Lista 3 - Geometria Analítica

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1. $X = \begin{bmatrix} -18/5 \\ 21/5 \\ -2 \end{bmatrix}$ // $\quad AX = B$

$A = \begin{bmatrix} 1 & 3 & 4 \\ -1 & 2 & 5 \\ -2 & -1 & 3 \end{bmatrix} \quad X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix}$

$AX = B$

$\begin{bmatrix} 1 & 3 & 4 \\ -1 & 2 & 5 \\ -2 & -1 & 3 \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix} \qquad \begin{cases} x_1 + 3x_2 + 4x_3 = 1 & (1) \\ -x_1 + 2x_2 + 5x_3 = 2 & (2) \\ -2x_1 - x_2 + 3x_3 = -3 & (3) \end{cases}$

$(1) + (2) = (x_1 + 3x_2 + 4x_3) + (-x_1 + 2x_2 + 5x_3) = 1 + 2 \rightarrow 5x_2 + 9x_3 = 3 \quad (4)$

$2.(1) + (3) = (2x_1 + 6x_2 + 8x_3) + (-2x_1 - x_2 + 3x_3) = 2 - 3 \rightarrow 5x_2 + 11x_3 = -1 \quad (5)$

$(5) - (4) = (5x_2 + 11x_3) - (5x_2 + 9x_3) = -1 - (+3) = 2x_3 = -4 \rightarrow \boxed{x_3 = -2}$

$(4) = 5x_2 + 9.(-2) = 3 \rightarrow 5x_2 = 21 \rightarrow \boxed{x_2 = 21/5}$

$(1) = x_1 + 3.\left(\frac{21}{5}\right) + 4.(-2) = 1 \rightarrow x_1 + \frac{63}{5} - \frac{40}{5} = 1 \rightarrow x_1 = 1 - \frac{23}{5} \rightarrow \boxed{x_1 = -\frac{18}{5}}$

2 - a) $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix} X = \begin{bmatrix} 2 \\ -1 \end{bmatrix} \qquad X = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$ //

$A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ det (A) = 3 - 8 = -5

$A^{-1} = \frac{1}{-5} \cdot \begin{bmatrix} 3 & -4 \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} -3/5 & 4/5 \\ 2/5 & -1/5 \end{bmatrix}$

$X = A^{-1} \cdot B \Rightarrow X = \begin{bmatrix} -3/5 & 4/5 \\ 2/5 & -1/5 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ -1 \end{bmatrix} \rightarrow X = \begin{bmatrix} -\frac{3}{5} \cdot 2 + \frac{4}{5} \cdot (-1) \\ \frac{2}{5} \cdot 2 + \left(-\frac{1}{5}\right) \cdot (-1) \end{bmatrix} = \begin{bmatrix} -\frac{6}{5} - \frac{4}{5} \\ \frac{4}{5} + \frac{1}{5} \end{bmatrix} = \begin{bmatrix} -\frac{10}{5} \\ \frac{5}{5} \end{bmatrix} = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$ //

2-b) $\begin{bmatrix} 2 & 3 \\ 5 & 5 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix} Y = \begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix}$ $\qquad Y = \begin{bmatrix} -1 & 4 \\ 0 & -2 \end{bmatrix}$

$\begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix} Y = \begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix} - \begin{bmatrix} 2 & 3 \\ 5 & 5 \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix} Y = \overbrace{\begin{bmatrix} -1 & 0 \\ -3 & 2 \end{bmatrix}}^{B}$

$A \cdot Y = B \qquad \det(A) = 5 - 6 = -1$

$A^{-1} = \frac{1}{-1} \cdot \begin{bmatrix} 5 & -2 \\ -3 & 1 \end{bmatrix} \rightarrow A^{-1} = \begin{bmatrix} -5 & 2 \\ 3 & -1 \end{bmatrix}$

