pythagorean theorem for the magnitude, and the vector is in Quadrant I.
2. **<-28, -45>; magnitude 53; direction 180 degrees + tan^-1(45/28) degrees.** West and south give negative components, so the vector is <-28, -45>. Its direction is in Quadrant III, so add the reference angle to 180 degrees.

CHALLENGE

B = (6, 0); vector AB = <15, -8>; direction 360 degrees - tan^-1(8/15) degrees.

Accept equivalent direction expressions that identify the same angle in the correct quadrant. Accept magnitude forms such as sqrt(128) only if they are mathematically equivalent, although simplified radical form is preferred.