Matrix Warmup

2019-01-14

Let

$$X = \begin{pmatrix} 1 & 0 \\ 2 & 1 \\ 1 & 0 \end{pmatrix}, \quad Y = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, \quad b = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \quad c = 2, \quad I_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Find each of the following, or specify why you can't:

a. $X + X$

b. $b + X$

c. cX

d. Xb

e. bX

f. $I_3 X$

g. X^T

h. $\det(Y)$

i. Y^{-1}

j. $||b^2|| = b^T b$

You are expected to be able to do operations like a), c) d) and g). with matrices up to 4×4, and invert 2×2 matrices, by hand in an exam situation.

Want to check your answers?

You could use R:

```r
X <- matrix(c(
    1, 0,
    2, 1,
    1, 0
  ),
  ncol = 2,
  byrow = TRUE)

Y <- matrix(c(
    1, 2,
    3, 4
  ),
  ncol = 2,
  byrow = TRUE)

b <- matrix(c(
    1,
    2
  ),
  ncol = 1,
  byrow = TRUE)

c <- 2

I_3 <- diag(nrow = 3)
```

```r
# a
X + X
# b
b + X
# c
c * X
# d
X %*% b
# e
b %*% X
# f
I_3 %*% X
# g
t(X)
# h
det(Y)
# i
solve(Y)
# j
t(b) %*% b
```