$Y = A^{-1} \cdot B \rightarrow Y = \begin{bmatrix} -5 & 2 \\ 3 & -1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 0 \\ -3 & 2 \end{bmatrix} \Rightarrow Y = \begin{bmatrix} (-5).(-1) + 2.(-3) & (-5).0 + 2.2 \\ 3(-1) + (-1).(-3) & 3.0 + (-1).2 \end{bmatrix} \rightarrow Y = \begin{bmatrix} -1 & 4 \\ 0 & -2 \end{bmatrix}$ //

2-c) $\begin{bmatrix} 1 & 0 & 0 \\ 2 & -1 & 0 \\ 2 & 3 & 1 \end{bmatrix} \cdot W = \begin{bmatrix} 5 \\ 7 \\ 2 \end{bmatrix}$ $\qquad W = \begin{bmatrix} 5 \\ 3 \\ -17 \end{bmatrix}$

$A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & -1 & 0 \\ 2 & 3 & 1 \end{bmatrix} \quad W = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix} \quad \begin{cases} 1 \cdot w_1 = 5 \rightarrow w_1 = 5 \,// \\ 2w_1 - w_2 = 7 \rightarrow 10 - w_2 = 7 \rightarrow w_2 = 3 \,// \\ 2w_1 + 3w_2 + w_3 = 2 \rightarrow 10 + 9 + w_3 = 2 \rightarrow w_3 = -17 \,// \end{cases}$

3-a) $AXB = C \qquad X = A^{-1}CB^{-1}$

$A^{-1}AXB = A^{-1}C \rightarrow XB = A^{-1}C \rightarrow X = A^{-1}CB^{-1}$ //

3-b) $A(B + X) = A \qquad X = I - B$ //

$AB + AX = A$

$AX = A - AB \rightarrow AX = A(I - B) \rightarrow X = A^{-1}A(I - B) \rightarrow X = I\,(I - B) \rightarrow X = I - B$ //

3-c) $ACXB = C \qquad X = C^{-1}A^{-1}CB^{-1}$ //

$CXB = A^{-1}C$

$XB = C^{-1}A^{-1}C$

$X = C^{-1}A^{-1}CB^{-1}$ //

3-d) $(AB)^{-1}(AX) = CC^{-1} \qquad X = B$ //

$CC^{-1} = I \qquad B^{-1}A^{-1}(AX) = I$

$B^{-1}(A^{-1}A)X = I$

$B^{-1}IX = I$

$B^{-1}X = I \rightarrow X = B$ //

3 - e) $AB^T X B^{-1} = A^T$ $\qquad X = (AB)^{-1} A^T B$

$XB^{-1} = (AB^T)^{-1} A^T$

$X = (AB^T)^{-1} A^T B$

3 - f) $2AX - X = 3B$ $\qquad X = 3.(2A - I)^{-1} B$

$(2A - I)X = 3B$

$X = (2A - I)^{-1} 3B \rightarrow X = 3.(2A - I)^{-1} B$

4 - a) $\begin{cases} 3x - 4y = 1 \\ 2x + 6y = 18 \end{cases}$ $\qquad (x, y) = (3, 2)$

$A = \begin{bmatrix} 3 & -4 \\ 2 & 6 \end{bmatrix}, A_x = \begin{bmatrix} 1 & -4 \\ 18 & 6 \end{bmatrix}, A_y = \begin{bmatrix} 3 & 1 \\ 2 & 18 \end{bmatrix}$

$\det(A) = 3.6 - (-4).2 = 18 + 8 = 26$

$\det(A_x) = 1.6 - (-4).18 = 6 + 72 = 78$

$\det(A_y) = 3.18 - 1.2 = 54 - 2 = 52$

$x = \frac{\det(A_x)}{\det(A)} = \frac{78}{26} = 3$

$y = \frac{\det(A_y)}{\det(A)} = \frac{52}{26} = 2$

4 - b) $\begin{cases} 5x + 8y = 34 \quad (1) \\ 10x + 16y = 50 \quad (2) \end{cases}$

$A = \begin{bmatrix} 5 & 8 \\ 10 & 16 \end{bmatrix}$ $\quad \det(A) = 5.16 - 8.10 = 80 - 80 = 0$

$(2) = 2.(1) \rightarrow 10x + 16y = 68 \neq 50$

Não há resolução, sistema inconsistente.

