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Matrix inversion

R can perform standard matrix algebra operations. We can use matrix algebra functions in R to solve our problem from class.

$$7x + 5y - 3z = 16$$
$$3x - 5y + 2z = -8$$
$$5x + 3y - 7z = 0$$

First, we rewrite the system using matrix and vector notation:

$$\mathbf{A} = \begin{bmatrix} 7 & 5 & -3 \\ 3 & -5 & 2 \\ 5 & 3 & -7 \end{bmatrix} \mathbf{b} = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \mathbf{r} = \begin{bmatrix} 16 \\ -8 \\ 0 \end{bmatrix}$$

In order to obtain the result vector b, we have to use some simple matrix algebra operations.

$$\mathbf{A}^{-1}\mathbf{A}\mathbf{b} = \mathbf{A}^{-1}\mathbf{r}$$
$$\text{remember that} \mathbf{A}^{-1}\mathbf{A} = \mathbf{I}$$
$$\mathbf{b} = \mathbf{A}^{-1}\mathbf{r}$$

We are now ready to solve our system of equations using R:

```r
data <- c(7, 5, -3, 3, -5, 2, 5, 3, -7)

A <- matrix(data, nrow = 3, ncol = 3, byrow = TRUE)

r <- c(16, -8, 0)

b <- solve(A) %*% r

b
```

```
##      [,1]
## [1,]    1
## [2,]    3
## [3,]    2
```