

# 代数学幾何学 (A/B) 計算演習 [問題] (2009/06/25)

問. 次の行列の階数 (Rank) を求めよ

Q.1

$$\begin{pmatrix} -3 & 1 & 1 \\ -1 & 1 & -1 \\ 2 & -1 & 0 \\ 1 & -1 & 1 \\ 1 & 0 & -1 \end{pmatrix}$$

Q.7

$$\begin{pmatrix} 0 & 0 & 0 \\ 5 & 8 & -6 \\ -2 & -4 & 3 \\ -5 & -8 & 6 \\ -1 & -1 & 1 \end{pmatrix}$$

Q.2

$$\begin{pmatrix} -1 & -1 & 1 \\ 1 & 4 & -2 \\ -1 & -3 & 2 \\ 0 & 0 & 0 \\ 2 & 3 & -3 \end{pmatrix}$$

Q.8

$$\begin{pmatrix} 2 & -3 & -2 & 3 & 1 \\ 1 & -1 & -1 & 3 & -2 \\ -3 & 4 & 3 & -5 & 0 \\ 0 & 0 & 1 & -1 & 1 \end{pmatrix}$$

Q.3

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

Q.9

$$\begin{pmatrix} -1 & 3 & -2 \\ 1 & 0 & 0 \\ -1 & -1 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$

Q.4

$$\begin{pmatrix} 1 & -1 & 0 \\ -2 & 2 & 1 \\ 0 & 1 & -2 \end{pmatrix}$$

Q.10

$$\begin{pmatrix} -1 & 0 & 1 \\ -2 & 1 & 1 \\ 3 & -1 & -2 \\ 0 & 0 & 0 \end{pmatrix}$$

Q.5

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 2 & 0 & 0 & -2 & -2 \\ -1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Q.11

$$\begin{pmatrix} -1 & -3 & 2 \\ 0 & 1 & 0 \\ 1 & 0 & -1 \end{pmatrix}$$

Q.6

$$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ -4 & 4 & 3 \\ 4 & -4 & -3 \end{pmatrix}$$

Q.12

$$\begin{pmatrix} 3 & -3 & 2 & 2 \\ -4 & 4 & -4 & -1 \\ 0 & 0 & 1 & -1 \end{pmatrix}$$

## 代数学幾何学 (A/B) 計算演習 [解答] (2009/06/25)

A.1 rank = 2

A.7 rank = 3

A.2 rank = 3

A.8 rank = 4

A.3 rank = 1

A.9 rank = 3

A.4 rank = 3

A.10 rank = 2

A.5 rank = 1

A.11 rank = 3

A.6 rank = 1

A.12 rank = 3