4 - c) $\begin{cases} x + 2y = 5 \\ 2x - 3y = -4 \end{cases}$ $\qquad (x, y) = (1, 2)$

$A = \begin{bmatrix} 1 & 2 \\ 2 & -3 \end{bmatrix}, A_x = \begin{bmatrix} 5 & 2 \\ -4 & -3 \end{bmatrix}, A_y = \begin{bmatrix} 1 & 5 \\ 2 & -4 \end{bmatrix}$

$\det(A) = -3 - 4 = -7$

$\det(A_x) = -15 + 8 = -7$

$\det(A_y) = -4 - 10 = -14$

$x = \frac{\det(A_x)}{\det(A)} = \frac{-7}{-7} = 1, \quad y = \frac{\det(A_y)}{\det(A)} = \frac{-14}{-7} = 2$

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

$$A=\begin{bmatrix} 3 & 2 & -5 \\ 2 & -4 & -2 \\ 1 & -2 & -3 \end{bmatrix}, A_x=\begin{bmatrix} 8 & 2 & -5 \\ -4 & -4 & -2 \\ -4 & -2 & -3 \end{bmatrix}, A_y=\begin{bmatrix} 3 & 8 & -5 \\ 2 & -4 & -2 \\ 1 & -4 & -3 \end{bmatrix}, A_z=\begin{bmatrix} 3 & 2 & 8 \\ 2 & -4 & -4 \\ 1 & -2 & -4 \end{bmatrix}$$

$$\det(A)=3.\begin{vmatrix} -4 & -2 \\ -2 & -3 \end{vmatrix}-2\begin{vmatrix} 2 & -2 \\ 1 & -3 \end{vmatrix}-5\begin{vmatrix} 2 & -4 \\ 1 & -2 \end{vmatrix}=3.(12-4)-2.(-6+2)-5.(-4+4)=24+8+0=32$$

$$\det(A_x)=8.\begin{vmatrix} -4 & -2 \\ -2 & -3 \end{vmatrix}-2\begin{vmatrix} -4 & -2 \\ -4 & -3 \end{vmatrix}-5\begin{vmatrix} -4 & -4 \\ -4 & -2 \end{vmatrix}=8.(12-4)-2(12-8)-5(8-16)=64-8+40=96$$

$$\det(A_y)=3\begin{vmatrix} -4 & -2 \\ -4 & -3 \end{vmatrix}-8\begin{vmatrix} 2 & -2 \\ 1 & -3 \end{vmatrix}-5\begin{vmatrix} 2 & -4 \\ 1 & -4 \end{vmatrix}=3.(12-8)-8(-6+2)-5(-8+4)=12+32+20=64$$

$$\det(A_z)=3.\begin{vmatrix} -4 & -4 \\ -2 & -4 \end{vmatrix}-2\begin{vmatrix} 2 & -4 \\ 1 & -4 \end{vmatrix}+8\begin{vmatrix} 2 & -4 \\ 1 & -2 \end{vmatrix}=3(16-8)-2(-8+4)+8(-4+4)=24+8+0=32$$

$$x=\frac{\det(A_x)}{\det(A)}=\frac{96}{32}=3,\quad y=\frac{\det(A_y)}{\det(A)}=\frac{64}{32}=2,\quad z=\frac{\det(A_z)}{\det(A)}=\frac{32}{32}=1$$

4-e) $\begin{cases} x+2y-z=2 \\ 2x-y+3z=9 \\ 3x+3y-2z=3 \end{cases}$ $(x,y,z)=(1,2,3)$

$$A=\begin{bmatrix} 1 & 2 & -1 \\ 2 & -1 & 3 \\ 3 & 3 & -2 \end{bmatrix}, A_x=\begin{bmatrix} 2 & 2 & -1 \\ 9 & -1 & 3 \\ 3 & 3 & -2 \end{bmatrix}, A_y=\begin{bmatrix} 1 & 2 & -1 \\ 2 & 9 & 3 \\ 3 & 3 & -2 \end{bmatrix}, A_z=\begin{bmatrix} 1 & 2 & 2 \\ 2 & -1 & 9 \\ 3 & 3 & 3 \end{bmatrix}$$

