

Subject – Math (Standard Level)
Topic - Vector
Year - Nov 2011 – Nov 2017
Paper- 1

Question 2

- (a) (i) evidence of approach (M1)
e.g. $\vec{PO} + \vec{OQ}$, $P - Q$
- $$\vec{PQ} = \begin{pmatrix} 2 \\ 1 \\ -4 \end{pmatrix} \quad \text{A1} \quad \text{N2}$$
- (ii) any correct equation in the form $r = a + sb$ (accept any parameter for s)
where a is $\begin{pmatrix} 2 \\ 4 \\ 8 \end{pmatrix}$ or $\begin{pmatrix} 4 \\ 5 \\ 4 \end{pmatrix}$, and b is a scalar multiple of $\begin{pmatrix} 2 \\ 1 \\ -4 \end{pmatrix}$ A2 N2
- e.g. $r = \begin{pmatrix} 2 \\ 4 \\ 8 \end{pmatrix} + s \begin{pmatrix} 2 \\ 1 \\ -4 \end{pmatrix}$, $r = \begin{pmatrix} 4+2s \\ 5+s \\ 4-4s \end{pmatrix}$, $r = 2i + 4j + 8k + s(2i + j - 4k)$
- Note: Award A1 for the form $a + sb$, A1 for $L = a + sb$, A0 for $r = b + sa$.
- [4 marks]
- (b) (i) choosing correct direction vectors for L_1 and L_2 (A1)(A1)
e.g. $\begin{pmatrix} 2 \\ 1 \\ -4 \end{pmatrix}$, $\begin{pmatrix} 3p \\ 2p \\ 4 \end{pmatrix}$
- evidence of equating scalar product to 0 (M1)
correct calculation of scalar product A1
e.g. $2 \times 3p + 1 \times 2p + (-4) \times 4 = 8p - 16 = 0$
- $p = 2$ A1 N3
- (ii) any correct expression in the form $r = a + sb$ (accept any parameter for r)
where a is $\begin{pmatrix} 10 \\ 6 \\ -40 \end{pmatrix}$, and b is a scalar multiple of $\begin{pmatrix} 6 \\ 4 \\ 4 \end{pmatrix}$ A2 N2
- e.g. $r = \begin{pmatrix} 10 \\ 6 \\ -40 \end{pmatrix} + r \begin{pmatrix} 6 \\ 4 \\ 4 \end{pmatrix}$, $r = \begin{pmatrix} 10+6s \\ 6+4s \\ -40+4s \end{pmatrix}$, $r = 10i + 6j - 40k + s(6i + 4j + 4k)$
- Note: Award A1 for the form $a + sb$, A1 for $L = a + sb$ (unless they have been penalised for $L = a + sb$ in part (a)), A0 for $r = b + sa$.
- [7 marks]

Spec Math Sl Paper 2013

**Pierre Cartier, A.D.R. Choudary, Michel
Waldschmidt**

Spec Math SI Paper 2013:

Intelligent Computer Mathematics Jacques Carette, David Aspinall, Christoph Lange, Petr Sojka, Wolfgang Windsteiger, 2013-07-01 This book constitutes the joint refereed proceedings of the 20th Symposium on the Integration of Symbolic Computation and Mechanized Reasoning Calculemus 2013 6th International Workshop on Digital Mathematics Libraries DML 2013 Systems and Projects held in Bath UK as part of CICM 2013 the Conferences on Intelligent Computer Mathematics The 7 revised full papers out of 18 submissions for MKM 2013 5 revised full papers out of 12 submissions for Calculemus 2013 6 revised full papers out of 8 submissions for DML 2013 and 12 revised full papers out of 16 submissions for Systems and Project track presented together with 3 invited talks were carefully reviewed and selected resulting in 33 papers from a total of 73 submissions

