

Resolução de ficha nº 1 - Geometria - 11.º ano

① $Ax + y + K = 0 \Leftrightarrow Ax + y = -K \Leftrightarrow$
 $\text{tg } 45^\circ = 1 \quad \downarrow \quad y = -Ax - K$

$-A = 1 \Rightarrow \boxed{A = -1} \quad -K = 3 \Rightarrow \boxed{K = -3} \quad \text{Resposta } \textcircled{C}$

② $(x-2)^2 + (y+1)^2 = 5$



$\vec{CT} = (-1, 2) \rightarrow m = -2 \rightarrow m' = \frac{1}{2}$
 (A) $2y = x + 4$
 $y = \frac{1}{2}x + 2$
 (B) $y = -2x + 3$
 (C) $y = 2x - 1$
 (D) $x + 2y + 1 = 0$
 $2y = -x - 1$
 $y = -\frac{1}{2}x - \frac{1}{2}$

Resposta (A)

③ $M: 3x - 2y = 4 \quad \vec{u} = (3, K)$

$-2y = -3x + 4$
 $y = \frac{3}{2}x - 2$

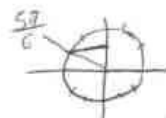
$\vec{v} = (2, 3)$

$\vec{u} \cdot \vec{v} = 0 \Leftrightarrow (2, 3) \cdot (3, K) = 0 \Leftrightarrow$

$\Leftrightarrow 6 + 3K = 0 \Leftrightarrow \boxed{K = -2}$

Resposta (B)

④ $\vec{u} \cdot \vec{v} = \|\vec{u}\| \|\vec{v}\| \cos \alpha$
 $= 3 \times 2 \times \cos \frac{5\pi}{6} =$
 $= 6 \times \left(-\frac{\sqrt{3}}{2}\right) = -3\sqrt{3}$



Resposta (B)

⑤ (B) $(x, y) = (1, 5) + K(2, 3) \quad (x, y) = (4, 0) + K(-3, 2)$

$m = \frac{3}{2}$

$m' = -\frac{2}{3}$

⑥ $M: 2x + 3y = 4 \quad \rightarrow y = Kx + L$

$3y = -2x + 4$

$y = -\frac{2}{3}x + \frac{4}{3}$

$m = -\frac{2}{3} \rightarrow m' = \frac{3}{2}$

$m' = K$

$\boxed{K = \frac{3}{2}}$

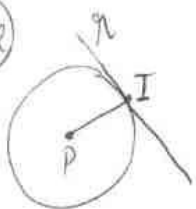
Resposta (D)

7) $\pi: y = 3x - 1$ $P(-1, 0)$

7.1) $m = 3$ $y = -\frac{1}{3}x + b$
 $m' = -\frac{1}{3}$ $(-1, 0) \rightarrow 0 = -\frac{1}{3}(-1) + b$
 $0 = \frac{1}{3} + b$

$b = -\frac{1}{3}$ Logo $y = -\frac{1}{3}x - \frac{1}{3}$
 $3y = -x - 1 \Rightarrow x + 3y + 1 = 0$

7.2)



$\begin{cases} y = 3x - 1 \\ y = -\frac{1}{3}x - \frac{1}{3} \end{cases} \Rightarrow \begin{cases} 3x - 1 = -\frac{1}{3}x - \frac{1}{3} \end{cases} \Rightarrow$
 $9x - 3 = -x - 1 \Rightarrow 10x = 2 \Rightarrow x = \frac{1}{5}$
 $y = \frac{2}{5} - 1 = -\frac{3}{5}$

$I \in (\frac{1}{5}, -\frac{3}{5})$ $P \in (-1, 0)$

$PI = \sqrt{(\frac{1}{5} + 1)^2 + (-\frac{3}{5})^2} = \sqrt{\frac{36}{25} + \frac{9}{25}} = \sqrt{\frac{45}{25}} = \sqrt{\frac{9}{5}}$
 $(x+1)^2 + y^2 = \frac{9}{5} \Rightarrow (x+1)^2 + y^2 = \frac{9}{5}$

8)

$\alpha: x + 2y - z = 2$

$\beta \parallel \alpha$

$\perp (1, 2, -1)$

$\beta: x + 2y - z + D = 0$

$(0, 1, 2) \rightarrow 0 + 2 - 2 + D = 0$
 $D = 0$

Resposta C

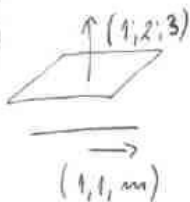
$\beta: x + 2y - z = 0$

9) C

10) $x = \frac{5 \cdot 1}{2} = 2.5$ $\textcircled{B} \quad x^2 + y^2 + (z-3)^2 = 4$

