

# Answers: Introduction to Matrices

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## Summary

Answers to a selection of questions on matrices.

These are the answers to Questions: Introduction to matrices.

**Please attempt the questions before reading these answers!**

## Q1

### Q1.1

1.1.1. The matrix  $A$  has dimension  $2 \times 3$

1.1.2. The matrix  $B$  has dimension  $2 \times 2$

1.1.3. The matrix  $C$  has dimension  $3 \times 4$

1.1.4. The matrix  $D$  has dimension  $3 \times 2$

1.1.5. The matrix  $E$  has dimension  $3 \times 3$

1.1.6. The matrix  $F$  has dimension  $3 \times 3$

1.1.7. The matrix  $G$  has dimension  $5 \times 1$

1.1.8. The matrix  $H$  has dimension  $4 \times 3$

### Q1.2

1.2.1.  $a_{1,1} = 2$

$$1.2.2. \quad g_{4,1} = 8$$

$$1.2.3. \quad d_{1,2} = -i$$

$$1.2.4. \quad f_{3,2} = 0$$

$$1.2.5. \quad b_{2,1} = 3$$

$$1.2.6. \quad a_{1,2} = -1$$

$$1.2.7. \quad c_{2,3} = i$$

$$1.2.8. \quad e_{2,3} = -4$$

$$1.2.9. \quad h_{3,1} = x$$

$$1.2.10. \quad h_{1,3} = 4$$

$$1.2.11. \quad e_{3,2} = -6$$

$$1.2.12. \quad g_{1,1} = -1$$

### **Q1.3**

$$1.3.1. \quad \text{diag}A = (2, 4)$$

$$1.3.2. \quad \text{diag}C = (0, -\sqrt{2}, -7)$$

$$1.3.3. \quad \text{diag}E = (1, 3, 7)$$

$$1.3.4. \quad \text{diag}G = (-1)$$

## Q2

### Q2.1

$$2.1.1. \quad I + J = \begin{bmatrix} 2 \\ 4 - \sqrt{5} + i \\ 2/3 + 2i \\ \pi - \sqrt{7} \end{bmatrix}$$

$$2.1.2. \quad L - K = \begin{bmatrix} -1 + \sqrt{3} & -2 & -1/2 \\ -10 & 7 - i & -3 \\ 3 & 7 - i & 10 - \pi \end{bmatrix}$$

$$2.1.3. \quad N + M = \begin{bmatrix} -\pi + 1 & -5/4 & 2 & 4 + 2i \\ 5 & -\sqrt{5} - i & x + \sqrt{2} & 1 \end{bmatrix}$$

$$2.1.4. \quad O - P = \begin{bmatrix} 1 - \sqrt{3} & 2 \\ 3 - \pi & -1 \\ 1 & -6i \end{bmatrix}$$

$$2.1.5. \quad 3I = \begin{bmatrix} 9 \\ -3\sqrt{5} \\ 6i \\ 3\pi \end{bmatrix}$$

$$2.1.6. \quad -2J = \begin{bmatrix} 2 \\ -8 - 2i \\ -4/3 \\ 2\sqrt{7} \end{bmatrix}$$

$$2.1.7. \quad xK = \begin{bmatrix} x & -2x & 3x \\ 4x & xi & -5x \\ 6x & -7x & \pi x \end{bmatrix}$$

$$2.1.8. \quad -4L = \begin{bmatrix} \sqrt{3} & -4 & 5/2 \\ 24 & -28 & 32 \\ -36 & 4i & -40 \end{bmatrix}$$

$$2.1.9. \quad yM = \begin{bmatrix} y & -2y & 3y & 4y \\ 5y & -yi & \sqrt{2}y & -6y \end{bmatrix}$$

$$2.1.10. \quad 7N = \begin{bmatrix} -7\pi & 21/4 & -7 & 14i \\ 0 & -7\sqrt{5} & 7x & 49 \end{bmatrix}$$

$$2.1.11. \quad (1/2)O = \begin{bmatrix} 1/2 & -1 \\ 3/2 & 2 \\ -5/2 & 1/2i \end{bmatrix}$$

$$2.1.12. \quad -4P = \begin{bmatrix} -4\sqrt{3} & 16 \\ -4\pi & -20 \\ 24 & 28i \end{bmatrix}$$

$$2.1.13. \quad 3I + J = \begin{bmatrix} 8 \\ 4 - 3\sqrt{5} + i \\ 2/3 + 6i \\ 3\pi - \sqrt{7} \end{bmatrix}$$

$$2.1.14. \quad -2(K + L) = \begin{bmatrix} -2 - 2\sqrt{3} & 12 & -11 \\ 4 & -14 - 2i & 26 \\ -30 & 14 = 2i & -20 - 2\pi \end{bmatrix}$$

$$2.1.15. \quad N - 4M = \begin{bmatrix} -4 - \pi & 35/4 & -13 & -16 + 2i \\ -20 & -\sqrt{5} + 4i & x - 4\sqrt{2} & 31 \end{bmatrix}$$

$$2.1.16. \quad 5O - iP = \begin{bmatrix} 5 - i\sqrt{3} & -10 + 4i \\ 15 - \pi i & 20 - 5i \\ -25 + 6i & 7 + 5i \end{bmatrix}$$

