

# Vectors and Matrices

**Spoken Tutorial Project**

**<http://spoken-tutorial.org>**

**National Mission on Education through ICT**

**<http://sakshat.ac.in>**

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# Learning Objectives



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- How to draw a vector



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- How to draw a vector
- Arithmetic operations on vectors



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- How to draw a vector
- Arithmetic operations on vectors
- How to create a matrix



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- **Transpose of a matrix**



# Learning Objectives

- How to draw a vector
- Arithmetic operations on vectors
- How to create a matrix
- Arithmetic operations on matrices
- Transpose of a matrix
- Determinant of a matrix





# Learning Objectives

- How to draw a vector
- Arithmetic operations on vectors
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- Transpose of a matrix
- Determinant of a matrix
- Inverse of a matrix



# System Requirement



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- **Ubuntu Linux OS v 14.04**



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- **Ubuntu Linux OS v 14.04**
- **Geogebra v 5.0.388.0-d**



# Pre-requisites



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- **Geogebra** interface



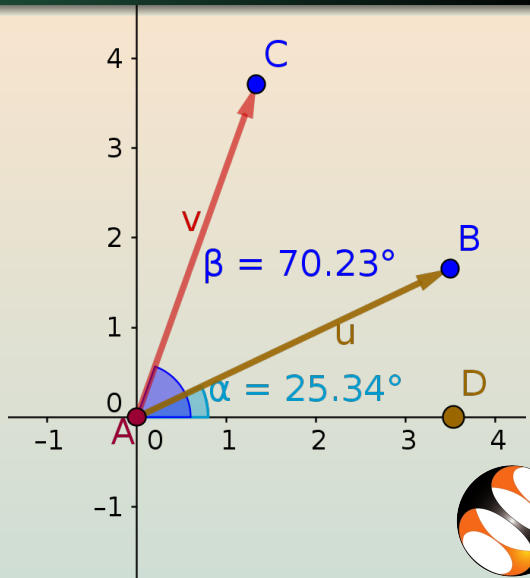
# Pre-requisites

- **Geogebra** interface
- For relevant Geogebra tutorials, visit our website  
[www.spoken-tutorial.org](http://www.spoken-tutorial.org)



# Vector

A **vector** is a quantity that has both magnitude and direction

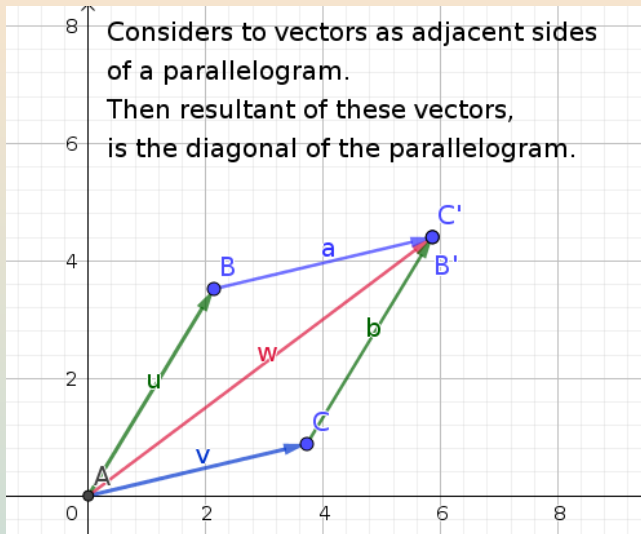




# Parallelogram Law of Vector Addition



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# Assignment



# Assignment

- 1 Subtract the vectors  $u$  and  $v$



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- 1 Subtract the vectors  $u$  and  $v$
- 2 Divide a vector by a scalar (ex:  $u/3$ )



# Matrix



# Matrix

- A **matrix** is an ordered set of numbers



# Matrix

- A **matrix** is an ordered set of numbers
- It is listed in a rectangular form as **m** rows and **n** columns

$$X = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1m} \\ a_{21} & a_{22} & \dots & a_{2m} \\ - & - & \dots & - \\ - & - & \dots & - \\ a_{n1} & a_{n2} & \dots & a_{nm} \end{bmatrix}$$





# Identity Matrix



# Identity Matrix

- A unit matrix is  $I=[1]$ ,  $m=n=1$



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- An identity matrix is a square matrix



# Identity Matrix

- A unit matrix is  $I=[1]$ ,  $m=n=1$
- An identity matrix is a square matrix
- It has all the diagonal elements as 1 and rest of the elements as 0



# Identity Matrix



# Identity Matrix

$\mathbf{X} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$  is a  $2 \times 2$  identity matrix



# Identity Matrix

$\mathbf{X} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$  is a  $2 \times 2$  identity matrix

$\mathbf{Y} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  is a  $3 \times 3$  identity matrix



# Create Matrices





# Create Matrices

**In GeoGebra we can create a matrix using,**



# Create Matrices

In GeoGebra we can create a matrix using,

- Spreadsheet view



# Create Matrices

In GeoGebra we can create a matrix using,

- Spreadsheet view
- CAS view



# Create Matrices

In GeoGebra we can create a matrix using,

- Spreadsheet view
- CAS view
- Input bar



# Matrix Multiplication



# Matrix Multiplication

- Two matrices **X** and **Y** can be multiplied if,



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- number of columns of  $X$  is equal to the number of rows of  $Y$



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- Two matrices **X** and **Y** can be multiplied if,
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- **X** is  $m \times n$  matrix, **Y** is  $n \times p$  matrix





# Matrix Multiplication

- Two matrices **X** and **Y** can be multiplied if,
- number of columns of **X** is equal to the number of rows of **Y**
- **X** is  $m \times n$  matrix, **Y** is  $n \times p$  matrix
- **X**  $\times$  **Y** is a matrix of order  $m \times p$



# Assignment



# Assignment

## 1 Subtract matrices



# Assignment

- 1 Subtract matrices
- 2 Multiply matrices of same order and different order



# Inverse of a Matrix



# Inverse of a Matrix

- A square matrix **P** has an inverse,



# Inverse of a Matrix

- A square matrix **P** has an inverse,
- only if the determinant of **P** is not equal to zero ( $|P| \neq 0$ )



# Assignment





# Assignment

- 1 Find the determinant and inverse of Matrices B and C



# Summary



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# About the Spoken Tutorial Project

- Watch the video available at [http://spoken-tutorial.org/What\\_is\\_a\\_Spoken\\_Tutorial](http://spoken-tutorial.org/What_is_a_Spoken_Tutorial)
- It summarises the Spoken Tutorial project
- If you do not have good bandwidth, you can download and watch it



# Spoken Tutorial Workshops

## The Spoken Tutorial Project Team

- Conducts workshops using spoken tutorials
- Gives certificates to those who pass an online test
- For more details, please write to [contact@spoken-tutorial.org](mailto:contact@spoken-tutorial.org)



# Forum for specific questions

- Do you have questions in THIS Spoken Tutorial?
- Please visit <http://forums.spoken-tutorial.org>
- Choose the minute and second where you have the question
- Explain your question briefly
- Someone from our team will answer them



# Forum for specific questions

- The Spoken Tutorial forum is for specific questions on this tutorial
- Please do not post unrelated and general questions on them
- This will help reduce the clutter
- With less clutter, we can use these discussion as instructional material



# Acknowledgements

- Spoken Tutorial Project is a part of the Talk to a Teacher project
- It is supported by the National Mission on Education through ICT, MHRD, Government of India
- More information on this Mission is available at

<http://spoken-tutorial.org /NMEICT-Intro>

