

Re: unit vector is dimensionless, how to draw when coordinates for length?

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- *From:* Virgil <ITSnetNOTcom#virgil@xxxxxxxxxxx>
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In article <1139521062.209375.248640@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>, i.love.jeevitha@xxxxxxxx wrote:

Virgil wrote:

In article
<1139456528.812781.109060@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>,
i.love.jeevitha@xxxxxxxx wrote:

Say there are x, y, z coordinates set up for "some space" on earth, where the coordinates represent lengths. Say the space is a playground or a space around some buildings in downtown new york.

If there is a position vector between 2 points in this space, say between two buildings or something, then the magnitude of this vector is a length (metres, or whatever). That is the dimension of the position vector or any vector which this coordinate system is really set up for is length.

Now if we find the unit vector of the said position vector, it is dimensionless. How would one graph the unit vector on this coordinate system? How would one go about "thinking" about what it really means to say that this unit vector has magnitude 1? Is that 1m? No. Then what is it (geometrically) ?

The issues gets even more muddled if we consider forces. Sometimes one

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finds the unit vector of a position vector between two points (along a rope or something) which has a force acting along it. The force vector can then be determined by multiplying the unit vector by the magnitude of the force. This obviously means that the unit vector is dimensionless and can be used to bring about vectors with different units into the same "x y z" frame. Anyone have an idea about what it means to say a unit vector has length 1, with respect to this coordinate system (which measures lengths)? How can it be graphed in this xyz frame?

A "unit vector" is of length 1 unit using whatever are the current units of distance.

Sorry I realized that I probably should have asked this question in sci.physics and later started a thread there. As for your answer, if that was true I would be very happy. Unfortunately the formula for the unit vector takes out the effect of any unit.

$$\text{unit vector} = v / \|v\|$$

Whatever unit vector v has, so will its norm. Thus the unit vector in direction of v has a magnitude of 1, but is dimensionless. Makes sense except when I put down my linear algebra book and pick up my mechanics book. Axes are often length based, and sometimes we normalize a position vector (make it dimensionless) then use it to introduce a vector with different units (say, Force) into the picture/axes. The dimensionless unit vector defies my thinking for cases like this, because I can't wrap my mind around "magnitude 1" for this case.

But someone explained that the unit vector in this case would be a "pure direction" which relieves most of my headache (better than ibuprofen).

Why not merely define a vector, v , as being a unit vector if and only if $\|v\| = 1$, in whatever units one is using?

In "pure" vector considerations, where no units are involved anyway, the two definitions coincide, but in "applied" considerations, it avoids the problem of having "unit vectors" which are not part of the vector space under consideration.

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