# StudyBuddy

Your most reliable study companion available 24/7

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# Dashboard

## Stefan Stefancik

@stef485

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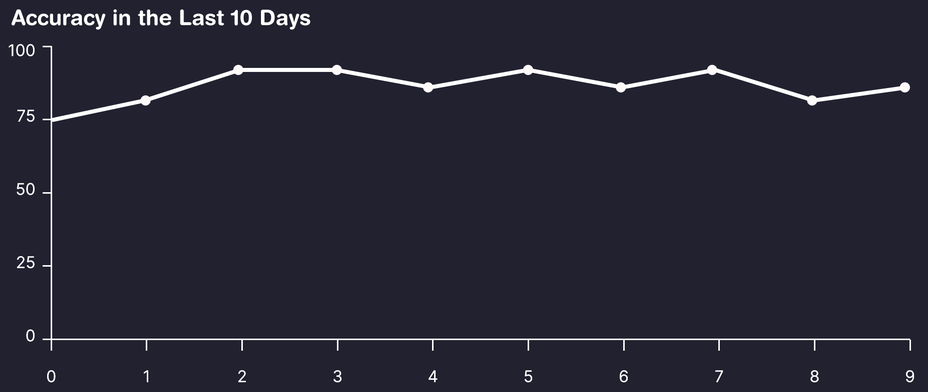
### Interests:

- Physics
- Linear Algebra
- Data Structures and Algorithms
- Calculus
- Theory of Computation


Accuracy

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## History

### Today

- OOP in Python
- NFA vs DFA in Theory of Computation
- Generate a quiz on Thermodynamics

### Last 7 Days

- Generate a note on Thermodynamics
- malloc and free in C
- How to go to a previous commit in git?
- Different types of join in RDBMS

### Last 30 Days

- Collections in Java
- Generate a quiz on Eigen Vectors
- Generate a short note from given content

## Buddy

New Chat

Hey Buddy! How can I help you today?

### Suggestions

**Analyze Content**

**Generate Content**

**Generate Quiz**

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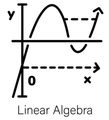
## Buddy

New Chat

Hey Buddy! How can I help you today?

Generate a short note on Eigen Vectors. The note should be brief, and contain an overview of the topic that I can peruse before attending a class on the topic to understand it better.

Sure thing! Here you go.



Linear Algebra

**A Short Note on Eigen Vectors**

Click to View

Message Buddy

MA322
*Sathaye*

# Notes on Eigenvalues

101025

## 1 Introduction

In these notes, we start with the definition of eigenvectors in abstract vector spaces and follow with the more common definition of eigenvectors of a square matrix.

Then we discuss the diagonalization problem for a linear transformation.

Finally, we discuss all cases eigenvectors of $2 \times 2$ matrices.

## 2 Eigenvectors and Eigenvalues in abstract spaces.

Let $V$ be a vector space over a field $K$. Let $L$ be a linear transformation from $V$ to itself.

A scalar $\lambda \in K$ is said to be an **eigenvalue** for $L$ if there is a **non zero vector** $v$ such that $L(v) = \lambda v$.

A vector $v \in V$ is said to be an **eigenvector for L** if it satisfies two conditions:

1. $v \neq 0$.
2. $L(v) = \lambda v$ for some $\lambda \in K$.
3. When the above conditions are satisfied, we get that $\lambda$ is an eigenvalue for $L$ and we will describe this by saying $v$ belongs to the eigenvalue $\lambda$.

1. **Examples.**

   (a) Let $A = \begin{pmatrix} 5 & 2 & 1 \\ 0 & 3 & -1 \\ 0 & 0 & 1 \end{pmatrix}$. Define a transformation $L$ from $\mathbb{R}^3$ to $\mathbb{R}^3$ by $L(v) = Av$. Note that

$$\begin{pmatrix} 5 & 2 & 1 \\ 0 & 3 & -1 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 5 \\ 0 \\ 0 \end{pmatrix} = 5 \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}.$$

   This shows that the vector $v = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ is an eigenvector of $L$ belonging to the eigenvalue 5.

   It is also clear that any non zero multiple of $v$ also has the same property.

   It is possible to show that $\lambda = 3$ and $\lambda = 1$ are also eigenvalues for $L$. What are eigenvectors belonging to them?

   (b) Consider a linear transformation $T : P_3 \to P_3$ defined by $T(p(x)) = xp'(x) - 3p'(x)$.

   Verify that the polynomials $1, (x-3), (x-3)^2, (x-3)^3$ are all eigenvectors belonging to different eigenvalues.

   For example

$$T((x-3)^2) = x(2(x-3)) - 3(2(x-3)) = 2(x-3)(x-3) = 2(x-3)^2.$$

   Thus, $(x-3)^2$ is an eigenvector belonging to eigenvalue 2.





Themes

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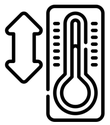
## Buddy

New Chat

Hey Buddy! How can I help you today?

Hey! I want to assess my knowledge on Thermodynamics. Could you please generate a quiz of medium difficulty for me. The duration should be about 25 minutes and there should be 30 questions.

Great initiative! Here is the quiz.



