



MATHEMATICS APPLICATIONS

Test 4 2018

Matrices

Section A-Resource Free

Marks: 32 Time Allowed: 30 minutes

31

Name: _____

ALL working must be shown for full marks.

For any answers that do not exist an explanation must be given.

Question 1

10
[11 marks]

Use the following matrices to answer the questions below.

For any answers that do not exist give an explanation why.

$$A = \begin{bmatrix} 2 & 7 & 6 \\ 4 & 3 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 2 & 0 \\ 3 & 0 & 6 \end{bmatrix} \quad D = \begin{bmatrix} -4 & 2 \\ 10 & 5 \end{bmatrix} \quad E = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

a) Give the value of c_{23} .

6 (✓)

b) Give the value of c_{32} .

Does not exist no row 3. (✓)

c) Calculate $A + B$

Can't do, not the same order (✓)

d) Calculate $B - D$

$$\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix} - \begin{bmatrix} -4 & 2 \\ 10 & 5 \end{bmatrix} = \begin{bmatrix} 5 & 1 \\ -8 & -1 \end{bmatrix} \quad (✓)$$

e) Calculate $2A$

$$2A = \begin{bmatrix} 4 & 14 & 12 \\ 8 & 6 & 2 \end{bmatrix} \quad (✓)$$

f) Calculate $2A + C$

$$\begin{bmatrix} 5 & 16 & 12 \\ 11 & 6 & 8 \end{bmatrix} \quad (✓)$$

g) Give the dimensions of C

2x3 (✓)

h) What is the name given to the Matrix E

Identity Matrix (✓)

Question 2

[1, 1, 1, 1, 2 = 6 marks]

Give an answer of True or False for the following.

- a) A matrix of order 3×4 will have 34 elements.

F (✓)

- b) For the 2×2 matrices A and B

$$A + B = B + A$$

T (✓)

- c) For the 2×2 matrices A , B and C

$$(A + B) + C = A + (B + C)$$

T (✓)

- d) For the 2×2 matrices A and B

$$A \times B = B \times A$$

F (✓)

- e) For the 4×3 matrix A and the 3×5 matrix B

- i) the dimensions of $A \times B$ are 4×5

T (✓)

- ii) the dimensions of $B \times A$ are 3×3

F (✓)

Question 3

[5 marks]

If matrix A is given by $A = \begin{bmatrix} 3 & 5 \\ 4 & 2 \end{bmatrix}$ and matrix B is given by $B = \begin{bmatrix} 9 & 8 & 7 \end{bmatrix}$

- a) Calculate A^2

$$\begin{bmatrix} 3 & 5 \\ 4 & 2 \end{bmatrix} \times \begin{bmatrix} 3 & 5 \\ 4 & 2 \end{bmatrix} = \begin{bmatrix} 9+20 & 15+10 \\ 12+8 & 20+4 \end{bmatrix} = \begin{bmatrix} 29 & 25 \\ 20 & 24 \end{bmatrix}$$

- b) Calculate B^2

can't be done. (✓)

(✓) Wrong dimensions^{or} (square matrix) needed

Question 4

[2, 2, 2, 1 = 7 marks]

Calculate the following products. If any are not possible give an explanation why.

$$\text{a) } \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 7 & 4 \end{bmatrix} \times \begin{bmatrix} 2 & -2 \\ 5 & 1 \end{bmatrix}$$

$3 \times 2 \quad 2 \times 2$

$$= \begin{bmatrix} 4+15 & -4+3 \\ 2 & -2 \\ 14+20 & -14+4 \end{bmatrix} (\checkmark)$$

$$= \begin{bmatrix} 19 & -1 \\ 2 & -2 \\ 34 & -10 \end{bmatrix} (\checkmark)$$

$$\text{b) } \begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \times \begin{bmatrix} 8 \\ 6 \\ 4 \end{bmatrix}$$

$1 \times 3 \quad 3 \times 1$

$$= \begin{bmatrix} 8 + 12 + 12 \end{bmatrix} (\checkmark)$$

$$= \begin{bmatrix} 32 \end{bmatrix} (\checkmark)$$

$$\text{c) } \begin{bmatrix} 7 & 9 \\ 2 & 11 \\ 4 & 3 \end{bmatrix} \times \begin{bmatrix} 5 & 8 \end{bmatrix}$$

$3 \times 2 \quad 1 \times 2$

can't be done (\checkmark)

Number of columns
don't match number
of rows. (\checkmark)

$$\text{d) } \begin{bmatrix} 2 \\ 5 \end{bmatrix} \times \begin{bmatrix} 3 & 4 \end{bmatrix}$$

$2 \times 1 \quad 1 \times 2$

$$= \begin{bmatrix} 6 & 8 \\ 15 & 20 \end{bmatrix} (\checkmark)$$

Question 5

[3 marks]

For the 2×2 matrices A, B, C and D

a) $A + B = A$ if matrix B is a Zero Matrix Matrix (\checkmark)

b) $A \times C = A$ if matrix C is a Identity Matrix (\checkmark)

c) $A \times D = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ if matrix D is a Zero matrix Matrix (\checkmark)

