Name : Ahmad Bustanul Aziz
Course : Mathematics for Machine Learning: Linear Algebra
Week : 1
Type : Question and Answer

Getting a handle on vectors

Pertanyaan

What is a vector? Select all correct answers.

☑ A list of numbers.

Benar
Vectors are usually viewed by computers as an ordered list of numbers which they can perform "operations" on - some operations are very natural and, as we will see, very useful!

☑ Position in three dimensions of space and in one dimension of time.

Benar
A vector in space-time can be described using 3 dimensions of space and 1 dimension of time according to some co-ordinate system.

☑ Something which moves in a space of fitting parameters.

Benar
As we will see, vectors can be viewed as a list of numbers which describes some optimisation problem.

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Solving some simultaneous equations

Total poin #5

Pertanyaan #1
In this quiz you'll be reminded of how to solve linear simultaneous equations as a way to practice some basic linear algebra. Some of the ideas presented here will be relevant later in the course.

Solving simultaneous equations is the process of finding the values of the variables (here *x* and y) that satisfy the system of equations. Let's start with the simplest type of simultaneous equation, where we already know all but one of the variables:
3x - y = 2
x = 4

Substitute the value of *x* into the first equation to find *y*, then select the correct values of x and *y* below.
a. x = 4, y = 14
b. x = 4, y = 2
c. x = 4, y = -10
d. x = 4, y = 10

Benar
When you know one of the variables, substituting it into one of the equations is a good way to find the other variable.

Pertanyaan #2
The first goal when solving simple simultaneous equations should be to isolate one of the variables. For example, try taking the second equation away from the first to solve the following pair of equations:

3x - 2y = 7
2x - 2y = 2

What value did you find for *x*? Now substitute x*x* into one of the equations to find *y*, and select the correct pair below:
a. x = 7, y = 7
b. x = 1, y = -4
c. x = 5, y = 4
d. x = 3, y = 1

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Benar
Elimination can be a useful method to solve a simple system of linear equations.

Pertanyaan #3
This method is called elimination, and you can use it even when the coefficients, the numbers in front of *x* and y, aren't the same.

For example, to solve the following equations try multiplying both sides of the first equation by 2, then solve using the same method as the last question.

3x - 2y = 4
6x + 3y = 15

Select the correct values of *x* and *y* below:
a. x = 2, y = 1
b. x = 4, y = -2
c. x = 1, y = 2
d. x = 3, y = 1

Benar
We've seen that elimination can be a useful method to solve a simple system of linear equations..

Pertanyaan #4
A very similar technique can be used to find the inverse of a matrix, which you will learn about in week three of this course.

There is also the substitution method, where we rearrange one of the equations to the form x = ay+b or y = cx+d and then substitute *x* or *y* into the other equation. Use any method you'd like to solve the following simultaneous equations:

-2x + 2y = 20
5x + 3y = 6

Select the correct values of x and y below:
a. x = 3, y = 13
b. x = 5, y = 15
c. x = -5, y = 5
d. x = -3, y = 7

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Benar
Substitution and elimination are useful techniques for solving simple systems of linear equations.

Pertanyaan #5
Systems of simultaneous equations can have more than two unknown variables. Below there is a system with three; x, y and z. First try to find one of the variables by elimination or substitution, which will lead to two equations and two unknown variables. Continue the process to find all of the variables.

Which values of x, y and z solve the following equations?

3x - 2y + z = 7
x + y + z = 2
3x - 2y - z = 3

Before you move on you might like to think about how many equations you would need to uniquely determine four, five, or more variables. Are there are any other rules for how the equations have to be related? In week two of this course you will learn about linear independence, which is very closely related to this.

a. x = 1, y = -1, z = 2
b. x = 2, y = -2, z = 2
c. x = 1, y = -1, z = -2
d. x = -1, y = -3, z = 4

Benar
Substitution and elimination can be extended to more than two variables.