$$\det(A)=1.\begin{bmatrix} -1 & 3 \\ 3 & -2 \end{bmatrix}-2\begin{bmatrix} 2 & 3 \\ 3 & -2 \end{bmatrix}-1\begin{bmatrix} 2 & -1 \\ 3 & 3 \end{bmatrix}=1.(2-9)-2(-4-9)-1(6+3)=-7+26-9=10$$

$$\det(A_x)=2\begin{bmatrix} -1 & 3 \\ 3 & 2 \end{bmatrix}-2\begin{bmatrix} 9 & 3 \\ 3 & -2 \end{bmatrix}-1\begin{bmatrix} 9 & -1 \\ 3 & 3 \end{bmatrix}=2.(2-9)-2(-18-9)-1(27+3)=-14+54-30=10$$

$$\det(A_y)=1.\begin{bmatrix} 9 & 3 \\ 3 & -2 \end{bmatrix}-2\begin{bmatrix} 2 & 3 \\ 3 & -2 \end{bmatrix}-1\begin{bmatrix} 2 & 9 \\ 3 & 3 \end{bmatrix}=1(-18-9)-2(-4-9)-1(6-27)=-27+26+21=20$$

$$\det(A_z)=1\begin{bmatrix} -1 & 9 \\ 3 & 3 \end{bmatrix}-2\begin{bmatrix} 2 & 9 \\ 3 & 3 \end{bmatrix}+2\begin{bmatrix} 2 & -1 \\ 3 & 3 \end{bmatrix}=1(-3-27)-2(6-27)+2(6+3)=-30+42+18=30$$

$$x=\frac{\det(A_x)}{\det(A)}=\frac{10}{10}=1,\quad y=\frac{\det(A_y)}{\det(A)}=\frac{20}{10}=2,\quad z=\frac{\det(A_z)}{\det(A)}=\frac{30}{10}=3$$

4-f) $\begin{cases} x+3z=-8 \\ 2x-4y=-4 \\ 3x-2y-5z=26 \end{cases}$ $\quad (x,y,z)=(4,3,-4)$

$A=\begin{bmatrix} 1 & 0 & 3 \\ 2 & -4 & 0 \\ 3 & -2 & -5 \end{bmatrix}, A_x=\begin{bmatrix} -8 & 0 & 3 \\ -4 & -4 & 0 \\ 26 & -2 & -5 \end{bmatrix}, A_y=\begin{bmatrix} 1 & -8 & 3 \\ 2 & -4 & 0 \\ 3 & 26 & -5 \end{bmatrix}, A_z=\begin{bmatrix} 1 & 0 & -8 \\ 2 & -4 & -4 \\ 3 & -2 & 26 \end{bmatrix}$

$det(A)=1\begin{bmatrix} -4 & 0 \\ -2 & -5 \end{bmatrix}-0\begin{bmatrix} 2 & 0 \\ 3 & -5 \end{bmatrix}+3\begin{bmatrix} 2 & -4 \\ 3 & -2 \end{bmatrix}=1(20-0)+3(-4+12)=20+24=44$

$det(A_x)=-8\begin{bmatrix} -4 & 0 \\ -2 & -5 \end{bmatrix}-0\begin{bmatrix} -4 & 0 \\ 26 & -5 \end{bmatrix}+3\begin{bmatrix} -4 & -4 \\ 26 & -2 \end{bmatrix}=8.(20-0)+3(8+104)=-160+336=176$

$det(A_y)=1\begin{bmatrix} -4 & -4 \\ -2 & 26 \end{bmatrix}-(-8)\begin{bmatrix} 2 & 0 \\ 3 & -5 \end{bmatrix}+3\begin{bmatrix} 2 & -4 \\ 3 & 26 \end{bmatrix}=1.(20-0)+8(-10-0)+3(52+12)=20-80+192=132$

$det(A_z)=1\begin{bmatrix} -4 & -4 \\ -2 & 26 \end{bmatrix}-0\begin{bmatrix} 2 & -4 \\ 3 & 26 \end{bmatrix}+(-8)\begin{bmatrix} 2 & -4 \\ 3 & -2 \end{bmatrix}=1.(-104-8)-8(-4+12)=-112-64=-176$

