5. Using The Matrix

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Lecture due Sep 15, 2021 20:30 IST

Explore

Now we can try some examples of changing L and θ by small amounts to see how the robot arm will behave.

Robot Arm Matrix Example 1

0.1 minus 0.1 is 0.

0, 0.1 is 0.1.

OK, let's box that in purple.

So what happened on the controller?

We increased them both by 0.1.

So we made this move on the controller.

What did the robot do?

Delta x is 0 and delta y is 0.1.

So the robot did that.

Moved straight up 0.1 which is what we were looking for.

▶ 1:00 / 1:00 2.0x

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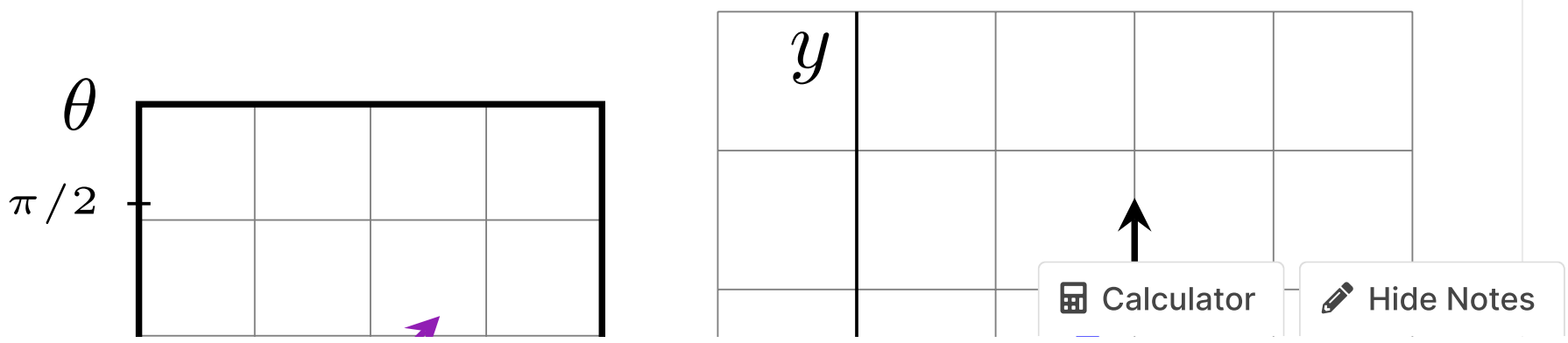
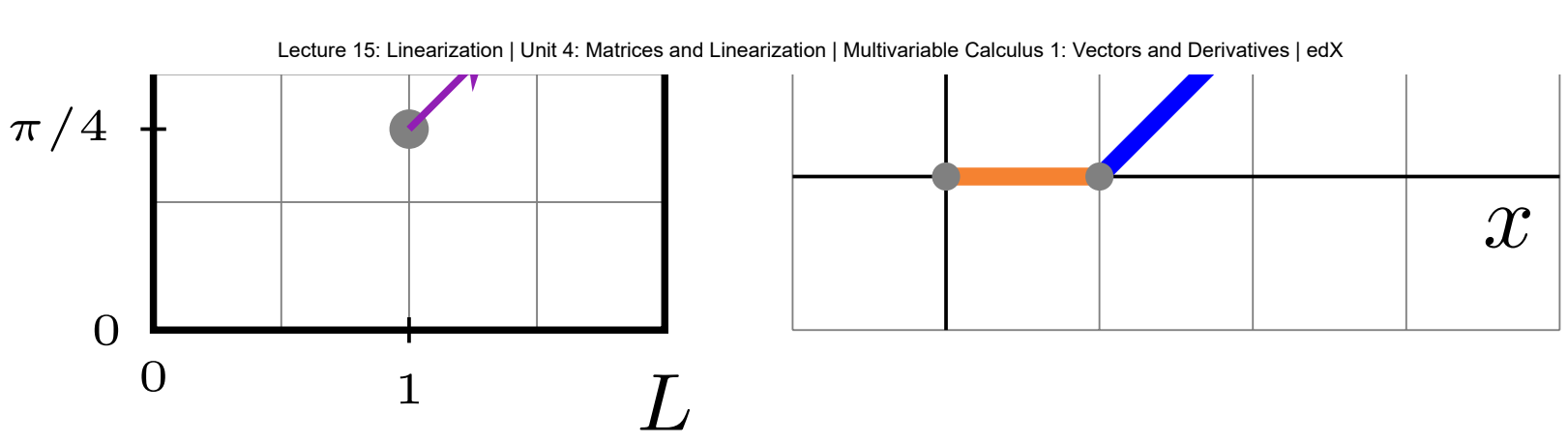
Example 1