11) Como a reta s' $\perp$ plano logo Resposta A

12)



$(1, 2, 3) \cdot (1, 1, m) = 0$

$1 + 2 + 3m = 0$

$3m = -3$

$m = -1$

Resposta C

(13) $\alpha \cap 3x - z = 2$ $\pi \cap x = \frac{y}{2} = \frac{z}{3}$ $P(0, 1, 3)$

~~$0 = 3 - 3 = 0$~~

$\perp (3, 0, -1)$

$(3, 0, -1) \cdot (1, 2, 3) = 3 - 3 = 0$

~~$0 = \frac{3}{2} - \frac{3}{3} = 0$~~

$\parallel (1, 2, 3)$

$\alpha \parallel \pi$ Respuesta (C)

(14) $(2, 1, -3) \parallel (-2, m, 3)$

$\frac{2}{-2} = \frac{1}{m} = \frac{-3}{3} \Rightarrow \frac{1}{m} = -1 \Rightarrow m = -1$

Respuesta (B)

(15) $\begin{cases} \frac{x+1}{2} = \frac{y-2}{-1} = \frac{z}{3} \\ y=0 \end{cases} \Rightarrow \begin{cases} \frac{x+1}{2} = 2 \\ \frac{z}{3} = 2 \end{cases} \Rightarrow \begin{cases} x+1 = 4 \\ z = 6 \end{cases} \Rightarrow \begin{cases} x = 3 \\ y = 0 \\ z = 6 \end{cases}$

Respuesta (D)

(16) $\alpha \cap x - y + z + 1 = 0$

$\beta \cap 2x + 2y + 2z + 2 = 0$

$\perp (1, -1, 1)$

$\perp (2, 2, 2)$

$\frac{1}{2} = \frac{-1}{2} = \frac{1}{2}$ Falso

$(1, -1, 1) \cdot (2, 2, 2) = 2 - 2 + 2 = 2$

NS SS paralelos

NS SS coincidentes

NS SS perpendiculares

Respuesta (D)

(17) $(x-2)^2 + (y-3)^2 + (z-4)^2 < 14$ $A(1, 1, 1)$

$C(2, 3, 4)$

Respuesta (B)

$A(1, 1, 1)$ $C(2, 3, 4)$ $B(x, y, z)$

$\begin{cases} \frac{1+x}{2} = 2 \\ \frac{1+y}{2} = 3 \\ \frac{1+z}{2} = 4 \end{cases} \Rightarrow \begin{cases} 1+x = 4 \\ 1+y = 6 \\ 1+z = 8 \end{cases} \Rightarrow \begin{cases} x = 3 \\ y = 5 \\ z = 7 \end{cases}$

18 (I) $\begin{cases} x - y + 2z = 1 \\ 3x - 3y + 6z = 5 \\ x - 2y + z = 4 \end{cases} \rightarrow \begin{matrix} \perp (1, -1, 2) \\ \perp (3, -3, 6) \end{matrix} \rightarrow \begin{matrix} \perp (1, -1, 2) \\ \perp (1, -1, 2) \end{matrix}$
 $\rightarrow$ paralelas
 Situação (E)

(II) $\begin{cases} x - y + 2z = 1 \\ 3x - 3y + 6z = 3 \\ x - 2y + z = 4 \end{cases} \rightarrow$ coincidentes
 Situação (D)

(III) $\begin{cases} 2x + 3y + z = 4 \\ 2x - y = -1 \\ 6x + y - z = 0 \end{cases} \rightarrow \begin{cases} 2x + 3y + z = 4 \\ 6x - 3y = -3 \\ 18x + 3y - 3z = 0 \end{cases} \rightarrow \begin{cases} 24x - 3z = -3 \\ 2x + z = 1 \end{cases}$

$\begin{cases} 2x - z = -1 \\ 2x + z = 1 \end{cases} \rightarrow \begin{cases} 16x = 0 \\ 16x = 0 \end{cases} \rightarrow \begin{cases} x = 0 \\ -3y = -3 \end{cases} \rightarrow \begin{cases} x = 0 \\ y = 1 \\ z = 1 \end{cases}$ Situação (C)