Issues in Algebra, Geometry, and Topology: 2013 Edition, 2013-05-01 Issues in Algebra Geometry and Topology 2013 Edition is a ScholarlyEditions book that delivers timely authoritative and comprehensive information about Topology The editors have built Issues in Algebra Geometry and Topology 2013 Edition on the vast information databases of ScholarlyNews You can expect the information about Topology in this book to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Algebra Geometry and Topology 2013 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at <http://www.ScholarlyEditions.com>

Elementary Mathematics Specialists Maggie B. McGatha, Nicole R. Rigelman, 2017-02-01 Elementary mathematics specialists are teacher leaders who are responsible for supporting effective PK 6 mathematics instruction and student learning The Association of Mathematics Teacher Educators AMTE the Association of State Supervisors of Mathematics the National Council of Supervisors of Mathematics and the National Council of Teachers of Mathematics in a 2010 joint position paper on Elementary Mathematics Specialists EMSs all advocate for the use of EMSs to support the teaching and learning of mathematics The specific roles and expectations of EMSs will vary according to the needs of each setting but their expertise and successful experience at the elementary level is critical

1 Elementary Mathematics Specialists Developing Refining and Examining Programs that Support Mathematics Teaching and Learning is AMTE s latest resource supporting the important work of EMSs It has five sections related to the preparation and professional development of EMSs a Overview and Current State of Affairs b Models of EMS Program Development c Supporting EMSs in the Field d The Mathematics Specialist Research and e Future Directions The book provides support to EMS practitioners program providers developers and researchers seeking to answer important questions about how to prepare Mathematics Specialists support them in the field and research their effectiveness

Digital Games and Mathematics Learning Tom Lowrie, Robyn Jorgensen

(Zevenbergen),2015-10-05 Digital games offer enormous potential for learning and engagement in mathematics ideas and processes This volume offers multidisciplinary perspectives of educators cognitive scientists psychologists and sociologists on how digital games influence the social activities and mathematical ideas of learners gamers Contributing authors identify opportunities for broadening current understandings of how mathematical ideas are fostered and embedded within digital game environments In particular the volume advocates for new and different ways of thinking about mathematics in our digital age proposing that these mathematical ideas and numeracy practices are distinct from new literacies or multiliteracies The authors acknowledge that the promise of digital games has not always been realised fulfilled There is emerging and considerable evidence to suggest that traditional discipline boundaries restrict opportunities for mathematical learning Throughout the book what constitutes mathematics learnings and pedagogy is contested Multidisciplinary viewpoints are used to describe and understand the potential of digital games for learning mathematics and identify current tensions within the field Mathematics learning is defined as being about problem solving engagement in mathematical ideas and processes and social engagement The artefact which is the game shapes the ways in which the gamers engage with the social activity of gaming In parallel the book as a textual artefact will be supported by Springer's online platform allowing for video and digital communication including links to relevant websites to be used as supplementary material and establish a dynamic communication space Assessment in Mathematics Education Contexts Jonathan D. Bostic,Erin E. Krupa,Jeffrey C. Shih,2019-05-13 This book aims to provide theoretical discussions of assessment development and implementation in mathematics education contexts as well as to offer readers discussions of assessment related to instruction and affective areas such as attitudes and beliefs By providing readers with theoretical implications of assessment creation and implementation this volume demonstrates how validation studies have the potential to advance the field of mathematics education Including chapters addressing a variety of established and budding areas within assessment and evaluation in mathematics education contexts this book brings fundamental issues together with new areas of application **Integral Transforms and Operational Calculus** H. M. Srivastava,2019-11-20 Researches and investigations involving the theory and applications of integral transforms and operational calculus are remarkably wide spread in many diverse areas of the mathematical physical chemical engineering and statistical sciences This Special Issue contains a total of 36 carefully selected and peer reviewed articles which are authored by established researchers from many countries Included in this Special Issue are review expository and original research articles dealing with the recent advances on the topics of integral transforms and operational calculus as well as their multidisciplinary applications **Simulation and Modeling Methodologies, Technologies and Applications** Mohammad S. Obaidat,Janusz Kacprzyk,Tuncer Ören,Joaquim Filipe,2016-05-27 The present book includes a set of selected extended papers from the 5th International Conference on Simulation and Modeling Methodologies Technologies and Applications SIMULTECH 2015 held in Colmar France from 21 to

