

**Dr. Norazaliza binti Mohd Jamil** is currently a senior lecturer in the Faculty of Industrial Sciences & Technology at the Universiti Malaysia Pahang. She earned her Bachelor of Science (Mathematics) with first class honours and Master of Science degree in Mathematics from Universiti Teknologi Malaysia. She completed her Doctor of Philosophy (PhD) in Applied and Computational Mathematics at the University of South Carolina, USA in 2015.

**Dr. Nor Alisa binti Mohd Damanhuri** is a senior lecturer in the Faculty of Industrial Sciences at the Universiti Malaysia Pahang. She obtained BSc. (Mathematics) and MSc. (Applied Mathematics) from the Universiti Sains Malaysia. She received her Ph.D in Mathematics from the University of Manchester, UK in 2014.

**Dr. Yuhani binti Yusof** is currently served as a Senior Lecturer in the Faculty of Industrial Sciences & Technology at Universiti Malaysia Pahang. She graduated from Universiti Teknologi Malaysia, with BSc. (Industrial Mathematics) and MSc. (Mathematics). She completed her Ph.D (Mathematics) at the same university in 2012 and attached as a visiting scholar of Towson University, USA under SLAI scholarship. Experiences of 10 years in teaching of various mathematics subjects at an Institute of Higher Learning, she also actively involved in research related to the biomathematics field.

**Dr. Nor Aida Zuraimi binti Md Noar** is currently a senior lecturer in the Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang (UMP). She received her Bachelor of Science (Industrial Mathematics) from Universiti Teknologi Malaysia. Upon completion her bachelor degree program, she was appointed as a Tutor at Universiti Pendidikan Sultan Idris (UPSI) in 2002 before she continued her postgraduate study in Master of Science (MSc) in Computational Mathematics with Modelling at Brunel University, UK. Then, she was appointed as a lecturer at UPSI. After she completed her Doctor of Philosophy (PhD) in Applied Mathematics at Brunel University, UK in 2012, she was promoted as a senior lecturer at UPSI before joining UMP in 2013.

**Norhafizah binti Md Sarif** is a lecturer in the Faculty of Industrial Sciences at the Universiti Malaysia Pahang. She obtained BSc. (Industrial Mathematics) and MSc. (Applied Mathematics) from the Universiti Teknologi Malaysia. She is currently pursuing her doctoral studies in Applied Mathematics at the University Malaysia Pahang.



ISBN 978-967-2054-68-9

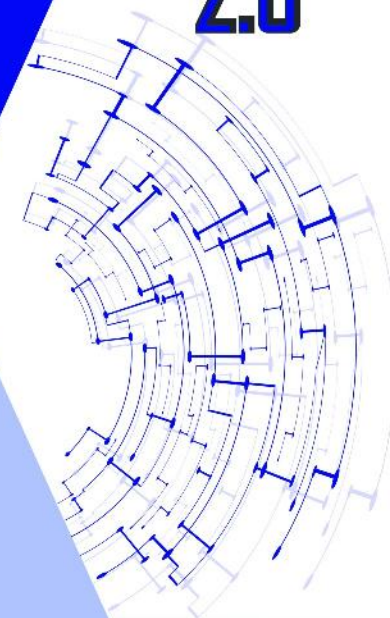


**PUBLISHER**  
**UNIVERSITI MALAYSIA PAHANG**



# Mathematical Formulae 2.0

Norazaliza Mohd Jamil  
Nor Alisa Mohd Damanhuri  
Yuhani Yusof  
Nor Aida Zuraimi Md Noar  
Norhafizah Md Sarif



# Mathematical Formulae 2.0



# Mathematical Formulae 2.0

**Norazaliza Mohd Jamil  
Nor Alisa Mohd Damanhuri  
Yuhani Yusof  
Nor Aida Zuraimi Md Noar  
Norhafizah Md Sarif**

Publisher  
Universiti Malaysia Pahang  
Kuantan  
2017

Copyright © Universiti Malaysia Pahang, 2017

First Published, 2017

All right reserved.

Apart from fair dealing for the purpose of study, research, criticism or review, as permitted under the Copyright Act, no part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher. Enquiries to be made to the author and the publisher Penerbit Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang Darul Makmur. Negotiation is subject to royalty arrangement or honorarium.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Norazaliza Mohd Jamil

Mathematical Formulae 2.0 / Norazaliza Mohd Jamil, Nor Alisa Mohd Damanhuri, Yuhani Yusof, Nor Aida Zuraimi Md Noar, Norhafizah Md Sarif.

ISBN 978-967-2054-68-9

1. Mathematics--Formulae. 2. Arithmetics--Formulae. 3. Government publications-Malaysia I. Title.

510

Published By:

**Publisher**

Universiti Malaysia Pahang,  
Lebuhraya Tun Razak,  
Pahang Darul Makmur.

