EXAM PAPERS PRACTICE

IB Maths: AA HL

Vector Equations of Lines

Topic Questions

These practice questions can be used by students and teachers and is Suitable for IB Maths AA HL Topic Questions

Course	IB Maths
Section	3. Geometry & Trigonometry
Topic	3.8 Vector Equations of Lines
Difficulty	Medium

Level: IB Maths

Subject: IB Maths AA HL

Board: IB Maths

Topic: Vector Equations of Lines

Question 1

The points A and B are given by $A(4, 2, -3)$ and $B(0, 5, 1)$.

(a) Find a vector equation of the line L that passes through points A and B.

[3 marks]

(b) Determine if the point $C(-1, 3, 2)$ lies on the line L.

[3 marks]

Question 2

Find the vector equations of a line that is parallel to the vector $\boldsymbol{a} = 3\mathbf{i} - 4\mathbf{j} + \boldsymbol{k}$ and passes through the point $X(3, -2, 0)$.

[5 marks]

Question 3

Find the equation of the line that is perpendicular to the vector $4\boldsymbol{i} + 5\boldsymbol{j}$ and passes through the point $P(7, -1)$, leaving your answer in the form $ax + by + c = 0$, where a, b and $c \in \mathbb{Z}$.

[6 marks]

Question 4

Consider the two lines l_1 and l_2 defined by the equations:

$$l_1 : \boldsymbol{a} = \begin{pmatrix} 4 \\ 1 \\ 6 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix}$$

$$l_2 : \boldsymbol{b} = \begin{pmatrix} 5 \\ -11 \\ 10 \end{pmatrix} + \mu \begin{pmatrix} -1 \\ 6 \\ 2 \end{pmatrix}$$

a)
Find the scalar product of the direction vectors.

[2 marks]

b)
Hence, find the angle, in radians, between the l_1 and l_2.

[4 marks]

Question 5

Consider the lines l_1 and l_2 defined by:

$$l_1 : \begin{cases} x = 3 - \mu \\ y = -2 + 5\mu \\ z = 4 + 2\mu \end{cases}$$

$$l_2 : \boldsymbol{r} = \begin{pmatrix} 3 \\ -1 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} 4 \\ 2 \\ 2 \end{pmatrix}.$$

(a) Show that the lines are not parallel.

[2 marks]

(b) Hence, show that the lines l_1 and l_2 do not intersect.

[5 marks]

Question 6

Consider the line l which can be defined by both $\boldsymbol{r_1} = \begin{pmatrix} t \\ -2 \\ 5 \end{pmatrix} + \alpha \begin{pmatrix} -5 \\ 2 \\ 1 \end{pmatrix}$ and $\boldsymbol{r_2} = \begin{pmatrix} -3 \\ 6 \\ 9 \end{pmatrix} + \beta \begin{pmatrix} 15 \\ 3k \\ -3 \end{pmatrix}$.

(a) Find the value of k.

[2 marks]

(b) Find the value of t.

[4 marks]

Question 7

Consider the line l_1, which can be represented by the equation $\boldsymbol{r} = \begin{pmatrix} 4 \\ 2 \\ -2 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ 4 \\ 3 \end{pmatrix}$ and l_2, which can be represented by the equation $\boldsymbol{s} = (3-\mu)i + (1-\mu)j + (5+7\mu)k$.

(a) Write down the equation for l_2 in its vector form.

[2 marks]

(b) Find vector product of the direction vectors of l_1 and l_2.

[2 marks]

(c) Hence find the angle between l_1 and l_2.

[3 marks]

Question 8

The lines l_1 and l_2 can be defined by:

$$l_1 : \boldsymbol{r} = \begin{pmatrix} 2 \\ -5 \\ 1 \end{pmatrix} + \alpha \begin{pmatrix} 3 \\ 2 \\ k \end{pmatrix}$$

$$l_2 : \boldsymbol{s} = \begin{pmatrix} -3 \\ -4 \\ 2 \end{pmatrix} + \beta \begin{pmatrix} -11 \\ -3 \\ 5 \end{pmatrix}$$

a)
Write down the parametric equations for l_1.

[2 marks]

b)
Given that l_1 and l_2 intersect at point T,

(i)
find the value of k.

(ii)
determine the coordinates of the point of intersection, T.

[7 marks]

Question 9

Consider the triangle ABC. The points A, B and C have coordinates $(4, 0, -3)$, $(2, -2, -1)$ and $(8, 1, 5)$ respectively.

M is the midpoint of [AB].

(a) Find the coordinates of the midpoint M.

[2 marks]

(b) Hence, find a vector equation of the line, l, that passes through points C and M.

[2 marks]

(c) Show that the line l is perpendicular to [AB].

[3 marks]

(d) Hence calculate the area of the triangle ABC.

[3 marks]