23 July 2015 The conference brought together researchers engineers and practitioners interested in methodologies and applications of modeling and simulation New and innovative solutions are reported in this book SIMULTECH 2015 received 102 submissions from 36 countries in all continents After a double blind paper review performed by the Program Committee 19% were accepted as full papers and thus selected for oral presentation Additional papers were accepted as short papers and posters A further selection was made after the Conference based also on the assessment of presentation quality and audience interest so that this book includes the extended and revised versions of the very best papers of SIMULTECH 2015 Commitment to high quality standards is a major concern of SIMULTECH that will be maintained in the next editions considering not only the stringent paper acceptance ratios but also the quality of the program committee keynote lectures participation level and logistics Mathematics in the 21st Century Pierre Cartier,A.D.R. Choudary,Michel

Waldschmidt,2014-11-15 Numerous well presented and important papers from the conference are gathered in the proceedings for the purpose of pointing directions for useful future research in diverse areas of mathematics including algebraic geometry analysis commutative algebra complex analysis discrete mathematics dynamical systems number theory and topology Several papers on computational and applied mathematics such as wavelet analysis quantum mechanics piecewise linear modeling cosmological models of super symmetry fluid dynamics interpolation theory optimization ergodic theory and games theory are also presented **Handbook of Research on Innovative Digital Practices to Engage**

Learners Bull, Prince Hycy,Keengwe, Jared,2019-06-28 Digital integration is the driving force of teaching and learning at all levels of education As more non traditional students seek credentialing certification and degrees institutions continue to push the boundaries of innovative practices to meet the needs of diverse students Programs and faculty have moved from merely using technology and learning management systems to unique and innovative ways to engage learners The Handbook of Research on Innovative Digital Practices to Engage Learners is an essential scholarly publication that offers theoretical frameworks delivery models current guidelines and digital design techniques for integrating technological advancements in education contexts to enforce student engagement and positive student outcomes Featuring a wide range of topics such as gamification wearable technologies and distance education this book is ideal for teachers curriculum developers instructional designers principals deans administrators researchers academicians education professionals and students **A Time**

Series Approach to Option Pricing Christophe Chorro,Dominique Guégan,Florian Ielpo,2014-12-04 The current world financial scene indicates at an intertwined and interdependent relationship between financial market activity and economic health This book explains how the economic messages delivered by the dynamic evolution of financial asset returns are strongly related to option prices The Black Scholes framework is introduced and by underlining its shortcomings an alternative approach is presented that has emerged over the past ten years of academic research an approach that is much more grounded on a realistic statistical analysis of data rather than on ad hoc tractable continuous time option pricing

models The reader then learns what it takes to understand and implement these option pricing models based on time series analysis in a self contained way The discussion covers modeling choices available to the quantitative analyst as well as the tools to decide upon a particular model based on the historical datasets of financial returns The reader is then guided into numerical deduction of option prices from these models and illustrations with real examples are used to reflect the accuracy of the approach using datasets of options on equity indices

Highlights in Educational Psychology: Teacher-student Relationship Claudio Longobardi, Alberto Crescentini, Elisabetta Sagone,2024-12-16 We are pleased to introduce the collection Frontiers in Psychology Highlights in Educational Psychology Teacher student Relationship This collection will welcome and showcase a selection of articles about this timely topic authored by leaders in the field The work presented here highlights the broad diversity of research performed across education and aims to put a spotlight on the main areas of interest