## Q3

### Q3.1

$$3.1.1. \quad QR = \begin{bmatrix} 27 + \pi \end{bmatrix}$$

$$3.1.2. \quad RQ = \begin{bmatrix} -2 & -3 & -1 & -4 \\ 6 & 9 & 3 & 12 \\ 2\pi & 3\pi & \pi & 4\pi \\ 10 & 15 & 5 & 20 \end{bmatrix}$$

$$3.1.3. \quad ST = \begin{bmatrix} -9 & 30 \\ 13 & 18 \end{bmatrix}$$

$$3.1.4. \quad TS = \begin{bmatrix} 23 & -34 & 31 \\ 1 & -6 & 33 \\ -24 & 32 & -8 \end{bmatrix}$$

$$3.1.5. \quad UV = \begin{bmatrix} 6 - \sqrt{2} & 29/2 \\ -12 + 3\sqrt{2} & -59/2 \end{bmatrix}$$

$$3.1.6. \quad VU = \begin{bmatrix} -3/2 - \sqrt{2} & 2 + 2\sqrt{2} \\ 18 & -22 \end{bmatrix}$$

$$3.1.7. \quad WR = \begin{bmatrix} -3 + 7\pi \\ -45 + 5\pi \\ 44 + 3\sqrt{7} - 8\pi \end{bmatrix}$$

$$3.1.8. \quad SW = \begin{bmatrix} -1 & 7 + 5\sqrt{7} & -48 & 57 + \pi \\ 11 & -13 - \sqrt{7} & 22 & -33 - 3\pi \end{bmatrix}$$

$$3.1.9. \quad TU = \begin{bmatrix} -23 & 34 \\ -1 & 6 \\ 24 & -32 \end{bmatrix}$$

$$3.1.10. \quad TV = \begin{bmatrix} 18 - 5\sqrt{2} & -89/2 \\ 6 + 7\sqrt{2} & 21/2 \\ 24 & 56 \end{bmatrix}$$

$$3.1.11. \quad TX = \begin{bmatrix} 17 \\ 29 \\ 4 \end{bmatrix}$$

$$3.1.12. \quad UX = \begin{bmatrix} -3 \\ 10 \end{bmatrix}$$

$$3.1.13. \quad VX = \begin{bmatrix} -1/4 + 4\sqrt{2} \\ 31/2 \end{bmatrix}$$

$$3.1.14. \quad XQ = \begin{bmatrix} -8 & 12 & 4 & 16 \\ 1 & 3/2 & 1/2 & 2 \end{bmatrix}$$

$$3.1.15. \quad VV = \begin{bmatrix} 1/2 & -7/2 - \sqrt{2}/2 \\ 21 + 3\sqrt{2} & 95/2 \end{bmatrix}$$

$$3.1.16. \quad UU = \begin{bmatrix} 7 & -10 \\ -15 & 22 \end{bmatrix}$$

### Q3.2

$$3.2.1. \quad UXQ = \begin{bmatrix} -6 & -9 & -3 & -12 \\ 20 & 30 & 10 & 40 \end{bmatrix}$$

$$3.2.2. \quad U^3 = \begin{bmatrix} -37 & 54 \\ 81 & -118 \end{bmatrix}$$

$$3.2.3. \quad STU = \begin{bmatrix} 99 & -138 \\ 41 & -46 \end{bmatrix}$$

$$3.2.4. \quad TXQR = \begin{bmatrix} 459 + 17\pi \\ 783 + 29\pi \\ 108 + 4\pi \end{bmatrix}$$

### Q3.3

$$3.3.1. \quad 3UX = \begin{bmatrix} -18 \\ 60 \end{bmatrix}$$

$$3.3.2. \quad (ST) - 2U = \begin{bmatrix} -11 & 26 \\ 7 & 10 \end{bmatrix}$$

$$3.3.3. \quad WR + TX = \begin{bmatrix} 14 + 7\pi \\ -16 + 5\pi \\ 18 + 3\sqrt{7} - 8\pi \end{bmatrix}$$

$$3.3.4. \quad -RQR = \begin{bmatrix} 27 + \pi \\ -81 - 3\pi \\ -27\pi + \pi^2 \\ 135 + 5\pi \end{bmatrix}$$

$$3.3.5. \quad (V + U)X = \begin{bmatrix} -5 - 3\sqrt{2} \\ 61 \end{bmatrix}$$

$$3.3.6. \quad 4U^2 + V^2 = \begin{bmatrix} 57/2 & -87/2 - \sqrt{2}/2 \\ -39 + 3\sqrt{2} & 271/2 \end{bmatrix}$$

## Version history

v1.0: initial version created 04/25 by ect6 (as part of a University of St Andrews VIP project)