Marked example 2

Paper 1 style · No calculator

2 7 marks AHL 3.18 · 1.16 ●●● Demanding

Consider the system of equations

$$x + y + z = 2, \qquad 2x - y + z = 1, \qquad x + 4y + 2z = k,$$

where $k \in \mathbb{R}$.

(a) Find the value of k for which the system has infinitely many solutions. **[3]**

(b) For this value of k, find the general solution of the system. **[3]**

(c) Interpret the general solution geometrically. **[1]**

MARKSCHEME (a)

$R_2 - 2R_1$: $-3y - z = -3$; $R_3 - R_1$: $3y + z = k - 2$ **M1**

adding: $0 = k - 5$ **A1**

$k = 5$ **A1**

Total 3 marks

Note Eliminate x.

MARKSCHEME (b)

let $y = t$: $z = 3 - 3t$ **M1**

$x = 2 - t - (3 - 3t) = -1 + 2t$ **A1**

$(x, y, z) = (-1 + 2t, t, 3 - 3t)$ **A1**

Total 3 marks

Note A parameter for one unknown.

Note Or an equivalent form, as $\mathbf{r} = \mathbf{a} + t\mathbf{b}$.

MARKSCHEME (c)

the three planes meet in a line **A1**

Total 1 mark

Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software.
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