

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

Question 1

[Maximum mark: 15]

(a) For non-zero vectors a and b , show that

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

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

(b) The points A, B and C have position vectors a , b and c .

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

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

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

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 $r_a = (5t)\mathbf{i} + (3 - 6t)\mathbf{j}$ and $r_b = (7 - 4t)\mathbf{i} + (7t - 6)\mathbf{j}$.

(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]

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Table of Contents Hl Maths Ib Past Papers

1. Understanding the eBook Hl Maths Ib Past Papers
 - The Rise of Digital Reading Hl Maths Ib Past Papers
 - Advantages of eBooks Over Traditional Books
2. Identifying Hl Maths Ib Past Papers
 - 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 Hl Maths Ib Past Papers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Hl Maths Ib Past Papers
 - Personalized Recommendations
 - Hl Maths Ib Past Papers User Reviews and Ratings
 - Hl Maths Ib Past Papers and Bestseller Lists

5. Accessing HL Maths Ib Past Papers Free and Paid eBooks
 - HL Maths Ib Past Papers Public Domain eBooks
 - HL Maths Ib Past Papers eBook Subscription Services
 - HL Maths Ib Past Papers Budget-Friendly Options
6. Navigating HL Maths Ib Past Papers eBook Formats
 - ePub, PDF, MOBI, and More
 - HL Maths Ib Past Papers Compatibility with Devices
 - HL Maths Ib Past Papers Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of HL Maths Ib Past Papers
 - Highlighting and Note-Taking HL Maths Ib Past Papers
 - Interactive Elements HL Maths Ib Past Papers
8. Staying Engaged with HL Maths Ib Past Papers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers HL Maths Ib Past Papers
9. Balancing eBooks and Physical Books HL Maths Ib Past Papers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection HL Maths Ib Past Papers
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine HL Maths Ib Past Papers
 - Setting Reading Goals HL Maths Ib Past Papers
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of HL Maths Ib Past Papers
 - Fact-Checking eBook Content of HL Maths Ib Past Papers
 - 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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