

Subject – Math(Higher Level)
Topic - Vector
Year - Nov 2011 – Nov 2019

Question 1

[Maximum mark: 15]

(a) For non-zero vectors $\mathbf{a}$ and $\mathbf{b}$, show that

(i) if $|\mathbf{a} - \mathbf{b}| = |\mathbf{a} + \mathbf{b}|$, then $\mathbf{a}$ and $\mathbf{b}$ are perpendicular;

(ii) $|\mathbf{a} \times \mathbf{b}|^2 = |\mathbf{a}|^2 |\mathbf{b}|^2 - (\mathbf{a} \cdot \mathbf{b})^2$. [8 marks]

(b) The points A, B and C have position vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$.

(i) Show that the area of triangle ABC is $\frac{1}{2} |\mathbf{a} \times \mathbf{b} + \mathbf{b} \times \mathbf{c} + \mathbf{c} \times \mathbf{a}|$.

(ii) Hence, show that the shortest distance from B to AC is

$$\frac{|\mathbf{a} \times \mathbf{b} + \mathbf{b} \times \mathbf{c} + \mathbf{c} \times \mathbf{a}|}{|\mathbf{c} - \mathbf{a}|}. \quad [7 \text{ marks}]$$

Question 2

[Maximum mark: 5]

Find the values of x for which the vectors $\begin{pmatrix} 1 \\ 2 \cos x \\ 0 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 2 \sin x \\ 1 \end{pmatrix}$ are perpendicular,
 $0 \leq x \leq \frac{\pi}{2}$.

Question 3

[Maximum mark: 6]

Two boats, A and B, move so that at time t hours, their position vectors, in kilometres, are $\mathbf{r}_A = (5t)\mathbf{i} + (3 - 6t)\mathbf{j}$ and $\mathbf{r}_B = (7 - 4t)\mathbf{i} + (7t - 6)\mathbf{j}$.

(a) Find the coordinates of the common point of the paths of the two boats. [4 marks]

(b) Show that the boats do not collide. [2 marks]

Nov 2014 Math Hl Paper

John Hooker



Nov 2014 Math HI Paper :

InCIEC 2014 Rohana Hassan, Marina Yusoff, Anizahyati Alisibramulisi, Norliyati Mohd Amin, Zulhabri Ismail, 2015-05-11

The special focus of this proceedings is to cover the areas of infrastructure engineering and sustainability management The state of the art information in infrastructure and sustainable issues in engineering covers earthquake bioremediation synergistic management timber engineering flood management and intelligent transport systems It provides precise information with regards to innovative research development in construction materials and structures in addition to a compilation of interdisciplinary finding combining nano materials and engineering *The Next Step* James

Freemyer, 2019-11-04 This book is written on the behalf of mathematics teachers who have been asked to teach more conceptually while simultaneously motivating more students of all ability levels to willingly embrace further upper level mathematics content and courses This is a BIG ASK Math teachers are being expected to overhaul their current teaching approach Can teachers be expected to embrace this crusade alone isolated in a classroom Principals are charged with leading the way They must provide the opportunities and resources necessary for effective teacher collaboration After reading this book a principal will comprehend the enormity of task each mathematics teachers faces and learn what must be done to help School leaders will be able to design a growth plan based on a plethora of collaborative approaches Mathematics teachers will experience the assistance they have desperately needed

Principles and Practice of Constraint Programming John Hooker, 2018-08-22 This book constitutes the proceedings of the 24th International Conference on Principles and Practice of Constraint Programming CP 2018 held in Lille France in August 2018 The 41 full and 9 short papers presented in this volume were carefully reviewed and selected from 114 submissions They deal with all aspects of computing with constraints including theory algorithms environments languages models systems and applications such as decision making resource allocation scheduling configuration and planning The papers were organized according to the following topics tracks main technical track applications track CP and data science CP and music CP and operations research CP optimization and power system management multiagent and parallel CP and testing and verification Quality

Assessment of Visual Content Ke Gu, Hongyan Liu, Chengxu Zhou, 2022-10-19 This book provides readers with a comprehensive review of image quality assessment technology particularly applications on screen content images 3D synthesized images sonar images enhanced images light field images VR images and super resolution images It covers topics containing structural variation analysis sparse reference information multiscale natural scene statistical analysis task and visual perception contour degradation measurement spatial angular measurement local and global assessment metrics and more All of the image quality assessment algorithms of this book have a high efficiency with better performance compared to other image quality assessment algorithms and the performance of these approaches mentioned above can be demonstrated by the results of experiments on real world images On the basis of this those interested in relevant fields can use the results

obtained through these quality assessment algorithms for further image processing The goal of this book is to facilitate the use of these image quality assessment algorithms by engineers and scientists from various disciplines such as optics electronics math photography techniques and computation techniques The book can serve as a reference for graduate students who are interested in image quality assessment techniques for front line researchers practicing these methods and for domain experts working in this area or conducting related application development

Theory and Applications of Satisfiability Testing - SAT 2017 Serge Gaspers,Toby Walsh,2017-08-14 This book constitutes the refereed proceedings of the 20th International Conference on Theory and Applications of Satisfiability Testing SAT 2017 held in Melbourne Australia in August September 2017 The 22 revised full papers 5 short papers and 3 tool papers were carefully reviewed and selected from 64 submissions The papers are organized in the following topical sections algorithms complexity and lower bounds clause learning and symmetry handling maximum satisfiability and minimal correction sets parallel SAT solving quantified Boolean formulas satisfiability modulo theories and SAT encodings