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Step By Step Solution

Mathematics for Machine Learning: Linear Algebra Date 17 March 2022

Solving some simultaneous equations

Answer

(1.) $x = 4$

$3x - y = 2$

$3(4) - y = 2$

$-y = 2 - 12$

$y = 10$

So $x = 4$, $y = 10$

(2.) $3x - 2y = 7$

$2x - 2y = 2$ −

$x = 5$

Find y

$3.5 - 2y = 7$

$-2y = 7 - 15$

$-2y = -8$

$y = 4$

So $x = 5$, $y = 4$

(3.) $3x - 2y = 4$ $\times 2$

$6x + 3y = 15$

$6x - 4y = 8$

$6x + 3y = 15$ −

$-7y = -7$

$y = 1$

Find x

$3x - 2.1 = 4$

$3x = 6$

$x = 2$

So $x = 2$, $y = 1$

(4) $-2x + 2y = 20$ $\times 3$

$5x + 3y = 6$ $\times 2$

$-6x + 6y = 60$

$10x + 6y = 12$ −

$-16x = 48$

$x = -3$

Find y

$-2.-3 + 2y = 20$

$6 + 2y = 20$

$2y = 14$

$y = 7$

So $x = -3$, $y = 7$

(5) $3x - 2y + z = 7$

$x + y + z = 2$ −

$2x - 3y = 5$

$x + y + z = 2$

$3x - 2y - z = 3$ +

$4x - y = 5$

$\rightarrow 2x - 3y = 5$ $\times 2$

$\rightarrow 4x - y = 5$

$4x - 6y = 10$

$4x - y = 5$ −

$-5y = 5$

$y = -1$

Find x

$4x - 1 = 5$

$4x = 4$

$x = 1$

Find z

$x + y + z = 2$

$1 - 1 + z = 2$

$z = 2$

So $x = 1$, $y = -1$, $z = 2$

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Operations with vectors

Complete the calculation before the lecturer: for **r** = $\begin{bmatrix}3\\2\end{bmatrix}$ and **s** = $\begin{bmatrix}-1\\2\end{bmatrix}$ what is **r**−**s** in square bracket notation?

a. $\begin{bmatrix}4\\2\end{bmatrix}$

b. $\begin{bmatrix}0\\4\end{bmatrix}$

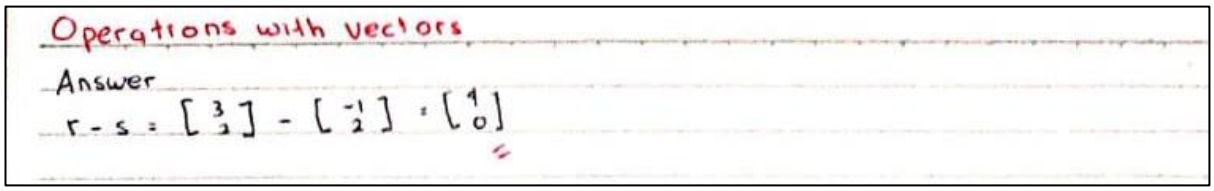
c. $\begin{bmatrix}2\\4\end{bmatrix}$

d. $\begin{bmatrix}4\\0\end{bmatrix}$

Benar

Well done! One could either add the components of **r** and −**s**, or subtract the components of **s** away from the components of **r**.

Step By Step Solution



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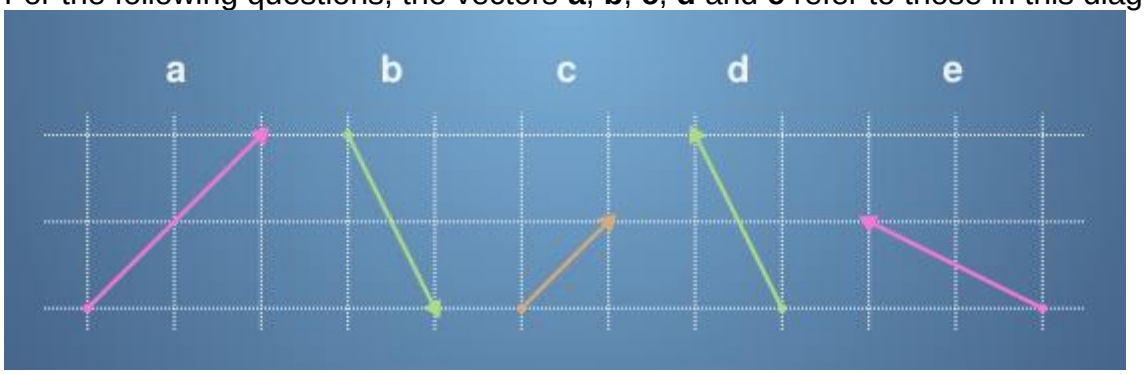
Doing some vector operations

Total poin #7

Pertanyaan #1

This aim of this quiz is to familiarise yourself with vectors and some basic vector operations.