(IV) $\begin{cases} 2x + 3y + z = 4 \\ 2x + y = 1 \\ 6x + y - z = 0 \end{cases} \rightarrow \begin{cases} 2x + 3y + z = 4 \\ 6x + 3y = 3 \\ -18x - 3y + 3z = 0 \end{cases} \rightarrow \begin{cases} -16x + 4z = 4 \\ -12x + 3z = 3 \end{cases} \rightarrow \begin{cases} -8x + 2z = 2 \\ 4x + z = -1 \end{cases}$

$\begin{cases} -8x + 2z = 2 \\ 4x + z = -1 \end{cases} \rightarrow \begin{cases} -2x + z = 1 \\ 4x + z = -1 \end{cases} \rightarrow \begin{cases} -2x + z = 1 \\ 0 = 0 \end{cases}$

Situação (B)

(V) $\begin{cases} 2x + 3y + z = 4 \\ 2x + y = 5 \\ 6x + y - z = 0 \end{cases} \rightarrow \begin{cases} 2x + 3y + z = 4 \\ 6x + 3y = 15 \\ -18x - 3y + 3z = 0 \end{cases} \rightarrow \begin{cases} -16x + 4z = 4 \\ -12x + 3z = 15 \end{cases} \rightarrow \begin{cases} -4x + z = 1 \\ -4x + z = 5 \end{cases}$

$\begin{cases} -4x + z = 1 \\ 4x - z = -5 \end{cases} \rightarrow \begin{cases} 0 = -4 \end{cases}$ imp. Situação (A)

$$(19) \quad \frac{x+1}{-3} = \frac{z-2}{3} = y-4 \quad (\Rightarrow) \quad \frac{x+1}{-3} = \frac{y-4}{1} = \frac{z-2}{3}$$

$$a) \quad P(-1, 4, 2) \quad \vec{n} = (-3, 1, 3)$$

$$b) \quad \begin{cases} \frac{x+1}{-3} = -4 \\ \frac{z-2}{3} = -4 \\ y = 0 \end{cases} \quad \begin{cases} x+1 = 12 \\ z-2 = -12 \\ y = 0 \end{cases} \quad \begin{cases} x = 11 \\ z = -10 \\ y = 0 \end{cases} \quad I = (11, 0, -10)$$

$$c) \quad A(0, 1, -1) \quad // (-3, 1, 3)$$

$$\frac{x}{-3} = \frac{y-1}{1} = \frac{z+1}{3}$$



$$-3x + y + 3z + D = 0$$

$$(0, 0, 0) \rightarrow D = 0$$

$$\text{Homod. } -3x + y + 3z = 0$$

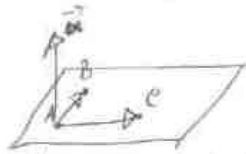
$$\begin{cases} -3x + y + 3z = 0 \\ \frac{x}{-3} = y-1 \\ \frac{x}{-3} = \frac{z+1}{3} \end{cases} \quad \begin{cases} x = -3y + 3 \quad (3) \\ x = -z - 1 \quad (3) \end{cases} \quad \begin{cases} -3x + y + 3z = 0 \\ x + 3y = 3 \\ x + z = -1 \end{cases}$$

$$\begin{cases} -3x + y + 3z = 0 \\ 3x + 9y = 9 \\ 3x + 3z = -3 \end{cases} \quad \begin{cases} 10y + 3z = 9 \\ y + 6z = -3 \end{cases} \quad \begin{cases} -20y - 6z = -18 \\ y + 6z = -3 \\ \hline -19y = -21 \end{cases}$$

$$\begin{cases} y = \frac{21}{19} \\ \frac{21}{19} + 6z = -3 \end{cases} \quad \begin{cases} 6z = -3 - \frac{21}{19} \\ 6z = -\frac{78}{19} \end{cases} \quad \begin{cases} 6z = -\frac{78}{19} \\ z = -\frac{13}{19} \end{cases} \quad \begin{cases} y = \frac{21}{19} \\ z = -\frac{13}{19} \\ x = \frac{13}{19} - 1 \end{cases}$$

$$\begin{cases} y = \frac{21}{19} \\ z = -\frac{13}{19} \\ x = -\frac{6}{19} \end{cases} \quad I \cap \left(-\frac{6}{19} ; \frac{21}{19} ; -\frac{13}{19} \right)$$

