Linear dependency of a set of vectors

1.Question 1

In the lecture videos you saw that vectors are linearly dependent if it is possible to write one vector as a linear combination of the others. For example, the vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are linearly dependent if $\boldsymbol{a} = q_1\boldsymbol{b} + q_2\boldsymbol{c}$ where q_1 and q_2 are scalars.

Are the following vectors linearly dependent?

$\mathbf{a} = \begin{pmatrix}1\\1\end{pmatrix}$ **and** $\mathbf{b} = \begin{pmatrix}2\\2\end{pmatrix}$.

Yes

No

2.Question 2

We say that two vectors are linearly independent if they are *not* linearly dependent, that is, we cannot write one of the vectors as a linear combination of the others. Be careful not to mix the two definitions up!

Are the following vectors linearly independent?

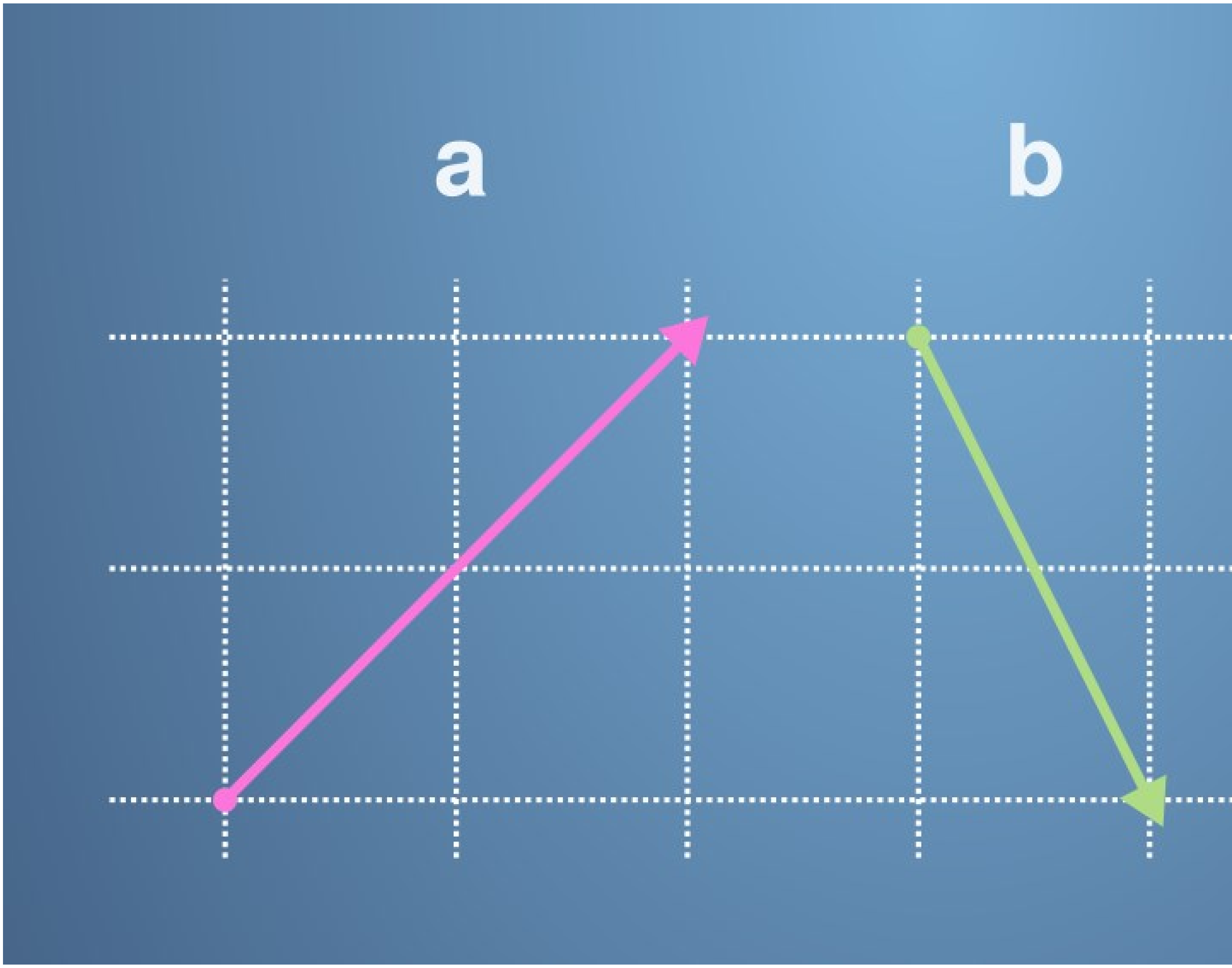
$\mathbf{a} = \begin{pmatrix}1\\1\end{pmatrix}$ **and** $\mathbf{b} = \begin{pmatrix}2\\1\end{pmatrix}$

Yes

No

3.Question 3

We also saw in the lectures that three vectors that lie in the same two dimensional plane must be linearly dependent. This tells us that $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are linearly dependent in the following diagram:



What are the values of q_1 and q_2 that allow us to write $a = q_1 b + q_2 c$? Put your answer in the following codeblock:

4.Question 4

In fact, an n-dimensional space can have as many as nn linearly independent vectors. The following three vectors are three dimensional, which means that we must check if they are linearly dependent or independent.

Are the following vectors linearly independent?

$\mathbf{a}=\begin{pmatrix}1\\0\\0\end{pmatrix}$, $\mathbf{b}=\begin{pmatrix}1\\1\\0\end{pmatrix}$ **and** $\mathbf{c}=\begin{pmatrix}1\\0\\1\end{pmatrix}$

Yes

No

5.Question 5

Are the following vectors linearly independent?

$\mathbf{a}=\begin{pmatrix}1\\0\\1\end{pmatrix}$, $\mathbf{b}=\begin{pmatrix}2\\-1\\1\end{pmatrix}$ **and** $\mathbf{c}=\begin{pmatrix}-3\\1\\-2\end{pmatrix}$.

Yes

No

1 point

6.Question 6

The following set of vectors cannot be used as a basis for a three dimensional space. Why?

$\mathbf{a}=\begin{pmatrix}1\\2\\0\end{pmatrix}$, $\mathbf{b}=\begin{pmatrix}-2\\1\\3\end{pmatrix}$ **and** $\mathbf{c}=\begin{pmatrix}4\\3\\-3\end{pmatrix}$.

The vectors are linearly independent

The vectors are not linearly independent

☐

The vectors do not span three dimensional space

☐

There are too many vectors for a three dimensional basis