The values $\begin{pmatrix} \Delta L \\ \Delta\theta \end{pmatrix} = \begin{pmatrix} 0.1 \\ 0.1 \end{pmatrix}$ result in

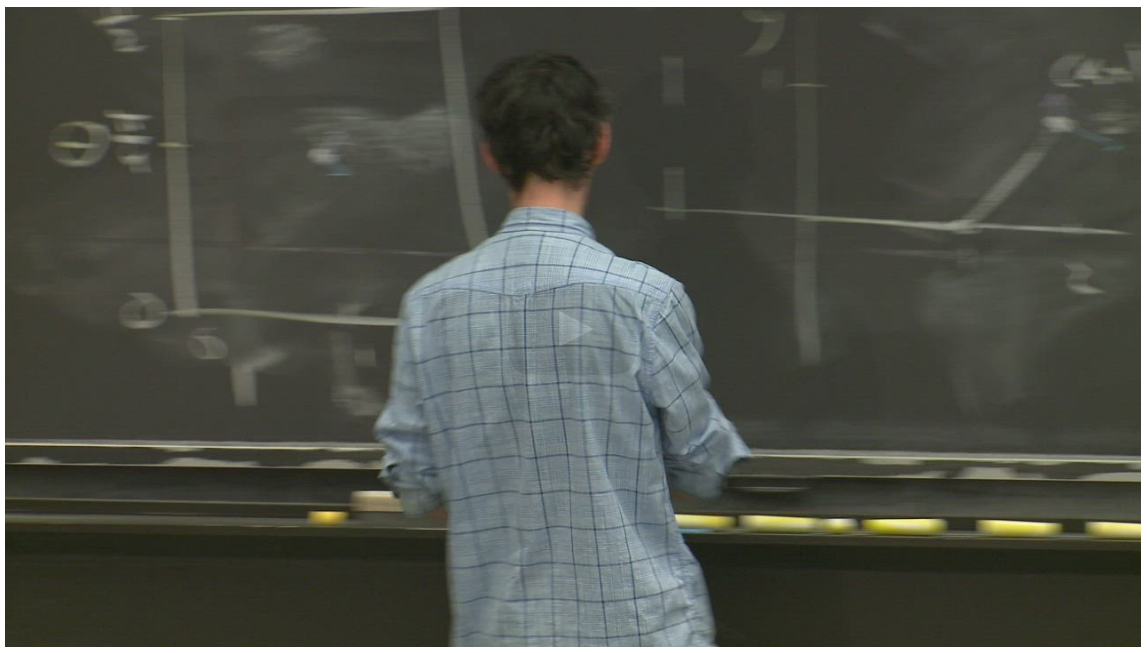
$$\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 0.1 \\ 0.1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0.1 \end{pmatrix}. \tag{5.107}$$

A sketch of the controller and resulting robot motion is shown below.





Robot Arm Matrix Example 2



Start of transcript. Skip to the end.

PROFESSOR: And let's do one more.

And then I'll do the numbers, and you can do the picture.

We take 1 minus 1 zero one.

We pick a vector 0, 0.1.

Let's do 0 minus 0.1.

What happens?

0 plus 0.1, and 0 minus 0.1.

And let's box that in yellow.

So before I do it, I want you on your

0:00 / 0:00 2.0x

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You do the picture

1/1 point (graded)

