

# Chapter 9 / Example 41

## Intersecting planes

Given the three planes  $\pi_1 : 2x - 3y + 5z = 1$ ,  $\pi_2 : x + 2y - z = 0$  and  $\pi_3 : 2x + 4y - 2z = 1$ , show that:

- a**  $\pi_2 \parallel \pi_3$       **b**  $\pi_1$  and  $\pi_2$  intersect and find the equation of the line.

Press **MENU** **A** **EQN** to enter equation mode.

Press **F1** Simultaneous.

There are 3 unknowns so press **F2** 3.

Simultaneous  
No Data In Memory

Number Of Unknowns?  
**2** **3** **4** **5** **6**

Solve the equations 
$$\begin{cases} x + 2y - z = 0 \\ 2x + 4y - 2z = 1 \end{cases}$$

Enter to coefficients into the matrix, leaving the third row as 0, 0, 0.

$a_n X + b_n Y + c_n Z = d_n$

	a	b	c	d
1	1	2	-1	0
2	2	4	-2	1
3	0	0	0	0

**SOLVE** **DELETE** **CLEAR** **EDIT**

Press **F1** SOLVE.

The calculator displays no solution.

If two planes do not intersect, then they must be parallel.

$a_n X + b_n Y + c_n Z = d_n$   
No Solution

**REPEAT**

Press **F1** REPEAT and **F3** CLEAR.

Solve the equations 
$$\begin{cases} 2x - 3y + 5z = 1 \\ x + 2y - z = 0 \end{cases}$$

Enter to coefficients into the matrix, leaving the third row as 0, 0, 0.

$a_n X + b_n Y + c_n Z = d_n$

	a	b	c	d
1	2	-3	5	1
2	1	2	-1	0
3	0	0	0	0

**SOLVE** **DELETE** **CLEAR** **EDIT**

Press **F1** SOLVE.

The calculator displays infinitely many solutions

$$\begin{cases} x = \frac{2}{7} - z \\ y = -\frac{1}{7} + z \\ z = z \end{cases} \quad \text{or} \quad \begin{cases} x = \frac{2}{7} - \mu \\ y = -\frac{1}{7} + \mu \\ z = \mu \end{cases} \quad \text{or} \quad \frac{x - \frac{2}{7}}{-1} = \frac{y + \frac{1}{7}}{1} = \frac{z}{1}$$

$a_n X + b_n Y + c_n Z = d_n$   
Many Solutions  
 $X = \frac{2}{7} - Z$   
 $Y = -\frac{1}{7} + Z$   
 $Z = Z$   
**REPEAT**