For the following questions, the vectors **a**, **b**, **c**, **d** and **e** refer to those in this diagram:



The sides of each square on the grid are of length 1. What is the numerical representation of the vector **a**?

a. $\begin{bmatrix}2\\2\end{bmatrix}$

b. $\begin{bmatrix}1\\2\end{bmatrix}$

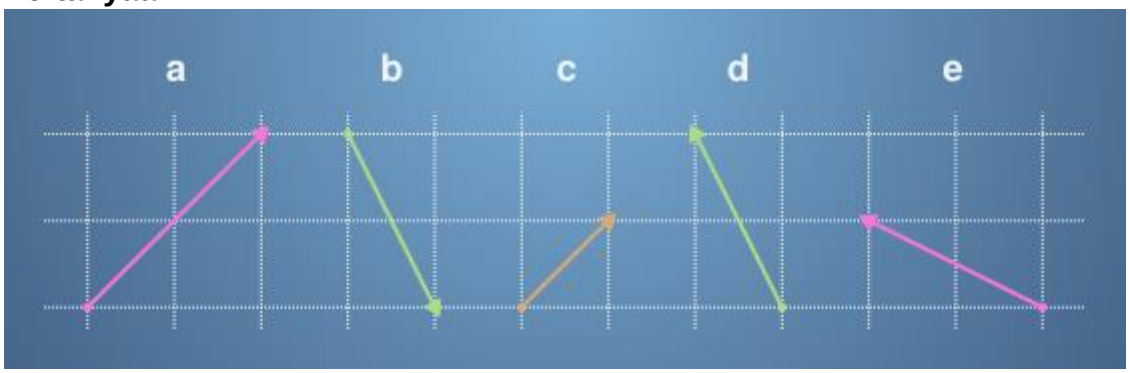
c. $\begin{bmatrix}1\\1\end{bmatrix}$

d. $\begin{bmatrix}2\\1\end{bmatrix}$

Benar

You can get the numerical representation by following the arrow along the grid.

Pertanyaan #2



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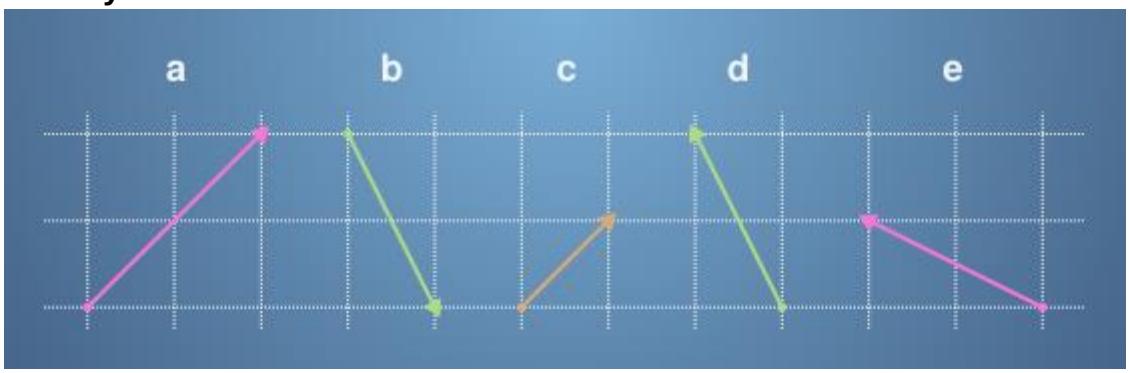
Which vector in the diagram corresponds to $\begin{bmatrix} -1 \\ 2 \end{bmatrix}$?

a. Vector a
b. Vector b
c. Vector c
d. Vector d

Benar
You can get the numerical representation by following the arrow along the grid.

