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2. Rotating a vector

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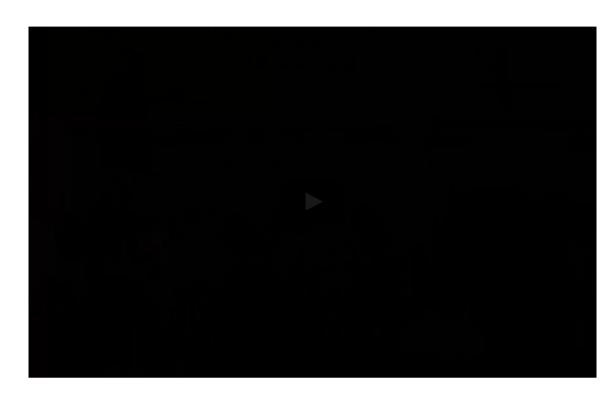
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Lecture due Sep 15, 2021 20:30 IST



Explore

Rotate a Vector



let's think about the case where v is in the y direction.

So v is 0 comma v2.

So I'll draw that one in red.

So there is v. And then we rotate it by an angle theta

and get a new vector.

We'll call that one w.

And I'd like you to find w.

So take a minute and talk with your neighbor,

try to figure out what is w.

And I'll put up some choices.

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Rotating a vector introduction

Recall: a vector is a pair of numbers, which we can visualize by drawing an arrow in the plane. We are going to introduce matrices and linear functions by solving a concrete problem: how does rotating a vector change its coordinates?

Notation: In previous sections, we would typically write a vector as $< v_1, v_2 >$. In this section, we will be using the notation $\begin{pmatrix} v_1 \\ v_2 \end{pmatrix}$ instead, because it is better suited to working with matrices.

Consider a vector $ec{v}=inom{v_1}{v_2}$. Suppose we want to rotate $ec{v}$ counterclockwise by an angle $m{ heta}$ to get a new vector $ec{w}$.

First, consider the case $v_2=0$, so $ec v=inom{v_1}{0}$. Let's find ec w where ec w is the vector created by rotating this ec v counterclockwise by an angle heta.

Since
$$ec{v} = \left(egin{array}{c} v_1 \ 0 \end{array}
ight)$$
 , we know that

 $|\vec{w}|=|\vec{v}|=v_1$.

Then, using the components of the right-triangle, we see that

$$\vec{w} = \begin{pmatrix} |\vec{v}| \cos \theta \\ |\vec{v}| \sin \theta \end{pmatrix} = \begin{pmatrix} v_1 \cos \theta \\ v_1 \sin \theta \end{pmatrix}. \tag{5.2}$$

So

$$|\vec{w} = \begin{pmatrix} v_1 \cos \theta \\ v_1 \sin \theta \end{pmatrix}|. \tag{5.3}$$

Vertical Example

1/1 point (graded)

Vertical Example

Now consider the case when $ec{v}=inom{0}{v_2}$. Find $ec{w}$ where $ec{w}$ is the vector created by rotating $ec{v}$ counterclockwise by an angle $m{ heta}$.

- $igcup_{v_2 \sin heta} igcup_{v_2 \sin heta} igcup_{v_3 \sin heta}$
- $egin{pmatrix} oldsymbol{\circ} & \left(egin{array}{c} -v_2 \sin heta \ v_2 \cos heta \end{array}
 ight) \end{array}$
- $igcup_{v_2 \cos heta} \left(egin{array}{c} v_2 \sin heta \ v_2 \cos heta \end{array}
 ight)$

~

Solution:

The correct answer is $egin{pmatrix} -v_2\sin\theta \ v_2\cos\theta \end{pmatrix}$.

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- **1** Answers are displayed within the problem
- 2. Rotating a vector

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