

# Questions: Introduction to matrices

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## Summary

A selection of questions on matrices.

Before attempting these questions, it is highly recommended that you read [Guide: Introduction to matrices].

## Q1

You are given the following matrices:

$$A = \begin{bmatrix} 2 & -1 & \sqrt{3} \\ 0 & 4 & -\pi \end{bmatrix}, \quad B = \begin{bmatrix} 2 & -2 \\ 3 & -4 \end{bmatrix}, \quad C = \begin{bmatrix} 0 & -1 & 2 & 3 \\ 4 & -\sqrt{2} & 1 & -5 \\ 6 & \pi & -7 & 0 \end{bmatrix}, \quad D = \begin{bmatrix} 3 & -1 \\ \sqrt{5} & x \\ y & 1/2 \end{bmatrix},$$

$$E = \begin{bmatrix} 1 & -2 & \sqrt{7} \\ 1 & 3 & -4 \\ 5 & -6 & 7 \end{bmatrix}, \quad F = \begin{bmatrix} -2 & 3/4 & -1 \\ \pi & -\sqrt{3} & x^2 \\ 7 & 0 & -5 \end{bmatrix}, \quad G = \begin{bmatrix} -1 \\ 5 \\ 1 \\ 8 \\ 3 \end{bmatrix}, \quad H = \begin{bmatrix} \sqrt{2} & -3 & 4 \\ 5 & -1 & 2/3 \\ x & \pi & -7 \\ 8 & 9 & -10 \end{bmatrix}.$$

### Q1.1

Give the dimensions of all matrices  $A - H$ .

### Q1.2

Give the values of the following entries:

a.  $[A]_{11}$

b.  $[G]_{41}$

c.  $[D]_{12}$

d.  $[F]_{32}$

e.  $[B]_{21}$

f.  $[A]_{12}$

g.  $[C]_{23}$

h.  $[E]_{23}$

i.  $[H]_{31}$

j.  $[H]_{13}$

k.  $[E]_{32}$

l.  $[G]_{11}$

### Q1.3

Give the main diagonals of the matrices  $A$ ,  $C$ ,  $E$ , and  $G$ .

### Q2

You are given the following matrices:

$$X = \begin{bmatrix} 3 \\ -\sqrt{5} \\ 2 \\ \pi \end{bmatrix}, \quad Y = \begin{bmatrix} -1 \\ 5 \\ 2/3 \\ -\sqrt{7} \end{bmatrix}, \quad Z = \begin{bmatrix} 1 & -2 & 3 \\ 4 & 1 & -5 \\ 6 & -7 & \pi \end{bmatrix}, \quad W = \begin{bmatrix} \sqrt{3} & -4 & 5/2 \\ -6 & 7 & -8 \\ 9 & -1 & 10 \end{bmatrix},$$

$$M = \begin{bmatrix} 1 & -2 & 3 & 4 \\ 5 & -1 & \sqrt{2} & -6 \end{bmatrix}, \quad N = \begin{bmatrix} -\pi & 3/4 & -1 & 2 \\ 0 & -\sqrt{5} & x & 7 \end{bmatrix}, \quad O = \begin{bmatrix} 1 & -2 \\ 3 & 4 \\ -5 & 1 \end{bmatrix}, \quad P = \begin{bmatrix} \sqrt{3} & -4 \\ \pi & 5 \\ -6 & 7 \end{bmatrix}.$$

Calculate the following questions using matrix addition, subtraction, and scalar multiplication:

- a.  $X + Y$
- b.  $Z - W$
- c.  $N + M$
- d.  $O - P$
- e.  $3X$
- f.  $-2Y$
- g.  $xZ$
- h.  $-4W$
- i.  $yM$
- j.  $7N$
- k.  $(1/2)O$
- l.  $-4P$
- m.  $3X + Y$
- n.  $-2(Z + W)$
- o.  $N - 4M$

### Q3

You are given the following matrices:

$$Q = \begin{bmatrix} 2 & 3 & 1 & 4 \end{bmatrix}, \quad R = \begin{bmatrix} -1 \\ 3 \\ \pi \\ 5 \end{bmatrix}, \quad S = \begin{bmatrix} 1 & -2 & 5 \\ -3 & 4 & -1 \end{bmatrix}, \quad T = \begin{bmatrix} 5 & -6 \\ 7 & 2 \\ 0 & 8 \end{bmatrix},$$

$$U = \begin{bmatrix} -1 & 2 \\ 3 & -4 \end{bmatrix}, \quad V = \begin{bmatrix} \sqrt{2} & -1/2 \\ 3 & 7 \end{bmatrix}, \quad W = \begin{bmatrix} 0 & -1 & 2 & \pi \\ 3 & -4 & 5 & -6 \\ 1 & \sqrt{7} & -8 & 9 \end{bmatrix}, \quad X = \begin{bmatrix} 4 \\ 1/2 \end{bmatrix}.$$

Calculate the following using matrix multiplication:

- a.  $QR$
- b.  $RQ$
- c.  $ST$
- d.  $TS$
- e.  $UV$
- f.  $VU$
- g.  $WR$
- h.  $SW$
- i.  $TU$
- j.  $TV$
- k.  $TX$
- l.  $UX$
- m.  $VX$
- n.  $XQ$
- o.  $VV$

- p.  $UU$
- q.  $UXQ$
- r.  $U^3$
- s.  $STV$
- t.  $TXQR$
- u.  $3UX$
- v.  $(ST) - 2U$
- w.  $WR + TX$
- x.  $-RQR$
- y.  $(V + U)X$
- z.  $4U^2 + V^2$

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After attempting the questions above, please click this link to find the answers.

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## Version history

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

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