Pertanyaan #3



What vector is 2**c**?

Please select all correct answers.

a. $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$

Benar
A scalar multiple of a vector can be calculated by multiplying each component.

b. **a**

Benar
Multiplying by a positive scalar is like stretching out a vector in the same direction.

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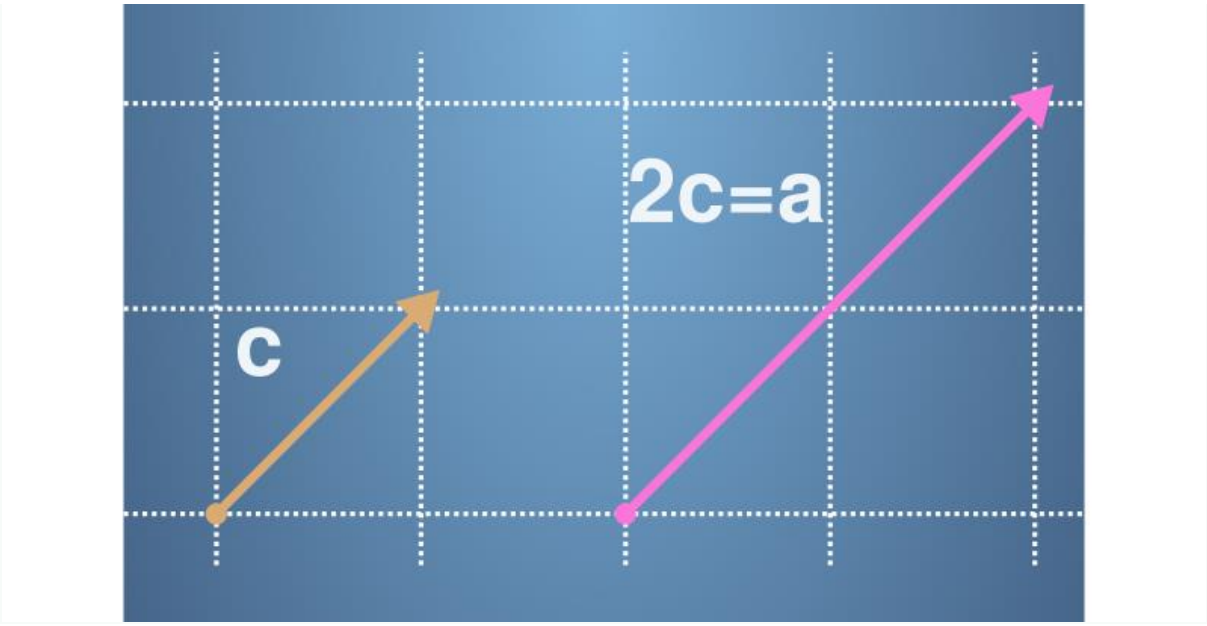
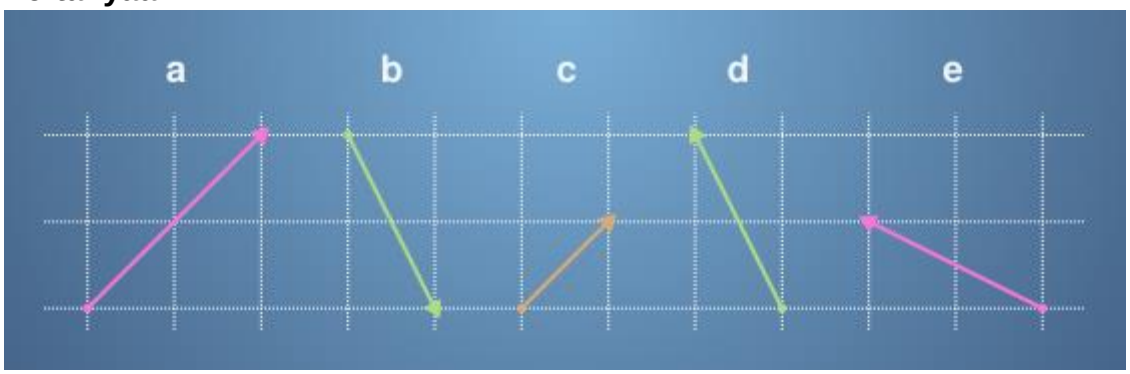


c. e
d. $\begin{bmatrix} -2 \\ 2 \end{bmatrix}$

.

