Vector Addition

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PHYS 211L 01 – General Physics I Lab

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Main Body

The purpose of the lab "Vector Addition" was to recognize the relationship between

vectors and the nature of the relationship itself. A vector is a quantity represented by arrows that

show magnitude and direction. There are multiple ways of seeing vectors and their relationship,

the first of them being adding the vectors together in more ways than one, including expressing

each vector in terms of their horizontal and vertical components then adding the components

together. One could also specify vectors in Cartesian or polar coordinates and observe the

magnitude, angle, and components of each vector. In addition to these approaches and purposes,

vector equations were experimented with and the sums and differences of vectors were

compared. Students were able to customize the base vectors and/or explore scalar multiplication

by adjusting the coefficients in an equation. The results from the lab were collected and the

figures below represent the process completed by students to obtain those results.
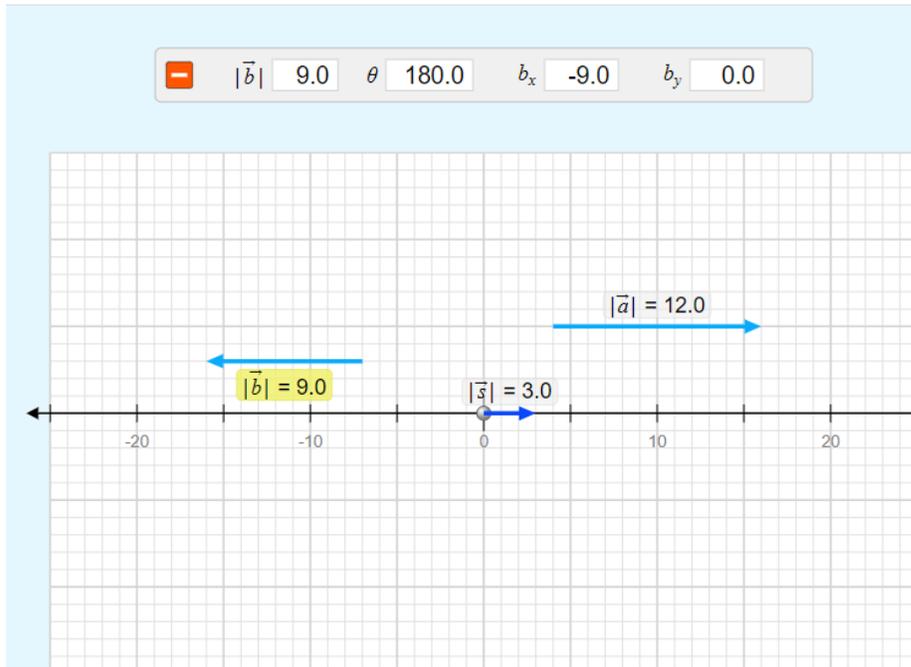
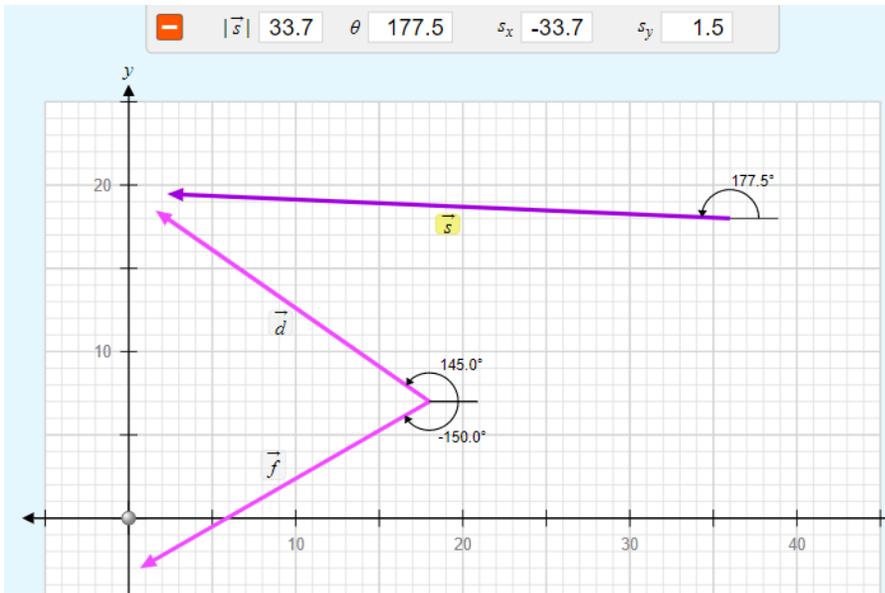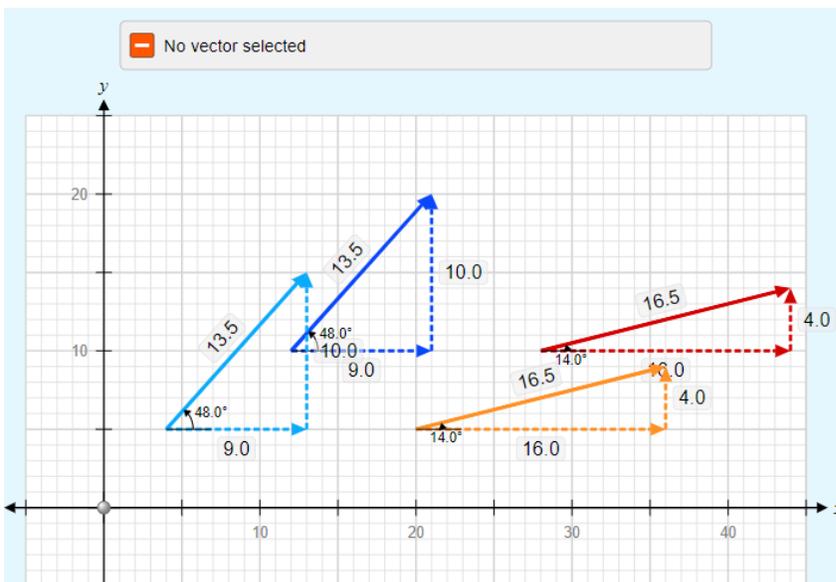Figure 1.1