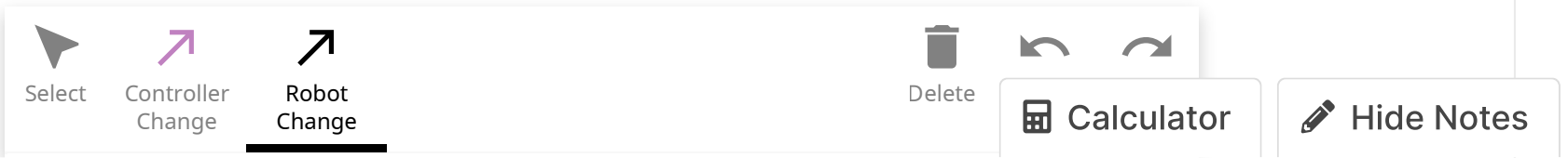
Example 2

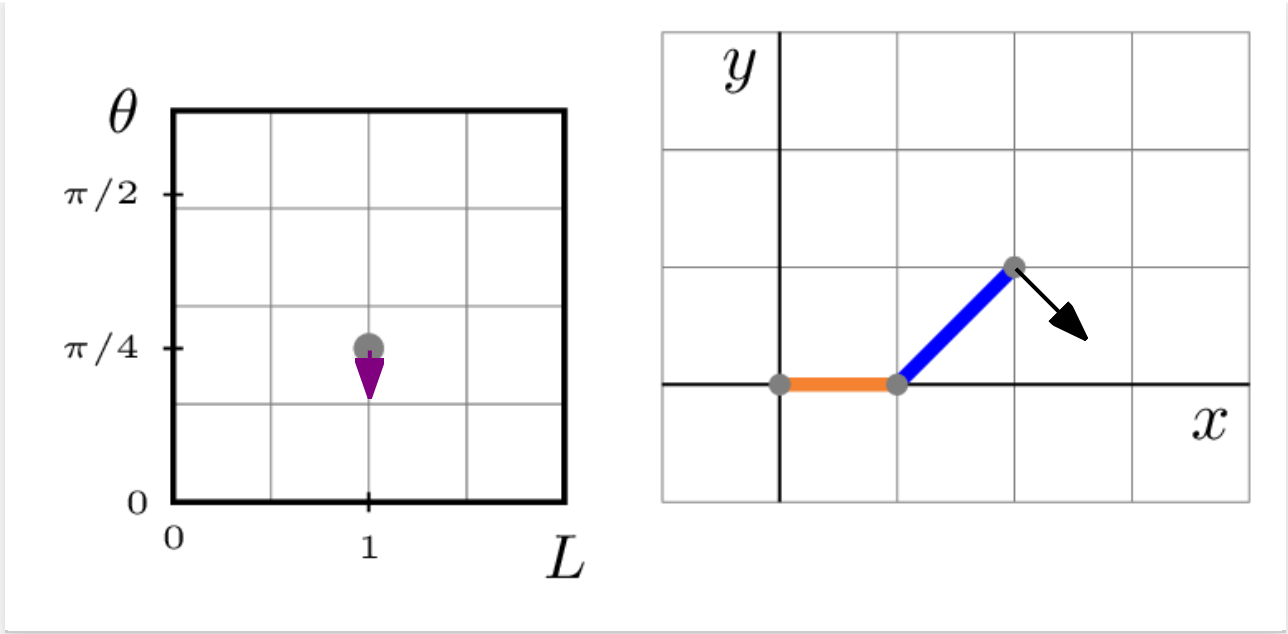
If $\begin{pmatrix} \Delta L \\ \Delta \theta \end{pmatrix} = \begin{pmatrix} 0 \\ -0.1 \end{pmatrix}$ then we have

$$\begin{pmatrix} \Delta x \\ \Delta y \end{pmatrix} = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 0 \\ -0.1 \end{pmatrix} = \begin{pmatrix} 0.1 \\ -0.1 \end{pmatrix}. \tag{5.108}$$

In the applet below, use the arrow tools to sketch how the input and output are changing in this example. Your sketch should have one Controller Change arrow and one Robot Change arrow. The direction of your arrows must be correct, but the magnitude is ignored.

You can rotate an arrow after drawing it by choosing the “Select" tool, and clicking-and-dragging on the arrowhead's tip.





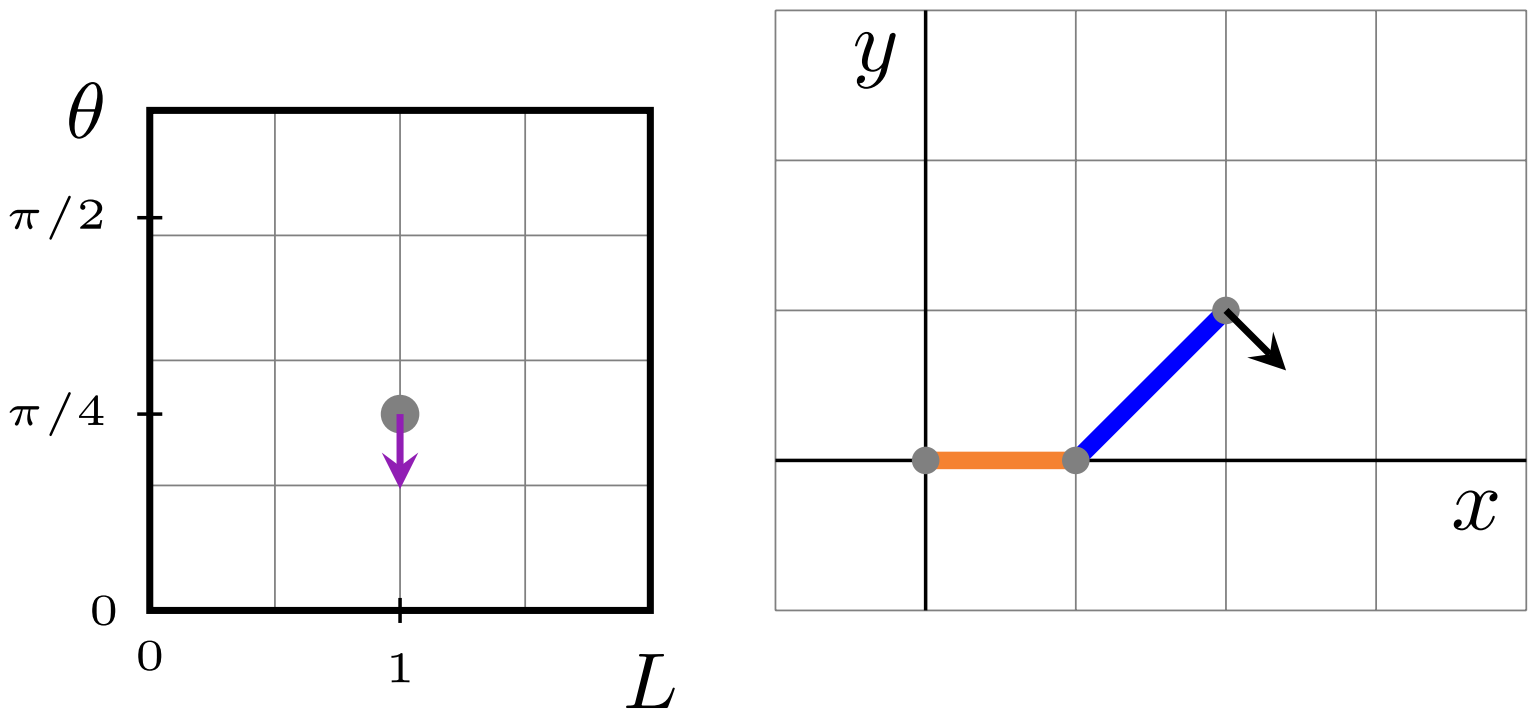
Answer: Checks for starting point and direction of arrows.