$x=\dfrac{det(A_x)}{det(A)}=\dfrac{176}{44}=4, \quad y=\dfrac{det(A_y)}{det(A)}=\dfrac{132}{44}=3, \quad z=\dfrac{det(A_z)}{det(A)}=\dfrac{-176}{44}=-4$

4-g) $\begin{cases} x+2y+3z=10 \\ 3x+4y+6z=23 \\ 3x+2y+3z=10 \end{cases}$

$A=\begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 6 \\ 3 & 2 & 3 \end{bmatrix}$ $\quad det(A)=1\begin{bmatrix} 4 & 6 \\ 2 & 3 \end{bmatrix}-2\begin{bmatrix} 3 & 6 \\ 3 & 3 \end{bmatrix}+3\begin{bmatrix} 3 & 4 \\ 3 & 2 \end{bmatrix}=0+18-18=0$

$2x=0 \rightarrow x=0 \; ; \; 2.(2y+3z=10) \rightarrow 4y+6z=20 \neq 23$

Não há solução, o sistema é inconsistente.

5-a) $\begin{cases} 3x_1-4x_2=0 \\ -6x_1+8x_2=0 \end{cases}$

$A=\begin{bmatrix} 3 & -4 \\ -6 & 8 \end{bmatrix}$ $det(A)=3.8-(-4).(-6)=24-24=0$

$det=0 \rightarrow$ infinitas soluções

Sistema possível e indeterminado.

5-b) $\begin{cases} x+y+z=0 \\ 2x+2y+4z=0 \\ x+y+3z=0 \end{cases}$

$A=\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 4 \\ 1 & 1 & 3 \end{bmatrix}$ $\det(A)=1.\begin{vmatrix} 2 & 4 \\ 1 & 3 \end{vmatrix}-1\begin{vmatrix} 2 & 4 \\ 1 & 3 \end{vmatrix}+1\begin{vmatrix} 2 & 2 \\ 1 & 1 \end{vmatrix}=1(6-4)-1(6-4)+1(2-2)=2-2+0=0$

$z=0$; $y=-x$; $x=x$ livre → infinitas soluções (dependem de 1 parâmetro).
Sistema possível e indeterminado.

5-c) $\begin{cases} x+y+2z=0 \\ x-y-3z=0 \\ x+4y=0 \end{cases}$

$A=\begin{bmatrix} 1 & 1 & 2 \\ 1 & -1 & -3 \\ 1 & 4 & 0 \end{bmatrix}$ $\det(A)=1.\begin{vmatrix} -1 & -3 \\ 4 & 0 \end{vmatrix}-1\begin{vmatrix} 1 & -3 \\ 1 & 0 \end{vmatrix}+2\begin{vmatrix} 1 & -1 \\ 1 & 4 \end{vmatrix}=1(0+12)-1(0+3)+2(4+1)$

$\det(A)=12-3+10=19$

$\det\neq 0$, uma única solução.
Sistema possível e determinado.

6-a) $\begin{cases} 3x+my=2 \\ x-y=1 \end{cases}$ $m\neq 3$

$A=\begin{bmatrix} 3 & m \\ 1 & -1 \end{bmatrix}$ $\det(A)=3.(-1)-m.1=-3-m$

Condição para SPD ($\det(A)\neq 0$): $-3-m\neq 0 \Rightarrow m\neq 3$

6-b) $\begin{cases} 3x+2(m-1)y=1 \\ mx-4y=0 \end{cases}$ Qualquer $m\in\mathbb{R}$.

$A=\begin{bmatrix} 3 & 2(m-1) \\ m & -4 \end{bmatrix}$ $\det(A)=3.(-4)-[2(m-1)]m=-12-2m(m-1)=-2m^2+2m-12$

$-2m^2+2m-12\neq 0 \rightarrow 2m^2-2m+12\neq 0$

$\Delta=(-2)^2-4.2.12=4-96=-92<0$

$\det(A)\neq 0$ para todo $m\in\mathbb{R}$.

