

Student directions *Vector Addition* activity: Introduction to Vector math  
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Learning Goals: Students will be able to

- Explain vector representations in their own words
  - Convert between the of angular form of vectors and the component form
  - Add vectors
1. You take a walk in the park for 15 steps using a compass that points  $25^\circ$  North of East.
    - How would you use the simulation to represent your path?
    - Explain why the same representation works for illustrating this different scenario: You drive at 15 miles/hour using a compass that points  $25^\circ$  North of East.
    - Write another scenario using different units that could also be represented the same.
  2. In the simulation, a vector is described by four measurements:  $|R|$ ,  $\Theta$ ,  $R_x$ , and  $R_y$ . Put a vector in the work area, and then investigate to make sense of what these four things represent. In your investigation, use a wide variety of vector measurements and all three styles of **Component Displays**. Then, describe in your own words what the measurements represent and what “component” means.
  3. Suppose you are driving 14 miles/hour with a compass reading of  $35^\circ$  north of east.
    - Represent the vector using the simulation. How fast is your car traveling in the north direction? How fast in the east direction?
    - Figure out how the components could be calculated using geometry if you couldn’t use the simulation.
    - Check your ideas by testing with other vectors and then write a plan for finding the components of any vector.
  4. To get to the sandwich shop, you left home and drove 6 miles south and then 10 miles west.
    - If a bird flew from your house to the sandwich shop in a straight line, how far do you think the bird would fly? Use the simulation to check your reasoning.
    - What direction should it fly from your house to get to the shop?
    - Explain how you could use the simulation to answer these questions.
    - Explain how you could use geometry equations to answer these questions.
  5. Suppose you and a friend are test driving a new car. You drive out of the car dealership and go 10 miles east, and then 8 miles south. Then, your friend drives 8 miles west, and 6 miles north.
    - If you had the dealer’s homing pigeon in the car, how far do you think it would have to fly to get back to the dealership? Use the simulation to test ideas.
    - The distance that the bird has to fly represents the sum of the 4 displacement vectors. Use the simulation to test ideas you have about vector addition. After your tests, describe how you can use the simulation to add vectors.
  6. A paper airplane is given a push so that it could fly 7m/s  $35^\circ$  North of East, but there is wind that also pushes it 8 m/s  $15^\circ$  North of East.
    - Use the simulation to solve the problem. How fast could it go and in what direction would it travel?
    - Think about your math tools and design a way to add vectors without the simulation.
    - Check your design by adding several vectors mathematically and then checking your answers using the simulation.