✔

Good Job

Solution:

Here is the correct figure:



Submit You have used 1 of 10 attempts

Answers are displayed within the problem

Robot Arm Matrix Example 2 Solution

PROFESSOR: Cool, OK, now I'll do it.

OK, so the delta L delta theta is 0 negative 0.1

So we're

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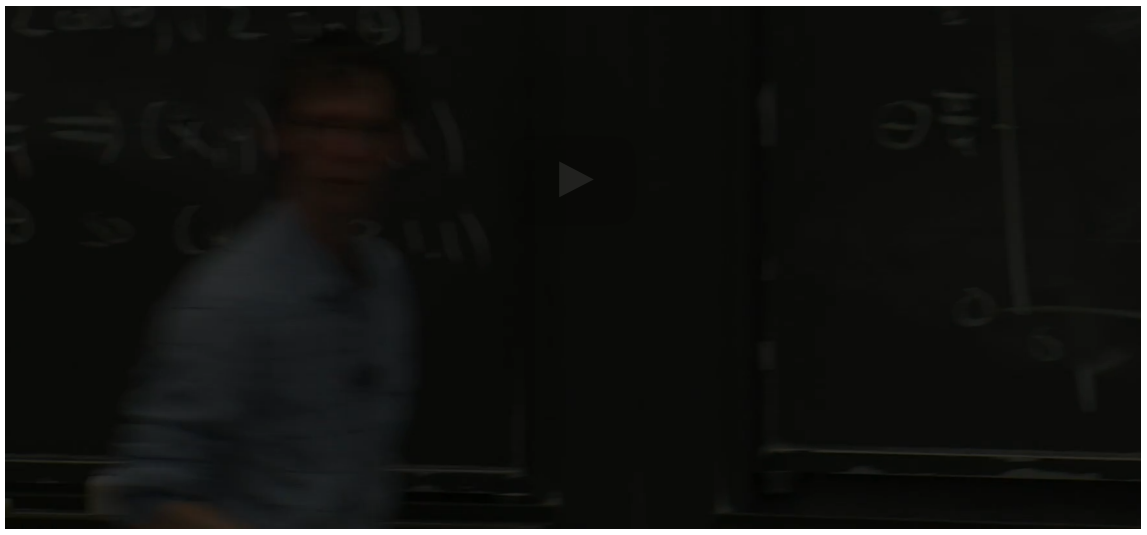

change on the controller.

And then it tells me that what will happen

is that delta x is 0.1 and delta y is minus 0.1.

So that is what will happen to the robot.

0:29 / 0:29 2.0x

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The arrow on the controller should point straight down, since $\begin{pmatrix} \Delta L \\ \Delta \theta \end{pmatrix} = \begin{pmatrix} 0 \\ -0.1 \end{pmatrix}$. The arrow on the robot arm should point south-east, since $\begin{pmatrix} \Delta x \\ \Delta y \end{pmatrix} = \begin{pmatrix} 0.1 \\ -0.1 \end{pmatrix}$.

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