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$$A(3, 0, 0)$$

$$B(0, 2, 0)$$

$$C(0, 0, 5)$$

$$\vec{AB} = (-3, 2, 0)$$

$$\vec{AC} = (0, -2, 5)$$

$$\begin{cases} \vec{n} \cdot \vec{AB} = 0 \\ \vec{n} \cdot \vec{AC} = 0 \end{cases} \begin{cases} (x, y, z) \cdot (-3, 2, 0) = 0 \\ (x, y, z) \cdot (0, -2, 5) = 0 \end{cases}$$

$$\begin{cases} -3x + 2y = 0 \\ -2y + 5z = 0 \end{cases} \begin{cases} 3x = 2y \\ 5z = 2y \end{cases} \begin{cases} x = \frac{2}{3}y \\ z = \frac{2}{5}y \end{cases}$$

$$\vec{n} = \left(\frac{2}{3}y; y; \frac{2}{5}y \right) \times 15 = (10; 15; 6)$$

$$10x + 15y + 6z + D = 0$$

$$(0, 0, 5) \rightarrow 0 + 0 + 30 + D = 0$$

$$D = -30$$

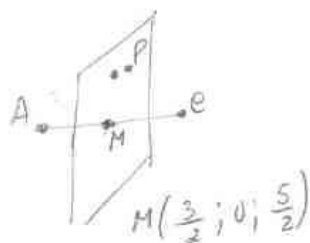
$$\alpha \vee 10x + 15y + 6z - 30 = 0$$

Plano 1 que passa pelo origem: $\frac{x}{10} = \frac{y}{15} = \frac{z}{6}$

$$\begin{cases} 10x + 15y + 6z - 30 = 0 \\ \frac{x}{10} = \frac{y}{15} \\ \frac{y}{15} = \frac{z}{6} \end{cases} \begin{cases} 10x + 15y + 6z - 30 = 0 \\ 15x - 10y = 0 \\ 6x - 10z = 0 \end{cases} \begin{cases} 30x + 45y + 18z - 90 = 0 \\ 30x - 20y = 0 \\ -30x + 50z = 0 \end{cases}$$

$$\begin{cases} 45y + 68z - 90 = 0 \\ -20y + 50z = 0 \end{cases} \Rightarrow \begin{cases} 45 \times \frac{5}{2} + 68z - 90 = 0 \\ y = \frac{5}{2}z \end{cases} \Rightarrow \begin{cases} \frac{225}{2} + 68z - 90 = 0 \\ z = -\frac{45}{68} \end{cases} \\
 \begin{cases} 68z = 90 - \frac{225}{2} \\ z = -\frac{45}{68} \end{cases} \Rightarrow \begin{cases} 68z = -45 \\ y = \frac{5}{2} \times (-\frac{45}{68}) \end{cases} \Rightarrow \begin{cases} z = -\frac{45}{68} \\ y = -\frac{225}{136} \end{cases} \\
 \begin{cases} 6x - 10(-\frac{45}{68}) = 0 \\ 6x + \frac{450}{68} = 0 \end{cases} \Rightarrow \begin{cases} 6x = -\frac{450}{68} \\ x = -\frac{225}{204} = -\frac{75}{68} \end{cases} \\
 \Rightarrow \omega \left(-\frac{75}{68}; -\frac{225}{136}; -\frac{45}{68} \right)$$

b) $A(3, 0, 0)$ $C(0, 0, 5)$



(1°) $\overline{AP} = \overline{CP} \Leftrightarrow$
 $\Rightarrow (x-3)^2 + y^2 + z^2 = x^2 + y^2 + (z-5)^2$
 $\Rightarrow x^2 - 6x + 9 + y^2 + z^2 = x^2 + y^2 + z^2 - 10z + 25$
 $\Rightarrow -6x + 10z - 16 = 0 \Leftrightarrow$
 $\Rightarrow 6x - 10z + 16 = 0 \Leftrightarrow$
 $\Rightarrow \boxed{3x - 5z + 8 = 0}$

(2°) $\overrightarrow{AC} \cdot \overrightarrow{MP} = 0$
 $\Rightarrow (-3, 0, 5) \cdot (x - \frac{3}{2}, y, z - \frac{5}{2}) = 0$
 $\Rightarrow -3x + \frac{9}{2} + 5z - \frac{25}{2} = 0$
 $\Rightarrow -3x + 5z - \frac{16}{2} = 0$
 $\Rightarrow \boxed{3x - 5z + 8 = 0}$