Tel: 09-549 3320 Fax: 09-549 3381

Printing:

**Syarikat Percetakan Inderapura Sdn. Bhd**

Jalan Tanjong Api Off Jalan Telok Sisek  
25200 Kuantan, Pahang Darul Makmur

Tel: 09-5177225/5177031 Fax: 095139434

# Preface

**Mathematical Formulae** intends to provide students, scientists, engineers, and researchers with a readily available reference to the mathematical formulae needed during their studies or work situation. It is a handy book that one must have on the bookshelf. The text is divided, for ease of reference, into ten main chapters embracing algebra, trigonometry, limit, differentiation and integration, vector calculus, coordinate geometry, differential equations, numerical methods, discrete mathematics, and financial mathematics. Essential theory, formulae, definitions and laws are clearly stated in this book. This collection of formulas constitutes a compilation of mathematics for Engineering and Sciences. In addition, people who often deal with practical or applied problems will also find this collection an efficient and easy-to-use work of reference. The present book arose as a result of many years of teaching experience of various faculties in Universiti Malaysia Pahang (UMP) which are Chemical & Natural Resources Engineering, Civil Engineering & Earth Resources, Computer Systems & Software Engineering, Electrical & Electronics Engineering, Industrial Sciences & Technology, Manufacturing Engineering, Mechanical Engineering, Engineering Technology and Industrial Management. The text assumes little previous knowledge and is suitable for a wide range of courses in UMP. Finally, we would also like to emphasize that remarks and criticism are always welcome.





# Contents

<b>1</b>	<b>Algebra</b> .....	<b>7</b>
1.1	Indices Rules	7
1.2	Logarithm and Exponent Rules	7
1.3	Surds	8
1.4	Absolute Values	8
1.5	Factoring Rules	8
1.6	Quadratic Formula	8
1.7	Complex Number	9
1.8	Pythagorean Theorem	9
1.9	Properties of Matrices	9
1.10	Matrix	10
1.11	Arithmetic Series	10
1.12	Geometric Series	10
1.13	Binomial Series	11
1.14	Taylor Series	11
1.15	Maclaurin Series	11
1.16	Partial Fractions	11
<b>2</b>	<b>Trigonometry</b> .....	<b>13</b>
2.1	Trigonometric Ratios	13
2.2	Special Angles	14
2.3	Basic Identities	15
2.4	Angle Sum and Difference Identities	16
2.5	Double-Angle Identities	16
2.6	Half-Angle Identities	16
2.7	Sum Identities	17



2.8	Hyperbolic Identities	17
<b>3</b>	<b>Limit</b> .....	<b>19</b>
3.1	Basic Properties of Limits	19
3.2	Properties of Limits	19
3.3	Limits of Logarithm Functions	20
3.4	L'Hopital's Rule	20
3.5	Continuity	20
<b>4</b>	<b>Differentiation and Integration</b> .....	<b>21</b>
4.1	Rules of Differentiation	21
4.2	Derivatives of Basic Functions	21
4.3	Higher Order Derivatives	22
4.4	Properties of Definite Integrals	22
4.5	Integrals of Basic Functions	23
4.6	Integration by parts	23
4.7	Basic Differentiation and Integration	23
4.8	Trigonometric Functions	24
4.9	Hyperbolic Functions	25
4.10	Inverse Trigonometric Functions	26
4.11	Applications of Differentiation	27
4.12	Applications of Integration	29
<b>5</b>	<b>Vector Calculus</b> .....	<b>33</b>
5.1	Polar Coordinates	33
5.2	Vectors and Geometry of Space	33
5.3	The Dot Products and Cross Product	33
5.4	Equation of Planes	34
5.5	Vector Functions	34
5.6	Vector Calculus	35
5.7	Multiple Integrals	36

<b>6</b>	<b>Coordinate Geometry</b> .....	<b>39</b>
6.1	Straight Line	39
6.2	Exponential and Logarithmic Graph	39
6.3	Quadratic Graph	39
6.4	Cubic Graph	40
6.5	Rational Graph	40
6.6	Circle and Ellipse	41
6.7	Graphing Techniques	41
6.8	Polar Coordinate	42
6.9	Cylindrical Coordinate	43
6.10	Spherical Coordinate	43
6.11	Three-Dimensional Graphs	43
6.12	Area	45
6.13	Surface Area and Volume	46
<b>7</b>	<b>Differential Equations</b> .....	<b>49</b>
7.1	Jargon	49
7.2	First Order Ordinary Differential Equations	49
7.3	Second Order Homogeneous Differential Equations	50
7.4	Euler / Euler-Cauchy Equation	51
7.5	Second Order Non-Homogeneous Differential Equations	52
7.6	Table of Laplace Transforms	53
7.7	Properties of Laplace Transforms	54
7.8	Laplace Transforms of Derivatives	54
7.9	Fourier Series	55
<b>8</b>	<b>Numerical Methods</b> .....	<b>57</b>
8.1	Errors	57
8.2	Taylor Series	57
8.3	Roots of Equations	58
8.4	Linear Algebraic Equations and Matrices	58
8.5	Curve Fitting	60

8.6	Numerical Integration	61
8.7	Ordinary Differential Equations: Initial Value Problem	61
8.8	Ordinary Differential Equations: Boundary Value Problem	63
<b>9</b>	<b>Discrete Mathematics</b> .....	<b>65</b>
9.1	Set Theory	65
9.2	Boolean Identities	66
9.3	Basic Counting	67
9.4	Elementary Number Theory	67
9.5	Discrete Probability	68
9.6	Discrete Distribution	69
9.7	Mathematical Expectation	70
9.8	Euler's Formula	70
9.9	Tree	71
9.10	Numerical Precision, Accuracy and Errors	71
<b>10</b>	<b>Financial Mathematics</b> .....	<b>73</b>