Pertanyaan #4



What vector is −**b**?

Please select all correct answers.

a. $\begin{bmatrix} -2 \\ 2 \end{bmatrix}$
b. **d**

Benar

Multiplying by a negative number points the vector in the opposite direction.

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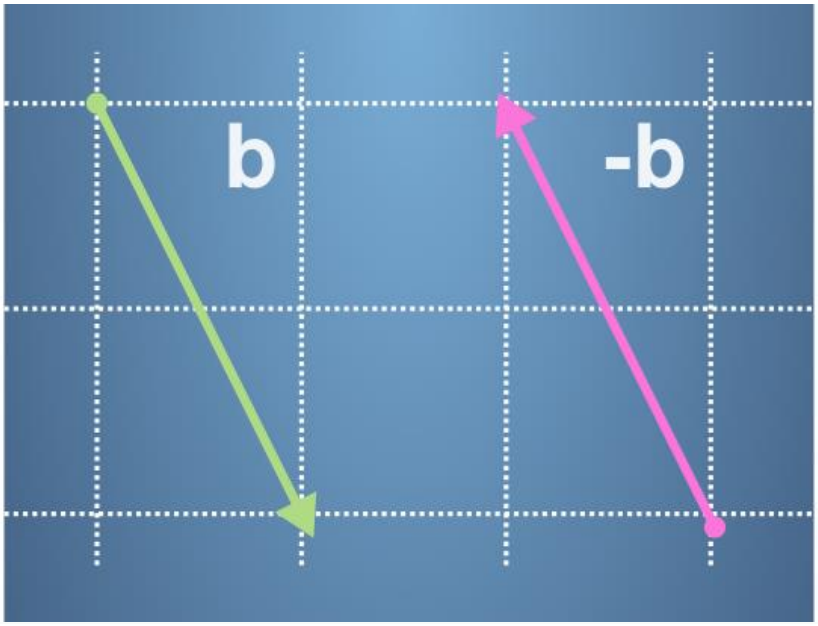
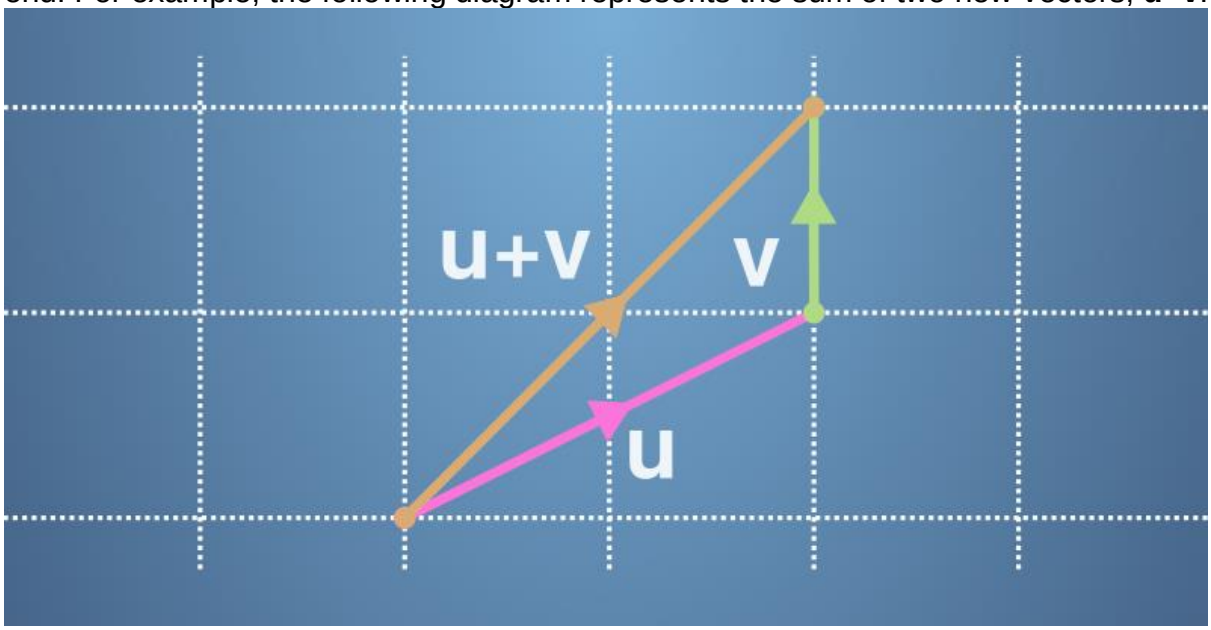