(3°) plano $\perp \overrightarrow{AC} = (-3, 0, 5)$ e passa por M
 $-3x + 5z + D = 0$
 $M(\frac{3}{2}, 0, \frac{5}{2}) \Rightarrow -\frac{9}{2} + \frac{25}{2} + D = 0$
 $\frac{16}{2} + D = 0$
 $D = -8$
 $-3x + 5z - 8 = 0$
 $\boxed{3x - 5z + 8 = 0}$

(21) $\alpha \cap 2x - y + z + 1 = 0 \quad P(-1, 1, 2)$

a) $2x - y + z + 0 = 0$

$P(-1, 1, 2) \rightarrow -2 - 1 + 2 + 0 = 0$
 $0 = 1$

$\beta \cap 2x - y + z + 1 = 0$

(22) a) $\begin{cases} x + y = 2 \\ x + y + z = 3 \\ z = -1 \end{cases} \Rightarrow \begin{cases} x + y = 2 \\ x + y = 4 \end{cases} \text{ imp.}$

Como não há planos paralelos, 

b) $\begin{cases} x + y - z = 1 \\ x - 3y + 2z = 0 \\ 2x + 2y - 2z = 3 \end{cases} \rightarrow \text{paralelos}$



2 paralelos e uma secante.

c) (2) $\begin{cases} x + y - z = 1 \\ x - 3y + 2z = 0 \end{cases} \Rightarrow \begin{cases} 2x + 2y - 2z = 2 \\ x - 3y + 2z = 0 \end{cases} \Rightarrow \begin{cases} 3x - y = 2 \\ 6x = 10 \end{cases} \Rightarrow \begin{cases} 3x \cdot \frac{5}{3} - y = 2 \\ x = \frac{5}{3} \end{cases}$

(2) $\begin{cases} 2x - y + z = 4 \\ 4x - 2y + 2z = 8 \end{cases} \Rightarrow \begin{cases} 5 - y = 2 \\ y = 3 \\ x = \frac{5}{3} \\ z = 3 + \frac{5}{3} - 1 \end{cases} \Rightarrow \begin{cases} y = 3 \\ x = \frac{5}{3} \\ z = \frac{11}{3} \end{cases}$

$I \cap (\frac{5}{3}, 3, \frac{11}{3})$

Concorrentes

(23) Circunferência

Centro $(3, 2)$

raio $= 2$

$(x-3)^2 + (y-2)^2 \leq 4$

Recta r

$m = \frac{2}{3}$

$y = \frac{2}{3}x$

Recta s

$s \perp r$ logo $m = -\frac{3}{2}$

$y = -\frac{3}{2}x + b$

$(3, 2) \rightarrow 2 = -\frac{9}{2} + b$

$b = \frac{13}{2}$

$y = -\frac{3}{2}x + \frac{13}{2}$

Condição: $(x-3)^2 + (y-2)^2 \leq 4 \wedge y \geq \frac{2}{3}x \wedge y \geq -\frac{3}{2}x + \frac{13}{2}$

$$(24) \quad \vec{AP} \cdot \vec{BP} = 0 \Leftrightarrow (x-3; y-1; z-2) \cdot (x-5; y+1; z) = 0$$

$$\Leftrightarrow x^2 - 5x - 3x + 15 + y^2 + y - 1 + z^2 - 2z = 0$$

$$\Leftrightarrow x^2 + y^2 + z^2 - 8x - 2z + 14 = 0$$

$$C = \text{Centro} = \text{ponto médio} = \left(\frac{3+5}{2}, \frac{1+1}{2}, \frac{2+0}{2} \right) = (4, 0, 1)$$

$$R = r_0 = \overline{CB} = \sqrt{4^2 + 1^2 + 1^2} = \sqrt{18} \quad \text{Resposta } (3)$$

$$(25) \quad A(6, 0, -3) \quad E(6, 0, 3)$$

$$B(6, 6, -3) \quad F(6, 6, 3)$$

$$C(0, 6, -3) \quad G(0, 6, 3)$$

$$D(0, 0, -3) \quad H(0, 0, 3)$$

$$(25.2) \quad \vec{LJ} = (-6, 6, 0)$$

$$-6x + 6y + 0 = 0$$

$$A(6, 0, -3) \rightarrow -36 + 0 + 0 = 0$$

$$D = 36$$

$$\Rightarrow -6x + 6y + 36 = 0$$

$$\boxed{x - y - 6 = 0}$$

$$(25.3) \quad \text{Ponto médio de } [LJ] = M(3; 3; 0)$$

$$\vec{MP} \cdot \vec{LJ} = 0 \Leftrightarrow (x-3; y-3; z) \cdot (-6, 6, 0) = 0$$

$$\Leftrightarrow -6x + 6y = 0 \Leftrightarrow \boxed{x - y = 0}$$

$$H(0, 0, 3) \rightarrow 0 - 0 = 0 \quad \text{verdadeiro}$$

$$F(6, 6, 3) \rightarrow 6 - 6 = 0 \quad \text{verdadeiro}$$

Como H e F estão ambos no plano, a reta HF pertence ao plano.