Computer Vision -- ACCV 2014 Daniel Cremers,Ian Reid,Hideo Saito,Ming-Hsuan Yang,2015-04-16 The five volume set LNCS 9003 9007 constitutes the thoroughly refereed post conference proceedings of the 12th Asian Conference on Computer Vision ACCV 2014 held in Singapore Singapore in November 2014 The total of 227 contributions presented in these volumes was carefully reviewed and selected from 814 submissions The papers are organized in topical sections on recognition 3D vision low level vision and features segmentation face and gesture tracking stereo physics video and events and poster sessions 1 3

Recent Trends In Peripheral Security Systems Abhishek Rawat,Dipankar Deb,Jatin Upadhyay,2021-05-06 This book covers selected topics and methods for peripheral security which are gaining attention nowadays The book discusses the security arrangement and methods for monitoring the inside outside entry of peripheral areas that need to be secured It relates to a periphery often portable device as well as the methods employed and systems including such a peripheral device and a host central command device with which the local geographical command device communicates enabling one or more security operations performed by the peripheral device It also covers the security scenario of snow prone areas in a remote location It also elaborates how we can secure the person and devices in extremely cold conditions and rescue them This book helps the researchers academicians and industry persons working in security areas to protect unauthentic entry in large scale areas that may be defense camps or civilian applications like large sized bungalows institutes and organizations of national importance The experimental results are in close conformance to the proposed methodologies

Handbook of Research on Classroom Diversity and Inclusive Education Practice Curran, Christina M.,Petersen, Amy J.,2017-05-30 As classrooms are becoming more diverse teachers are now faced with the responsibility of creating an inclusive classroom community As such researching classroom pedagogies and practices is an imperative step in curriculum planning The Handbook of Research on Classroom Diversity and Inclusive Education Practice is an authoritative reference source for the latest scholarly research on ways to effectively

teach all students and further refine and strengthen school wide inclusive pedagogy methods and policies Featuring extensive coverage on a number of topics such as special education online learning and English language learners this publication is ideally designed for professionals educators and policy makers seeking current research on methods that ensure all students have equal access to curricular content and the chance for growth and success

Instructional Practices with and without Empirical Validity Bryan G. Cook,Melody Tankersley,Timothy J. Landrum,2016-07-06 It is important for Stakeholders to be aware of both practices supported as effective as well as ineffective for students with learning and behavioral disabilities in order to provide instruction that results in improved learner outcomes in critical areas of education

Putting the "Why" Back into Bone "Archytecture" Phil Salmon,Daniel Chappard,Andrew Anthony Pitsillides,2017-07-27 A large literature exists on trabecular and cortical bone morphology The engineering performance of bone implied from its 3d architecture is often the endpoint of bone biology experiments being clinically relevant to bone fracture How and why does bone travel along its complex spatio temporal trajectory to acquire its architecture The question why can have two meanings The first teleological why is an architecture advantageous is the domain of substantial biomechanical research to date The second etiological how did an architecture come about has received far less attention This Frontiers Bone Research Topic invited contributions addressing this etiological why what mechanisms can coordinate the activity of bone forming and resorbing cells to produce the observed complex and efficient bone architectures One mechanism is proposed chaotic nonlinear pattern formation NPF which underlies in a unifying way natural structures as disparate as trabecular bone swarms of birds flying or shoaling fish island formation fluid turbulence and others At the heart of NPF is the fact that simple rules operating between interacting elements multiplied and repeated many times lead to complex and structured patterns This paradigm of growth and form leads to a profound link between bone regulation and its architecture in bone the architecture is the regulation The former is the emergent consequence of the latter Whatever mechanism does determine bone s developing architecture has to operate at the level of individual sites of formation and resorption and coupling between the two This has implications as to how we understand the effect on bone of agents such as gene products or drugs It may be for instance that the tuning of coupling between formation and resorption might be as important as the achievement of enhanced bone volume The ten articles that were contributed to this Topic were just what we hoped for a snapshot of leading edge bone biology research which addresses the question of how bone gets its shape We hope that you find these papers thought provoking and that they might stimulate new ideas in the research into bone architecture growth and adaptation and how to preserve healthy bone from gestation and childhood until old age

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Table of Contents Nov 2014 Math Hl Paper

1. Understanding the eBook Nov 2014 Math Hl Paper
 - The Rise of Digital Reading Nov 2014 Math Hl Paper
 - Advantages of eBooks Over Traditional Books
2. Identifying Nov 2014 Math Hl Paper
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Nov 2014 Math Hl Paper
 - User-Friendly Interface
4. Exploring eBook Recommendations from Nov 2014 Math Hl Paper
 - Personalized Recommendations
 - Nov 2014 Math Hl Paper User Reviews and Ratings
 - Nov 2014 Math Hl Paper and Bestseller Lists
5. Accessing Nov 2014 Math Hl Paper Free and Paid eBooks
 - Nov 2014 Math Hl Paper Public Domain eBooks
 - Nov 2014 Math Hl Paper eBook Subscription Services

- Nov 2014 Math HL Paper Budget-Friendly Options
- 6. Navigating Nov 2014 Math HL Paper eBook Formats
 - ePub, PDF, MOBI, and More
 - Nov 2014 Math HL Paper Compatibility with Devices
 - Nov 2014 Math HL Paper Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Nov 2014 Math HL Paper
 - Highlighting and Note-Taking Nov 2014 Math HL Paper
 - Interactive Elements Nov 2014 Math HL Paper
- 8. Staying Engaged with Nov 2014 Math HL Paper
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Nov 2014 Math HL Paper
- 9. Balancing eBooks and Physical Books Nov 2014 Math HL Paper
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Nov 2014 Math HL Paper
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Nov 2014 Math HL Paper
 - Setting Reading Goals Nov 2014 Math HL Paper
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Nov 2014 Math HL Paper
 - Fact-Checking eBook Content of Nov 2014 Math HL Paper
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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