Engineering Vibration, Communication and Information Processing Kanad Ray,S. N. Sharan,Sanyog Rawat,S. K. Jain,Sumit Srivastava,Anirban Bandyopadhyay,2018-10-30 This book discusses the revolution of cycles and rhythms that is expected to take place in different branches of science and engineering in the 21st century with a focus on communication and information processing It presents high quality papers in vibration sciences rhythms and oscillations neurosciences mathematical sciences and communication It includes major topics in engineering and structural mechanics computer sciences biophysics and biomathematics as well as other related fields Offering valuable insights it also inspires researchers to work in these fields The papers included in this book were presented at the 1st International Conference on Engineering Vibration Communication and Information Processing ICoEVCI 2018 India

Examining the Phenomenon of “Teaching Out-of-field” Linda Hobbs,Günter Törner,2019-01-01 This book identifies and surveys the major themes around out of field teaching that is teaching subjects or year levels without a specialization This has been an issue in many countries for some time yet until recently there has been little formal research and poor policy responses to related problems This book arises out of collaborations between members of an international group of researchers and practitioners from Australia Germany Ireland England South Africa Indonesia and the United States Cross national comparisons of ideas through case studies descriptions of practice and research data interrogates the experiences practices and contexts relating to out of field teaching In particular the book considers the phenomenon of out of field teaching in relation to national policy contexts local school leadership practices professional development The book represents an essential contribution on a highly topical issue that has implications for quality and equitable education around the globe

Mathematical and Statistical Methods for Actuarial Sciences and Finance Marco Corazza,María Durbán,Aurea Grané,Cira Perna,Marilena Sibillo,2018-07-17 The interaction between mathematicians statisticians and econometricians working in actuarial sciences and finance is producing numerous meaningful scientific results This volume introduces new ideas in the form of four page papers presented at the international conference Mathematical and Statistical Methods for Actuarial Sciences and Finance MAF held at Universidad

Carlos III de Madrid Spain 4th 6th April 2018 The book covers a wide variety of subjects in actuarial science and financial fields all discussed in the context of the cooperation between the three quantitative approaches The topics include actuarial models analysis of high frequency financial data behavioural finance carbon and green finance credit risk methods and models dynamic optimization in finance financial econometrics forecasting of dynamical actuarial and financial phenomena fund performance evaluation insurance portfolio risk analysis interest rate models longevity risk machine learning and soft computing in finance management in insurance business models and methods for financial time series analysis models for financial derivatives multivariate techniques for financial markets analysis optimization in insurance pricing probability in actuarial sciences insurance and finance real world finance risk management solvency analysis sovereign risk static and dynamic portfolio selection and management trading systems This book is a valuable resource for academics PhD students practitioners professionals and researchers and is also of interest to other readers with quantitative background knowledge

Progress in Cryptology - AFRICACRYPT 2023 Nadia El Mrabet, Luca De Feo, Sylvain Duquesne, 2023-07-12 This volume contains the papers accepted for presentation at Africacrypt 2023 the 14th International Conference on the Theory and Application of Cryptographic Techniques in Africa The 21 full papers included in this book were carefully reviewed and selected from 59 submissions They were organized in topical sections as follows Post quantum cryptography Symmetric cryptography Cryptanalysis Blockchain Lattice based cryptography Implementations Theory **Grading for Growth** David Clark, Robert Talbert, 2023-07-03 Are you satisfied with your current and traditional grading system Does it accurately reflect your students learning and progress Can it be gamed Does it lead to grade grubbing and friction with your students The authors of this book two professors of mathematics with input from colleagues across disciplines and institutions offer readers a fundamentally more effective and authentic approach to grading that they have implemented for over a decade Recognizing that traditional grading penalizes students in the learning process by depriving them of the formative feedback that is fundamental to improvement the authors offer alternative strategies that encourage revision and growth Alternative grading is concerned with students eventual level of understanding This leads to big changes Students take time to review past failures and learn from them Conversations shift from why did I lose a point for this to productive discussions of content and process Alternative grading can be used successfully at any level in any situation and any discipline in classes that range from seminars to large multi section lectures This book offers a comprehensive introduction to alternative grading beginning with a framework and rationale for implementation and evidence of its effectiveness The heart of the book includes detailed examples including variations on Standards Based Grading Specifications Grading and ungrading of how alternative grading practices are used in all kinds of classroom environments disciplines and institutions with a focus on first hand accounts by faculty who share their practices and experience The book includes a workbook chapter that takes readers through a step by step process for building a prototype of their own alternatively graded class and ends with concrete practical time tested