**Quiz on Thermodynamics**

Difficulty: Medium
Duration: 25 mins
Questions: 30

Click to Attempt

Message Buddy

14:39 | Quiz on Thermodynamics | 12/25 | Submit

15. If a system absorbs 800 J energy from the environment and that increases its internal energy by 500 J, then what is the work done by the system on then environment?

(A) 200 J

(B) 400 J

(C) 1500 J

(D) 300 J

16. Change in internal energy is-

- [x] measurable
- [x] 0 in constant temperature
- [ ] 0 in constant pressure
- [ ] independent of temperature

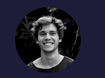
17. What thermodynamic process runs inside a tire of a car when it is running?

(A) Isothermal Process

(B) Adiabatic Process

(C) Isochoric Process

(D) Isobaric Process



# Submission Successful

Questions Answered: 20

Questions Skipped: 05

Time Remaining: 05:24

Get Scores

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Quiz on Thermodynamics

Score 18/25

15. If a system absorbs 800 J energy from the environment and that increases its internal energy by 500 J, then what is the work done by the system on then environment?

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Explanation

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Explanation

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Explanation

Back

Quiz on Thermodynamics

Score 18/25

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Explanation

17. What thermodynamic process runs inside a tire of a car when it is running?

- (A) Isothermal Process
- (B) Adiabatic Process
- (C) Isochoric Process
- (D) Isobaric Process

When a car runs, the volume of the tire does not change, although the temperature and pressure changes. Moreover, heat exchange with the environment also occurs. Hence, the process must be Isochoric.

Close

## Resources ⊕

### Points and Distances

Subject: Mathematics
Area: Coordinate Geometry
Class: 11-12
Tags: High School Geometry, Coordinate Geometry, Points and Distances

View

### Straight Line

Subject: Mathematics
Area: Coordinate Geometry
Class: 11-12
Tags: High School Geometry, Coordinate Geometry, Straight Line

View

### Conics

Subject: Mathematics
Area: Coordinate Geometry
Class: 11-12
Tags: High School Geometry, Coordinate Geometry, Conics

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## Resources ⊕

### Points and Distances

Subject: Mathematics
Area: Coordinate Geometry
Class: 11-12
Tags: High School Geometry, Coordinate Geometry, Points and Distances

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### Add Resource

Name: Conics

Subject: Mathematics

Area: Coordinate Geometry

Class: 11 - 12

Tags: High School Geometry, Coordinate Geometry, Conics

Description

Circle.pdf
246 KB

Upload


## Resources ⊕

### Points and Distances

Subject: Mathematics
Area: Coordinate Geometry
Class: 11-12
Tags: High School Geometry, Coordinate Geometry, Points and Distances

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Description

## Processing Resource

Uploading-> 

Chunking-> 

Embedding-> 

Generating Questions-> 

View

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Circle

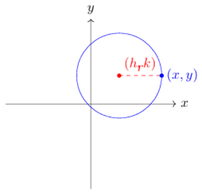
1/3

# Coordinate Geometry of Circles

## 1. Definition and Standard Form

A circle is the locus of all points in a plane that are equidistant from a fixed point called the center. In coordinate geometry, if $(h, k)$ is the center and $r$ is the radius, then any point $(x, y)$ on the circle satisfies:

$$(x - h)^2 + (y - k)^2 = r^2$$




## 2. General Form

The general equation of a circle is:

$$x^2 + y^2 + 2gx + 2fy + c = 0$$

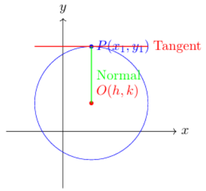
where:

- Center: $(-g, -f)$
- Radius: $r = \sqrt{g^2 + f^2 - c}$

## 3. Key Properties

### 3.1. Tangent and Normal

For a circle with center $(h, k)$ and point of tangency $(x_1, y_1)$:




**Tangent equation:**

$$(x - h)(x_1 - h) + (y - k)(y_1 - k) = r^2$$

**Normal equation:**

$$\frac{x - x_1}{x_1 - h} = \frac{y - y_1}{y_1 - k}$$

### 3.2. Length of Tangent

The length of tangent from an external point $(x_1, y_1)$ to a circle $(x - h)^2 + (y - k)^2 = r^2$ is:

$$T = \sqrt{(x_1 - h)^2 + (y_1 - k)^2 - r^2}$$


100%

# Questions

**1. A circle has a radius of 7 cm. What is the length of the diameter of the circle?**

Ⓐ 7 cm
Ⓑ 14 cm
Ⓒ 21 cm
Ⓓ 28 cm

Approve

Reject

**Explanation:**
The diameter of a circle is twice the radius. So, diameter = 2 * radius = 2 * 7 = 14 cm

**2. In a circle with center O, angle AOB is 80 degrees, where A and B are points on the circumference. What is the measure of the inscribed angle ACB, where C is another point on the circumference?**

Ⓐ 20 degrees
Ⓑ 40 degrees
Ⓒ 60 degrees
Ⓓ 80 degrees

Approve

Reject

**Explanation:**
The measure of an inscribed angle is half the measure of the central angle that subtends the same arc. Therefore, angle ACB is half of angle AOB, which equals 40 degrees.