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Quiz 3

Math 2210Q, Section 12

(1) Compute the inverse of

$$\begin{bmatrix} 1 & 0 & 1 \\ 2 & 6 & 1 \\ 1 & 3 & 0 \end{bmatrix}.$$

Show your work.

$$\begin{bmatrix} 1 & 0 & 1 \\ 2 & 6 & 1 \\ 1 & 3 & 0 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$R2 - 2R1$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 6 & -1 \\ 1 & 3 & 0 \end{bmatrix}$$

$R3 - R1 = R3$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 6 & -1 \\ 0 & 3 & -1 \end{bmatrix}$$

$R2 = \frac{R2}{6}$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & -\frac{1}{6} \\ 0 & 3 & -1 \end{bmatrix}$$

$R3 = R3 - 3R2$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & -\frac{1}{6} \\ 0 & 0 & -\frac{1}{2} \end{bmatrix}$$

$R1 = R1 + 2R3$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -\frac{1}{6} \\ 0 & 0 & -\frac{1}{2} \end{bmatrix}$$

$R3 = R3 \cdot -2$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -\frac{1}{6} \\ 0 & 0 & 1 \end{bmatrix}$$

$R2 + \frac{1}{6}R3$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Ainv $\begin{bmatrix} 1 & -1 & 2 \\ -\frac{1}{3} & \frac{1}{3} & -\frac{1}{3} \\ 0 & 1 & -2 \end{bmatrix}$

(2) Compute the determinant of

$$\begin{bmatrix} c & 0 & 1 \\ 0 & 2 & 3 \\ 1 & 7 & 2 \end{bmatrix},$$

where c is some constant. **Show your work.**

$$c \cdot \det\begin{pmatrix} 2 & 3 \\ 7 & 2 \end{pmatrix} - \cancel{0 \cdot \begin{bmatrix} 0 & 3 \\ 1 & 2 \end{bmatrix}} + 1 \det\begin{bmatrix} 0 & 2 \\ 1 & 7 \end{bmatrix}$$

$$4 - 21 \qquad\qquad 0 - 2$$

$$+ \; -2$$

$$\boxed{-17c - 2}$$

(3) For what value(s) of c is the linear transformation represented by the matrix **not** invertible?

$$0 = -17c - 2$$

$$+2 \qquad\qquad +2$$

$$\frac{2}{-17} = \frac{\cancel{-17}c}{\cancel{-17}}$$

Bonus: Consider the complex numbers, **C**, as a two dimensional **R**-vector space. What matrix represents complex conjugation, i.e., the map $a + bi \mapsto a - bi$? The complex numbers are obtained by adjoining a root, i, of the polynomial $x^2 + 1$ to **R**. Loosely speaking, complex conjugation corresponds to choosing the other root. **If you don't have time to answer here, send me the answer on Piazza (using LaTeX to render the matrix) before I post solutions.**

$$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$