6-c) $\begin{cases} x - y = 2 \\ x + my = -z \\ -x + y - z = 4 \end{cases}$ $m \neq 1$

$\begin{cases} x - y = 2 \\ x + my + z = 0 \\ -x + y - (-x - my) = 4 \rightarrow -x + y + x + my = 4 \rightarrow y(1+m) = 4 \end{cases}$

$A = \begin{bmatrix} 1 & -1 & 0 \\ 1 & m & 1 \\ -1 & 1 & -1 \end{bmatrix}$ $\det(A) = 1\begin{bmatrix} m & 1 \\ 1 & -1 \end{bmatrix} - (-1)\begin{bmatrix} 1 & 1 \\ -1 & -1 \end{bmatrix} + 0\begin{bmatrix} 1 & m \\ -1 & 1 \end{bmatrix} = 1(-m-1) + 1(-1+1) =$

$\det(A) = -m - 1 \rightarrow -m - 1 \neq 0 \rightarrow m \neq -1$

6-d) $\begin{cases} mx + y - z = 4 \\ x + my + z = 0 \\ x - y = 2 \end{cases}$ $m \neq -1$

$A = \begin{bmatrix} m & 1 & -1 \\ 1 & m & 1 \\ 1 & -1 & 0 \end{bmatrix}$ $\det(A) = m\begin{vmatrix} m & 1 \\ -1 & 0 \end{vmatrix} - 1\begin{vmatrix} 1 & 1 \\ 1 & 0 \end{vmatrix} + (-1)\begin{vmatrix} 1 & m \\ 1 & -1 \end{vmatrix} = m(0+1) - 1(0-1) - 1(-1-m)$

$\det(A) = m + 1 + 1 + m = 2m + 2$

$2m + 2 \neq 0 \rightarrow m \neq -1$

7) A assistente produziu 150 peças corretamente.

$\begin{cases} x + y = 225 \rightarrow \text{total de peças} \\ 6x - 2y = 750 \rightarrow \text{saldo final} \end{cases}$

$y = 225 - x$

$6x - 2(225 - x) = 750$

$6x - 450 + 2x = 750$

$8x - 450 = 750$

$8x = 1200 \rightarrow x = \frac{1200}{8} = 150$

8) 480 Km com o Toyota AE86 e 60 Km com a motocicleta Suzuki.

distância total: $x + y = 540$

custo total: $0{,}6x + 0{,}2y = 300$

$(3x + y) - (x + y) = 1500 - 540$

$2x = 960$

$x = 480\text{Km}$

$\begin{cases} x + y = 540 \\ 3x + y = 1500 \end{cases}$

$y = 540 - x = 540 - 480 = 60\text{Km}$

$0{,}6 \cdot 480 + 0{,}2 \cdot 60 = 288 + 12 = 300$ reais.

9) Nikaido precisará de 52 cédulas de cinco reais.

Total de cédulas: $x+y+z=92$

Quantidade de cédulas de 2 e 10 iguais: $x=z$

Quantia total: $2x+5y+10z=500$

$$\begin{cases} 2x+y=92 \rightarrow y=92-2x \\ 12x+5y=500 \end{cases}$$

$12x+5(92-2x)=500$

$12x+460-10x=500$

$2x=40 \rightarrow x=20$

$y=92-2(20)=92-40=52$

52 cédulas de 5 reais.

10) Kiba: 77 Kg; Tamaki: 65 Kg; Akamaru: 32 Kg.

K = peso de Kiba (Kg)

T = peso de Tamaki (Kg)

A = peso de Akamura (Kg)

$$\begin{cases} K+A=109 \\ K+T=142 \\ T+A=97 \end{cases}$$

$(K+A)+(K+T)+(T+A)=109+142+97$

$2K+2T+2A=348 \rightarrow K+T+A=174$

$(K+T+A)-(K+A)=174-109$

$\boxed{T=65\,Kg}$

$(K+T+A)-(K+T)=174-142$

$\boxed{A=32\,Kg}$

$(K+T+A)-(T+A)=174-97$

$\boxed{K=77\,Kg}$