



**MANIPAL**  
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## **Your Title of the Thesis**

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A thesis submitted to

**Your Institute Name**

in partial fulfillment of the requirement for the degree of

**Doctor of Philosophy**

*by*

**Your Name**

Reg. No: 162400001

*under the guidance of*

**Dr. Guide Name**

Professor of Mathematics

Department of Mathamtics

**Your Institute Name**

Tamil Nadu, India

March 2019

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## Declaration

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I, M. Your Name (Reg.No:162400001), declare that the thesis entitled '*Your Title of the Thesis*' which is being submitted to Your Institute Name for the award of degree of *Doctor of Philosophy in Mathematics* is a bonafide record of research work carried out by me, under the guidance of Your Guide's Name, Professor of Mathematics in the Department of Mathematics, Your institute's name, Tamil Nadu, India. No part of this work is submitted either to MAHE, Manipal or to any other University for the award of a degree or a diploma.

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## Certificate

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This is to certify that the thesis titled '*Your Title of the Thesis*' submitted by Mr. M. Your Name (Reg. No : \_\_\_\_\_) to Institute name for the award of degree of *Doctor of Philosophy in Mathematics*, is a bonafide record of research work carried out by him, independently under my supervision. No part of this work is submitted either to Your Institute Name or to any other University for the award of any other degree or a diploma.

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Place : Place Name

Date : \_\_\_\_\_

**Guide Name**

Professor of Mathematics  
Department of Mathematics  
Your Institute Name  
Tamil Nadu, India

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# Abstract

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**Keywords:** generalized inverse; g-inverse; outer inverse; regular element; minus partial order; absorption law; semigroup; associative ring; core-EP inverse; core-EP generalized inverse; bordering technique; iterative method;

**AMS subject classifications:** 2010 MSC: 15A09; 18B40; 06A06; 05C25; 20M99; 20M17

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# Acknowledgements

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The acknowledgments and the people to thank go here, don't forget to include your project advisor. . .

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# List of Abbreviations

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**LAH** List Abbreviations **Here**

**WSF** What (it) Stands **For**

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# Physical Constants

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# List of Symbols

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$S$	Semigroup with or without involution
$a^-$	Generalized inverse of $a$
$\{a^-\}$	Set of all generalized inverses of $a$
$a^=$	Outer inverse of $a$
$\{a^=\}$	Set of all outer inverses of $a$
$a_r^-$	Reflexive generalized inverse of $a$
$a^\dagger$	Drazin inverse of $a$

*Dedicated to my Mother*

***Ms. Elizebeth Rani***

# Chapter 1

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## Introduction

---

Here you start your introduction...

You can cite the articles using `\cite{AR87}`.. For example, `[1]` gives the article number, `\citeauthor{AR87}` gives the article author (Eg. Anstreicher and Rothblum), `\citeyear{AR87}` gives the year of the article (Eg 1987).

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### 1.1 Publications

1. X. Sheng and G. Chen, “A note of computation for M-P inverse of a,” *International Journal of Computer Mathematics*, vol. 87, no. 10, pp. 2235–2241, 2010
2. K. M. Anstreicher and U. G. Rothblum, “Using gauss-jordan elimination to compute the index, generalized nullspaces, and drazin inverse,” *Linear Algebra and its Applications*, vol. 85, pp. 221 –239, 1987, ISSN: 0024-3795

## 1.2 Conference Presentations

1. K. M. Prasad and M. D. Raj, “Computational methods to find core-EP inverse,” in *International Conference on Linear Algebra and Its Applications*, Organised by Department of Statistics, MAHE, Manipal, Dec. 2017
2. K. M. Prasad and M. D. Raj, “Iterative method to find core-EP inverse,” in *Manipal Student Research Colloquium 2017*, Organized by Manipal University, Jaipur, India., Mar. 2017



## Chapter 2

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# Title of Chapter 2

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The contents of this chapter are drawn from the following article.

1. K. M. Anstreicher and U. G. Rothblum, “Using gauss-jordan elimination to compute the index, generalized nullspaces, and drazin inverse,” *Linear Algebra and its Applications*, vol. 85, pp. 221 –239, 1987, ISSN: 0024-3795

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## 2.1 This is your section 1 of Chapter 2

Use longtable environment for big tables..

For example,

Table 2.1: Feasible triples for highly variable Grid, MLMMH.

Time (s)	Triple chosen	Other feasible triples
0	(1, 11, 13725)	(1, 12, 10980), (1, 13, 8235), (2, 2, 0), (3, 1, 0)
2745	(1, 12, 10980)	(1, 13, 8235), (2, 2, 0), (2, 3, 0), (3, 1, 0)
5490	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
8235	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
10980	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
13725	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
16470	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
19215	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
21960	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
24705	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
27450	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
30195	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
32940	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
35685	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
38430	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
41175	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
43920	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
46665	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
49410	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
52155	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
54900	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
57645	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
60390	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
63135	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
Continued on next page		

**Table 2.1 – continued from previous page**

<b>Time (s)</b>	<b>Triple chosen</b>	<b>Other feasible triples</b>
65880	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
68625	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
71370	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
74115	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
76860	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
79605	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
82350	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
85095	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
87840	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
90585	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
93330	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
96075	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
98820	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
101565	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
104310	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
107055	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
109800	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
112545	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
115290	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
118035	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
120780	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
123525	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
126270	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
129015	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
131760	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
134505	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
137250	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
139995	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
142740	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
145485	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
Continued on next page		

**Table 2.1 – continued from previous page**

<b>Time (s)</b>	<b>Triple chosen</b>	<b>Other feasible triples</b>
148230	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
150975	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
153720	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
156465	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
159210	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
161955	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
164700	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)

Finally, cite the table using [Table 2.1](#) wherever you want. Thats all...

## Chapter 3

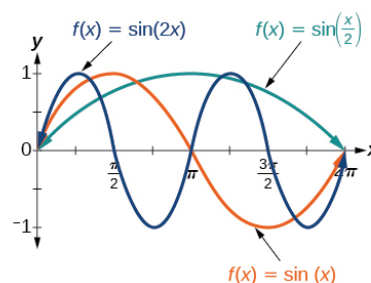
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### 3.1 How to add Figures..

Add your images in 'images' folder. Then refer them here as given in the following..

Figure 3.1: This is the graph of Sin



In the given [Figure 3.1](#) the graph of  $\sin x$  is shown.

## Chapter 4

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# Here is the Forth Chapter...

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## Chapter 5

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# Summary and Future Scope

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## Appendix A

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### Implementation Details

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