edX

7. Worked examples
Solving a matrix equation

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Question 7.1

Choose a value of b for which the system is inconsistent, and another value of b for which the system is consistent and has infinitely many solutions. What are two of those solutions?

$$\begin{cases} 3x + 2y = 10 \\ 6x + 4y = b. \end{cases}$$

Worked Solution

We put the system into augmented matrix form:

$$\left(\begin{array}{cc|c} 3 & 2 & 10 \\ 6 & 4 & b \end{array} \right).$$

We can eliminate the second equation by subtracting 2 times the first equation from it, leaving us with

$$\left(\begin{array}{cc|c} 3 & 2 & 10 \\ 0 & 0 & b-20 \end{array} \right).$$

The second row reads $0 \cdot x + 0 \cdot y = b - 20$. If $b \neq 20$, then the equation can never be satisfied, in which case, there would be no solutions to the system. If $b = 20$, then there are infinitely many solutions to the system. The first row tells us that

$$3x + 2y = 10,$$

or that

$$x + \frac{2}{3}y = \frac{10}{3}.$$

Setting $y = c_1$ we see that

$$x = \frac{10}{3} - \frac{2}{3}c_1,$$

so

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 10/3 \\ 0 \end{pmatrix} + c_1 \begin{pmatrix} -2/3 \\ 1 \end{pmatrix}.$$

You should check to see if the two solutions you found can be written in this form. To get any one solution plug in a specific number for c_1.

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