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### 1.5 Solving Matrix Equations

Consider the matrix equation  $AX = C$ , where  $X$  is an unknown matrix.

We cannot divide by  $A$ . Instead, we multiply both sides of the equation by  $A^{-1}$

(if  $A^{-1}$

exists). In particular, if  $A^{-1}$

exists then we can solve the above equation for the matrix  $X$ ,

as follows:

$$AX = C \Rightarrow A$$

$$-1AX = A$$

$-1C$  (multiplying both sides of the equation on the left by  $A$

$-1$

)

$$\Rightarrow IX = A$$

$$-1C$$

$$\Rightarrow X = A$$

$$-1C .$$

Similarly,

$$XA = C \Rightarrow XAA^{-1} = CA^{-1}$$

(multiplying both sides of the equation on the right by  $A$

$-1$

)

$$\Rightarrow X = CA^{-1}$$

.

Note that

- Multiplying on the left is called premultiplying.

- Multiplying on the right is called postmultiplying.