advice for new practitioners The underlying principles of alternative grading involve Evaluating student work using clearly defined and context appropriate content standards Giving students helpful actionable feedback Summarizing the feedback with marks that indicate progress rather than arbitrary numbers Allowing students to revise without penalty using the feedback they receive until the standards are met or exceeded This book is intended for faculty interested in exploring alternative forms of learning assessment as well as those currently using alternative grading systems who are looking for ideas and options to refine practice

Practical Post-Quantum Signatures Kwangjo Kim,2025-02-15 The current digital signature methods like RSA DSA and ECDSA are relatively simple to understand and their signing and verification processes operate in comparable time frames However in the quantum computing era cryptographic methods must be designed to withstand both classical and quantum attacks This requires an in depth understanding of advanced mathematical concepts like algebraic geometry lattice theory Gaussian sampling and efficient polynomial computation techniques such as FFT and NTT which are essential for lattice based cryptosystems The FALCON algorithm chosen as a finalist in the NIST Post Quantum Cryptography PQC standardization project is a lattice based hash and sign digital signature scheme known for its efficiency and compactness compared to other quantum resistant signatures like Dilithium and SPHINCS Following FALCON s development the SOLMAE algorithm was introduced in 2021 offering a simplified signing process within the same GPV framework and also implemented in Python for easier accessibility This monograph provides a practical and educational introduction to post quantum digital signatures focusing on the FALCON and SOLMAE algorithms The material aims to bridge the gap between theory and practice offering hands on knowledge of post quantum cryptographic techniques With a focus on clear practical examples using Python this book is a valuable resource for anyone looking to understand or implement quantum secure digital signatures

Statistical Language and Speech Processing Laurent Besacier,Adrian-Horia Dediu,Carlos Martín-Vide,2014-09-02 This book constitutes the refereed proceedings of the Second International Conference on Statistical Language and Speech Processing SLSP 2014 held in Grenoble France in October 2014 The 18 full papers presented together with three invited talks were carefully reviewed and selected from 53 submissions The papers are organized in topical sections on machine translation speech and speaker recognition machine learning methods text extraction and categorization and mining text

Advances in Social Simulation Harko Verhagen,Melania Borit,Giangiacomo Bravo,Nanda Wijermans,2020-04-30 This book presents the state of the art in social simulation as presented at the Social Simulation Conference 2018 in Stockholm Sweden It covers the developments in applications and methods of social simulation addressing societal issues such as socio ecological systems and policy making Methodological issues discussed include large scale empirical calibration model sharing and interdisciplinary research as well as decision making models validation and the use of qualitative data in simulation modeling Research areas covered include archaeology cognitive science economics organization science and social simulation education This collection gives readers insight into the

increasing use of social simulation in both its theoretical development and in practical applications such as policy making whereby modelling and the behavior of complex systems is key The book will appeal to students researchers and professionals in the various fields **Automated Theorem Proving in Software Engineering** Johann M.

Schumann,2013-06-29 Growing demands for the quality safety and security of software can only be satisfied by the rigorous application of formal methods during software design This book methodically investigates the potential of first order logic automated theorem provers for applications in software engineering Illustrated by complete case studies on protocol verification verification of security protocols and logic based software reuse this book provides techniques for assessing the prover s capabilities and for selecting and developing an appropriate interface architecture

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