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13. Practice with dot product

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Lecture due Aug 18, 2021 20:30 IST Completed

Practice

Find the angle

1/1 point (graded)

Let $\vec{v} = \langle 1, 1 \rangle$ and $\vec{w} = \langle 2, 1 \rangle$. Use the dot product to find $\cos\theta$ where θ is the angle between $\vec{v}$ and $\vec{w}$.

$\cos\theta =$ 3/sqrt(2)/sqrt(5) ✔ **Answer:** 3/sqrt(10)

Solution:

From the dot product formula, we have

$$\vec{v} \cdot \vec{w} = \langle 1, 1 \rangle \cdot \langle 2, 1 \rangle = (1)(2) + (1)(1) = 3. \tag{3.35}$$

We also have

$$\vec{v} \cdot \vec{w} = |\vec{v}||\vec{w}| \cos\theta. \tag{3.36}$$

So we need to compute $|\vec{v}|$ and $|\vec{w}|$ and set the above quantity equal to 3. We have

$$|\vec{v}| = \sqrt{(1)^2 + (1)^2} = \sqrt{2} \tag{3.37}$$

$$|\vec{w}| = \sqrt{(2)^2 + (1)^2} = \sqrt{5}. \tag{3.38}$$

Putting it all together, we have

$$3 = \sqrt{2}\sqrt{5}\cos\theta = \sqrt{10}\cos\theta. \tag{3.39}$$

Solving for $\cos\theta$ gives

$$\cos\theta = \frac{3}{\sqrt{10}}. \tag{3.40}$$

Submit You have used 1 of 5 attempts

Answers are displayed within the problem

We'll help with this next part

In this problem, we will continue using $\vec{v} = \langle 1, 1 \rangle$ and $\vec{w} = \langle 2, 1 \rangle$. We have drawn the vectors in the xy-plane below.

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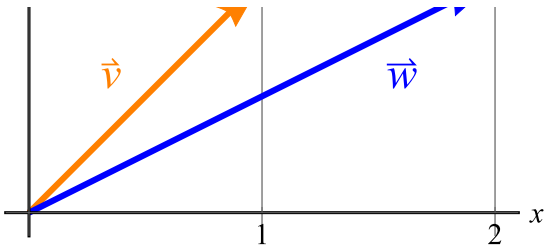
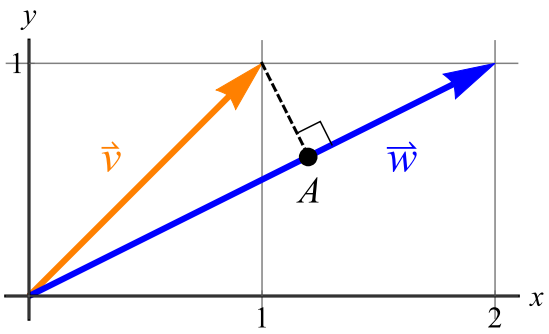
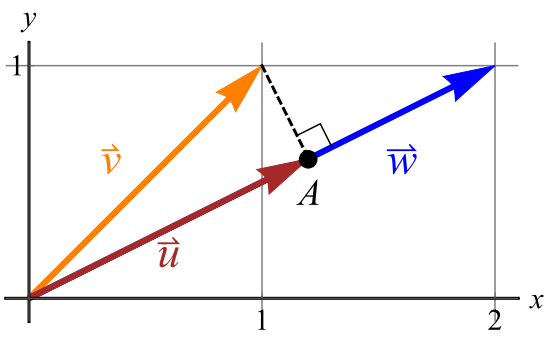


We then draw a line from the tip of $\vec{v}$ to $\vec{w}$ such that the line forms a right angle with $\vec{w}$ as shown below where we denote the point where the line intersects $\vec{w}$ by A.



We define the vector $\vec{u}$ to be the vector that starts at the origin and extends to the point A.



Your turn, find the magnitude

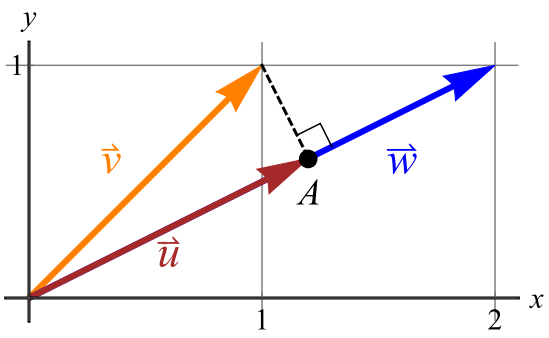
1/1 point (graded)

Using the information given and your answer to the previous problem, find the magnitude of $\vec{u}$.

$|\vec{u}| =$ 3/sqrt(5) ✔ **Answer:** 3/sqrt(5)

Solution:

Notice that $\vec{v}$, $\vec{u}$, and the dotted line form a right triangle.



This means that the length of $\vec{u}$ is equal to the length of $\vec{v}$ multiplied by $\cos\theta$. In other words,

$$|\vec{u}| = |\vec{v}|\cos\theta. \tag{3.41}$$

From the previous problem, we know that

$$|\vec{v}| = |\langle 1, 1\rangle| = \sqrt{2} \tag{3.42}$$

and

$$\cos\theta = \frac{3}{}$$

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$$\sqrt{10}. \tag{3.43}$$

So we have

$$|\vec{u}| = |\vec{v}| \cos\theta = \sqrt{2}\left(\frac{3}{\sqrt{10}}\right) = \frac{3}{\sqrt{5}}. \tag{3.44}$$

Submit You have used 1 of 5 attempts

Answers are displayed within the problem

Find the vector

1.0/1 point (graded)

Using the information from the previous problems, find the vector $\vec{u}$.

(Enter your answer as a vector with two components inside square brackets, e.g., [1,1].)

$\vec{u} =$ [6/5,3/5] ✔ **Answer:** [6/5,3/5]

Solution:

We know that $\vec{u}$ is in the same direction as $\vec{w}$. So we have

$$\vec{u} = c\vec{w} = c\langle 2, 1\rangle \tag{3.45}$$

for some constant c. To find c, we take the magnitude of $\vec{u}$ and set it equal to our answer from the previous problem. So we have

$$\frac{3}{\sqrt{5}} = |\vec{u}| = c|\langle 2, 1\rangle| = c\sqrt{5}. \tag{3.46}$$

Solving for c gives

$$c = \frac{3}{5}. \tag{3.47}$$

Our answer is then

$$\vec{u} = \frac{3}{5}\langle 2, 1\rangle = \langle \frac{6}{5}, \frac{3}{5}\rangle. \tag{3.48}$$

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

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Minor typo In the second problem, should "We then draw a line from the tail of v to w" be "from the tip of v" perhaps? Best wishes.		2
STAFF -- Find the angle (equation 3.38)		2
Finding the magnitude of "u" Hi, could someone give a hint on how we would find the magnitude of u (*Your turn, find the magnitude*)? Thanks		5
Help with why my solution was wrong I let the vector _u_ be [u_1, u_2]. Then using the fact that cos(theta) = u_1/|u| and the pythagorean theorem, I was able to get a value ...	?	2
Find the Vector Wow! I correctly solved the problem using trig identities, rather than vector scaling. This is the second time that I used either algebr...		3
Is the answer to find the vector correct nm	?	10

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