

Test 5

Maths IB₁ HL

Subjects : *Scalar product & equations of Planes*

Total : / 37

Thursday 20.03.2025

Name: _____

Question 1 (May 23 Paper1)

[8 marks]

The angle between a line and a plane is α , where $\alpha \in \mathbb{R}$, $0 < \alpha < \frac{\pi}{2}$.

The equation of the line is $\frac{x-1}{3} = \frac{y+2}{2} = 5-z$, and the equation of the plane is $4x + (\cos \alpha)y + (\sin \alpha)z = 1$.

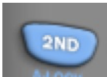
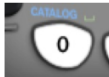
i) Find a trigonometric equation for α (in other terms: α should be a solution of this equation) [4]

ii) In the original IB question (paper 2) it was asked to give a value of α .

That can be done only using the function *SOLVE* of your calculator.

If you have a Ti calculator, you can try to follow the instructions in the frame below [+2]

) Finding and selecting « **solve** (» in the **CATALOG**.

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CATALOG
sin(
sin⁻¹(
sinh(
sinh⁻¹(
SinReg
solve(
SortA(
            
```

) Using **solve**($f(x), x, g$) to find an approximate solution of, for example: equation : $x^2 - x = 1$

The equation has to be introduced on the form « $f(x) = 0$ ».

(g is a *guess-value*)

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solve(X²-X-1,X,1)
1.618033989
            
```

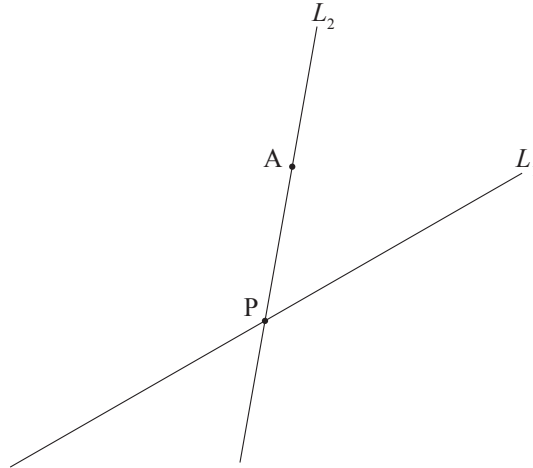
iii) If $\alpha = \frac{3\pi}{2}$ rad, what are the coordinates of I, the intersection between the line and the plane ? [4]

Question 2 (May 23 Paper 2)

[24 marks]

Two lines, L_1 and L_2 , intersect at point P. Point A($2t, 8, 3$), where $t > 0$, lies on L_2 . This is shown in the following diagram.

diagram not to scale



The acute angle between the two lines is $\frac{\pi}{3}$.

The direction vector of L_1 is $\begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$, and $\vec{PA} = \begin{pmatrix} 2t \\ 0 \\ 3+t \end{pmatrix}$.

- (a) Show that $4t = \sqrt{10t^2 + 12t + 18}$. [4]
- (b) Find the value of t . [4]
- (c) Hence or otherwise, find the shortest distance from A to L_1 . [4]
- (d) Find a point B that lies on L_1 [2]
- (e) Find a vector equation of the plane Π_{ABC} that contains A B and C [4]
- (f) Find a cartesian equation of the plane Π_{ABC} [3]
- (g) From (f) otherwise, find a vector \vec{n} perpendicular to L_1 and L_2 [3]

Question 3 (Kognity)

[5 marks]

A plane, which is parallel to the plane $x - 2y + 3z = 2$, passes through the points $(-1, -1, 1)$ and $(-1, 2, k)$. Find the value of k .