$$L(6, 0, 0)$$

$$K(3, 6, 3)$$

$$J(0, 6, 0)$$

$$\vec{LK} = (-3, 6, 3) \quad \vec{LJ} = (-6, 6, 0)$$

$$\vec{u} \cdot \vec{LK} = 0 \quad \vec{u} \cdot \vec{LJ} = 0$$

$$(x, y, z) \cdot (-3, 6, 3) = 0 \quad (x, y, z) \cdot (-6, 6, 0) = 0$$

$$\begin{cases} -3x + 6y + 3z = 0 \\ -6x + 6y = 0 \end{cases} \Rightarrow \begin{cases} -x + 2y + z = 0 \\ -x + y = 0 \end{cases} \Rightarrow \begin{cases} -x + 2x - z = 0 \\ y = x \end{cases} \Rightarrow \begin{cases} z = x \\ y = x \end{cases}$$

$$\vec{u} = (x, x, x) \rightarrow (1, 1, 1)$$

$$x + y + z + D = 0$$

$$(0, 6, 0) \rightarrow 0 + 6 + 0 + D = 0$$

$$D = -6$$

$$\text{plano } \omega \quad \boxed{x + y + z - 6 = 0}$$

$$\begin{cases} x + y + z - 6 = 0 \\ x = 0 \\ y = 0 \end{cases} \Rightarrow \begin{cases} z = 6 \\ z = 6 \end{cases} \quad I \omega(0, 0, 6)$$

25.5 $\alpha \cap x+y+z-6=0$

Plano FB $\begin{cases} x=6 \\ y=6 \end{cases}$

Interseção

$$\begin{cases} x+y+z-6=0 \\ x=6 \\ y=6 \end{cases} \Rightarrow \begin{cases} 6+6+z-6=0 \\ z=-6 \end{cases} \Rightarrow \begin{cases} z=-6 \\ x=6 \\ y=6 \end{cases} \Rightarrow \alpha \cap (6, 6, -6)$$

25.6 a) $\vec{AP} \cdot \vec{GP} = 0 \Leftrightarrow (x-6, y, z+3) \cdot (x, y-6, z-3) = 0$

$\Leftrightarrow x^2 - 6x + y^2 - 6y + z^2 - 9 = 0 \Leftrightarrow$

$\Leftrightarrow (x-3)^2 + (y-3)^2 + z^2 = 9 + 9 + 9$

$\Leftrightarrow (x-3)^2 + (y-3)^2 + z^2 = 27 \rightarrow$ Sup. esf. de centro $(3, 3, 0)$ e r.a. = $\sqrt{27}$

b) $\vec{MP} = (x-3, y-3, z) \quad \vec{IK} = (0, 6, -6)$

$\vec{MP} \cdot \vec{IK} = 0 \Leftrightarrow 6y - 18 - 6z = 0 \Leftrightarrow y - z - 3 = 0$

$I(3, 0, 3)$

$J(0, 6, 0)$

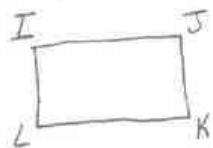
$K(3, 6, -3)$

$L(6, 0, 0)$

Plano mediatriz de $[IK]$.

25.7 $\vec{IJ} = (-3, 6, -3) \quad \vec{IL} = (3, 0, -3)$

$\vec{IJ} \cdot \vec{IL} = -9 + 0 + 9 = 0$ Logo $\vec{IJ} \perp \vec{IL}$



$\overline{IK} = \sqrt{9+36+9} = \sqrt{54}$

$\overline{IL} = \sqrt{9+0+9} = \sqrt{18}$

$A = \sqrt{54} \times \sqrt{18} = 3\sqrt{6} \times 3\sqrt{2} = 9\sqrt{12} = 9 \times 2\sqrt{3} = 18\sqrt{3}$