Math 323
Linear Algebra and Matrix Theory I
Fall 1999

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Key Homework 3

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$$\left.\begin{aligned} 2x+3y&=1\\ 10x+9y&=11\end{aligned}\right| \Rightarrow \left.\begin{aligned} 2x+3y&=1\\ -6y&=6\end{aligned}\right| \Rightarrow y=-1 \Rightarrow 2x-3=1 \Rightarrow 2x=4 \Rightarrow x=2.$$

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-1/2 times the first equation needs to be substracted from the second equation.

$$\left.\begin{aligned} 2x-4y&=6\\ -x+5y&=0\end{aligned}\right| \Rightarrow \left.\begin{aligned} 2x-4y&=6\\ 3y&=3\end{aligned}\right| \Rightarrow y=1 \Rightarrow 2x-4=6 \Rightarrow 2x=10 \Rightarrow x=5$$

If the right side changes to (-6, 0) then the new result is given by:

$$\left.\begin{aligned} 2x-4y&=-6\\ -x+5y&=0\end{aligned}\right| \Rightarrow \left.\begin{aligned} 2x-4y&=-6\\ 3y&=-3\end{aligned}\right| \Rightarrow y=-1 \Rightarrow 2x+4=-6 \Rightarrow 2x=-10 \Rightarrow x=-5$$

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$$\left.\begin{aligned} 2x+by&=13\\ 4x+8y&=g\end{aligned}\right| \Rightarrow \left.\begin{aligned} 2x+by&=13\\ (8-2b)y&=g-26\end{aligned}\right| \Rightarrow$$ the system becomes singular when

$8-2b=0 \Rightarrow b=4$. It then becomes solvable when $g=26$.

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$$\begin{aligned} ax+3y&=-3\\ 4x+6y&=6\end{aligned}$$

Gaussian elimination will fail permanently if $a=2$, and fail temporarily if $a=0$. In the last case we can change the equations.

$$\left.\begin{aligned} 4x+6y&=6\\ 3y&=-3\end{aligned}\right| \Rightarrow y=-1 \Rightarrow 4x-6=6 \Rightarrow 4x=12 \Rightarrow x=3.$$

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$3x - 2y = b_1$
$6x - 4y = b_2$

$(6x - 4y)$ equals two times $(3x - 2y)$, therefore this system has a solution only if $b_2 = 2b_1$.

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$$\left.\begin{matrix} 2x+3y+z=1 \\ 4x+7y+5z=7 \\ -2y+2z=6 \end{matrix}\right| \Rightarrow \left.\begin{matrix} 2x+3y+z=1 \\ y+3z=5 \\ -2y+2z=6 \end{matrix}\right| \Rightarrow \left.\begin{matrix} 2x+3y+z=1 \\ y+3z=5 \\ 8z=16 \end{matrix}\right| \Rightarrow z=2$$

$\Rightarrow y+6=5 \Rightarrow y=-1 \Rightarrow 2x-3+2=12x=2 \Rightarrow x=1.$

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$$\left.\begin{matrix} 2x-3y=3 \\ 4x-5y+z=7 \\ 2x-y-3z=5 \end{matrix}\right| \Rightarrow \left.\begin{matrix} 2x-3y=3 \\ y+z=1 \\ 2y-3z=2 \end{matrix}\right| \Rightarrow \left.\begin{matrix} 2x-3y=3 \\ y+z=1 \\ -5z=0 \end{matrix}\right| \Rightarrow z=0$$

$\Rightarrow y=1 \Rightarrow 2x-3=3 \Rightarrow x=3.$