c. **e**
d. $\begin{bmatrix} \mathbf{-1} \\ \mathbf{2} \end{bmatrix}$

Benar
A scalar multiple of a vector can be calculated by multiplying each component.

Pertanyaan #5
In the previous videos you saw that vectors can be added by placing them start-to-end. For example, the following diagram represents the sum of two new vectors, **u**+**v**:



The sides of each square on the grid are still of length 1. Which of the following equations does the diagram represent?

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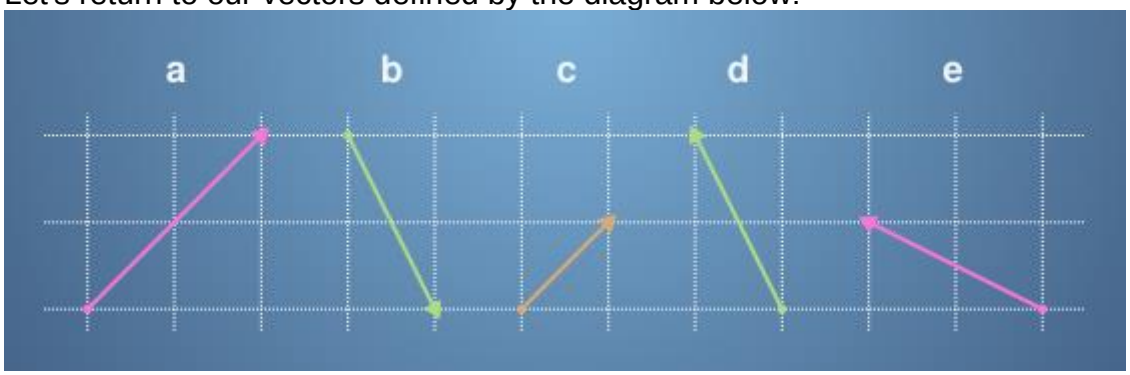
a. $\begin{bmatrix}2\\1\end{bmatrix}+\begin{bmatrix}0\\1\end{bmatrix}=\begin{bmatrix}2\\2\end{bmatrix}$
b. $\begin{bmatrix}1\\1\end{bmatrix}+\begin{bmatrix}1\\0\end{bmatrix}=\begin{bmatrix}2\\1\end{bmatrix}$
c. $\begin{bmatrix}1\\2\end{bmatrix}+\begin{bmatrix}1\\0\end{bmatrix}=\begin{bmatrix}2\\2\end{bmatrix}$
d. $\begin{bmatrix}1\\2\end{bmatrix}+\begin{bmatrix}0\\1\end{bmatrix}=\begin{bmatrix}2\\2\end{bmatrix}$

Benar

We can see that summing the vectors by adding them start-to-end and adding up the individual components gives us the same answer.

