

PY105S Unit 1 – Worksheet for Vectors and Vector Addition

Knowing how to work with vectors, add vectors, and distinguish between vectors and scalars will be an important part of the course.

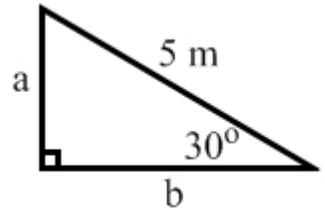
What is a vector? Give a brief definition in words.

Give some examples of quantities that are vectors.

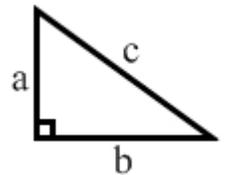
What is a scalar? Give a brief definition in words.

Give some examples of quantities that are scalars.

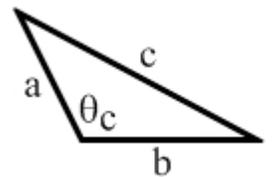
Consider the following right-angled triangle. The hypotenuse has a length of 5 m, and the angle opposite side a is 30° . What is the length of side a and side b ?



What is the relationship between a , b , and c in a general right-angled triangle?



What is the relationship between a , b , and c in a triangle that has an angle θ_c opposite side c ? Show that the Pythagorean Theorem is a special case of this relationship for $\theta_c = 90^\circ$.



You have two vectors of length _____ and _____. You get to choose the direction of each vector. When you add these two vectors tip-to-tail what is...

...the largest resultant vector you can obtain?

...the smallest resultant vector you can obtain?

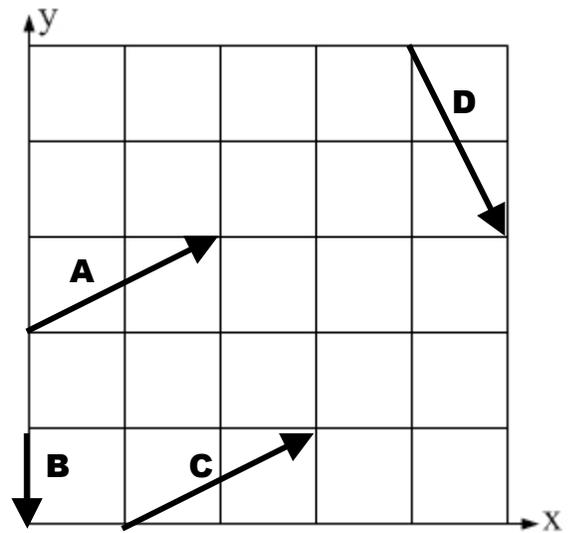
Can you obtain resultant vectors of all possible lengths between the smallest and largest values?

CHALLENGE: Prove your last statement mathematically.

The grid lines in the figure are 1 m apart. Four “displacement” vectors **A**, **B**, **C** and **D** have been drawn on the diagram. Which two displacement vectors are equal? Why?

Add vectors **A** and **B** together tip-to-tail. Draw the resultant vector. How long is the resultant vector?

In which direction is the resultant vector?



Does it matter in which order you add the vectors? Is $\vec{A} + \vec{B}$ the same as $\vec{B} + \vec{A}$, or not?

Consider the resultant vector obtained by adding the vectors **A** and **D**.

What is the *x*-component of this resultant vector?

What is the *y*-component of this resultant vector?

What is the magnitude of this resultant vector?

CHALLENGE: What is the direction of this resultant vector? (Feel free to write down an expression for the sine, cosine, or tangent of an appropriate angle if you can't determine an angle directly.)

CHALLENGE SECTION

You have three vectors of length 4m, 7 m, and 9 m. You get to choose the direction of each vector. When you add these three vectors what is...

...the largest resultant vector you can obtain?

...the smallest resultant vector you can obtain?

You have three vectors of length 4m, 7 m, and 16 m. You get to choose the direction of each vector. When you add these three vectors what is...

...the largest resultant vector you can obtain?

...the smallest resultant vector you can obtain?

Other topics to pay attention to: Changing units, dimensional analysis.