Figure 1.2

Figure 1.3

Figure 1.4

Figure 1.5

| | $|\vec{c}|$ 20.6 | θ 76.0 | c_x 5.0 | c_y 20.0 |

$\vec{a} + \vec{b} = \vec{c}$ $\vec{a} - \vec{b} = \vec{c}$ $\vec{a} + \vec{b} + \vec{c} = 0$ $3\ \vec{a}\ +\ 1\ \vec{b}\ =\ \vec{c}$
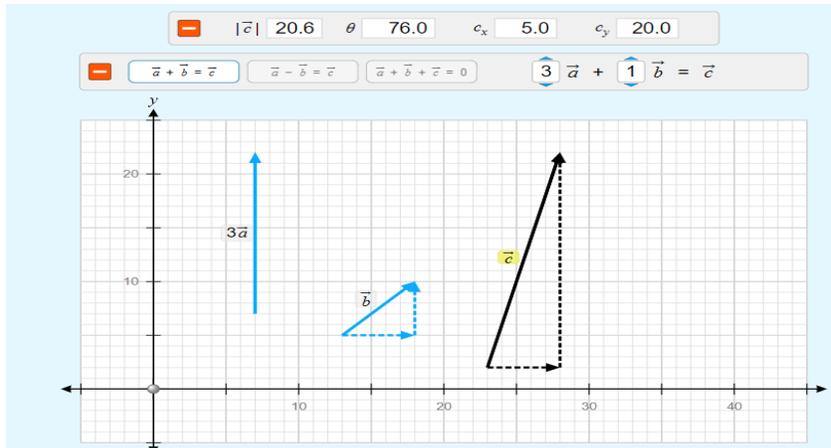
Conclusion

Figure 1.1 shows the basic relationship between vectors and the sum; the origin is zero, while vector A is 12.0 and vector B is 9.0 but is behind zero is it is –9.0. The sum of vector A and vector B is 3.0, that being the vector sum. Figures 1.2 and 1.3 display vectors, angle, and components of each vector. Figure 1.2 shows the sum of the two vectors, allowing the angle of vector B to be determined as 32 degrees and the angle of vector C to be 61 degrees; the sum of the two vectors has a total magnitude of 11.4, with a final angle of –37.9 degrees. Figure 1.4 displays the sum of the two vectors in comparison of one another, while figure 1.5 displays the different equations for vectors - vectors replicate the equation (a + b = +c with a coefficient of 3a and 1b). It was determined that when multiplying a vector by a scalar, the direction of the vector is not changed and the magnitude is only multiplied by the magnitude of the scalar, resulting in a new vector arrow pointing in the same direction as the original one with a longer or shorter length. The relationship of adding, subtracting, and multiplying vectors was recognized and utilized within the lab by students during their experience of spectating the magnitudes and angles.