Pertanyaan #6

Let's return to our vectors defined by the diagram below:



What is the vector **b**+**e**?

a. $\begin{bmatrix}1\\3\end{bmatrix}$
b. $\begin{bmatrix}2\\-1\end{bmatrix}$
c. $\begin{bmatrix}-1\\-1\end{bmatrix}$
d. $\begin{bmatrix}-1\\2\end{bmatrix}$

Benar

Vectors are added together entry by entry. They can also be thought of as adding start to end, like in the following diagram:

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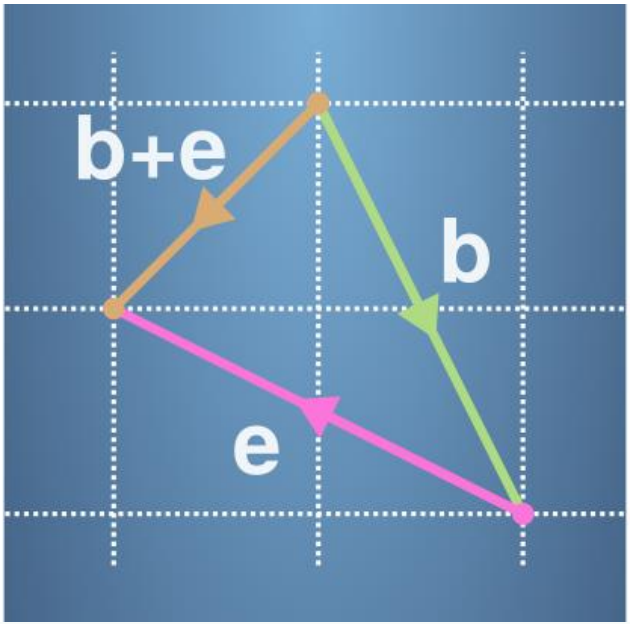
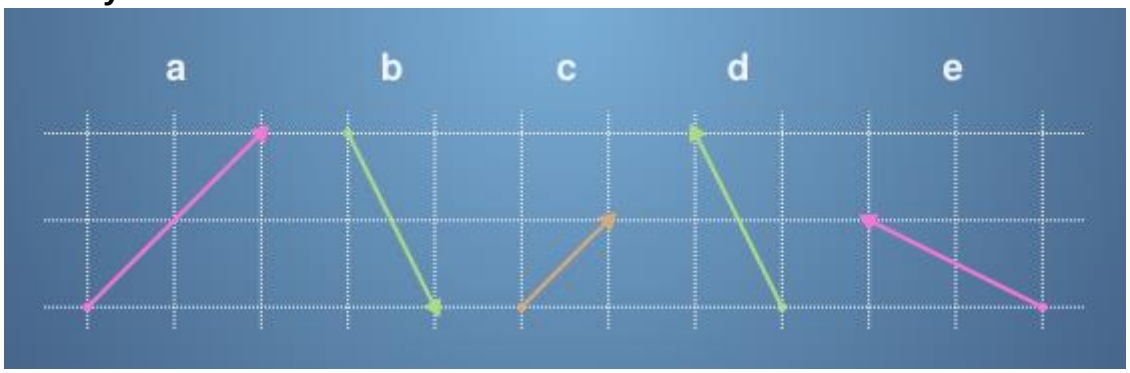


Pertanyaan #7



What is the vector **d**−**b**?

a. $\begin{bmatrix} 4 \\ -2 \end{bmatrix}$
b. $\begin{bmatrix} 2 \\ -4 \end{bmatrix}$
c. $\begin{bmatrix} -2 \\ 4 \end{bmatrix}$
d. $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$

Benar

Remember that vectors add by attaching the end of one to the start of the other, and that multiplying by a negative number points the vector in the opposite direction.

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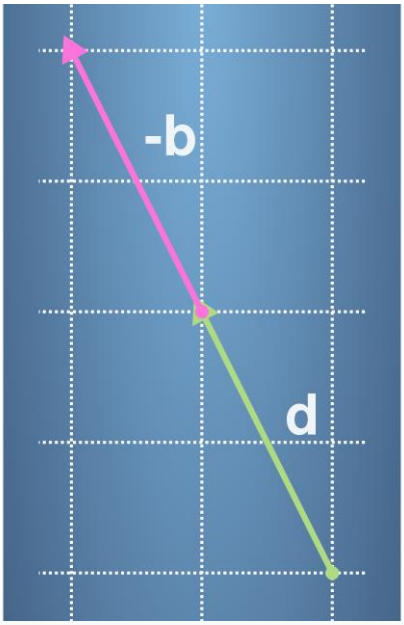

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Step By Step Solution