MATHEMATICS APPLICATIONS

Test 5 2018

Matrices

Section B-Resource Assumed

Marks: 29 Time Allowed: 30 minutes

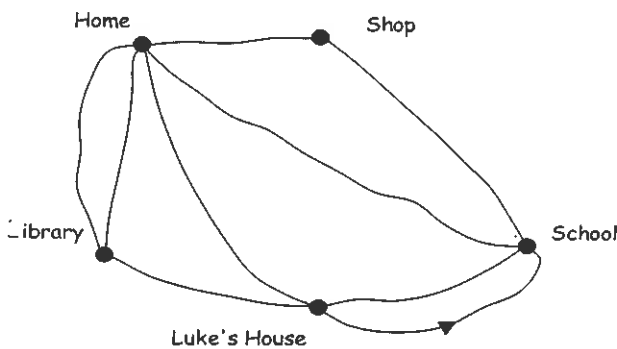
ALL working must be shown for full marks.

For any answers that do not exist an explanation must be given.

Question 1

[2, 1, 1, 1, 1, 3 = 9 marks]

a) Construct a route matrix R for the following network showing Ben's trip to school.



$$R = \begin{matrix} & \text{To} \\ & \begin{matrix} H & Sh & Sc & Li & Lu \end{matrix} \\ \text{From} \begin{matrix} H \\ Sh \\ Sc \\ Li \\ Lu \end{matrix} & \begin{bmatrix} 0 & 1 & 1 & 2 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 2 & 0 & 0 & 0 & 1 \\ 1 & 0 & 2 & 1 & 0 \end{bmatrix} \end{matrix} \quad \begin{matrix} -1 \text{ each} \\ \text{error} \end{matrix}$$

b) The two stage route matrix can be obtained by doing what to the original route matrix?

Square Route matrix

c) Give the two stage route matrix for Ben's trip to school.

$$R^2 = \begin{matrix} & \begin{matrix} H & Sc \end{matrix} \\ \begin{matrix} H \\ Sc \end{matrix} & \begin{bmatrix} 7 & 1 & 3 & 1 & 3 \\ 1 & 2 & 1 & 2 & 2 \\ 2 & 1 & 4 & 3 & 1 \\ 1 & 2 & 4 & 5 & 2 \\ 4 & 3 & 1 & 2 & 4 \end{bmatrix} \end{matrix}$$

d) How many ways can Ben get to school if he makes one stop on the way?

3 ways

e) How many ways can Ben get home from school if he makes one stop on the way?

2 ways

f) On the way home from school today Ben needs to make two stops.

i) What needs to be done to matrix R to show these paths?

R^3

ii) Show this matrix

$$R^3 = \begin{matrix} & \begin{matrix} H \\ Sc \end{matrix} \\ \begin{matrix} H \\ Sc \end{matrix} & \begin{bmatrix} 9 & 10 & 14 & 17 & 11 \\ 9 & 2 & 7 & 4 & 4 \\ 12 & 6 & 5 & 5 & 9 \\ 18 & 5 & 7 & 4 & 10 \\ 12 & 5 & 15 & 12 & 7 \end{bmatrix} \end{matrix}$$

iii) How many ways can Ben get home if he stops at Luke's house and the library?

5/11 2 ways.

Question 2

3 4
[3, 4 = 10 marks]

a) Find the value of x and y if

$$\begin{bmatrix} 1 & -2 \\ 2x & 3 \end{bmatrix} + \begin{bmatrix} y & 7 \\ -5 & -1 \end{bmatrix} = \begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$$

$$1 + y = 8$$

$$\boxed{y = 7} \quad (\checkmark)$$

$$2x - 5 = 3 \quad (\checkmark)$$

$$2x = 8$$

$$\boxed{x = 4} \quad (\checkmark)$$

b) Find the values of a and b if

$$P = \begin{bmatrix} a \\ 2 \\ -1 \end{bmatrix} \quad Q = \begin{bmatrix} -3 \\ 0 \\ 5 \end{bmatrix} \quad R = \begin{bmatrix} -2 \\ 2 \\ b \end{bmatrix}$$

$$\text{and } P + 2Q = R$$

$$\begin{bmatrix} a \\ 2 \\ -1 \end{bmatrix} + \begin{bmatrix} -6 \\ 0 \\ 10 \end{bmatrix} = \begin{bmatrix} -2 \\ 2 \\ b \end{bmatrix}$$

(✓)

$$a - 6 = -2$$

$$\boxed{a = 4} \quad (\checkmark)$$

$$-1 + 10 = b$$

$$\boxed{b = 9} \quad (\checkmark)$$

c) Find the values of m and n if

$$\begin{bmatrix} 2 & m \\ n & 4 \end{bmatrix} \times \begin{bmatrix} 5 & -1 \\ 10 & 3 \end{bmatrix} = \begin{bmatrix} 40 & 7 \\ 45 & 11 \end{bmatrix}$$

$$2 \times 5 + 10m = 40 \quad (\checkmark)$$

$$10 + 10m = 40$$

$$10m = 30$$

$$\boxed{m = 3} \quad (\checkmark)$$

$$5n + 40 = 45 \quad (\checkmark)$$

$$5n = 5$$

$$\boxed{n = 1} \quad (\checkmark)$$

Question 3

[2, 2 = 4 marks]

a) If a_{mn} is the element situated in the m^{th} row and n^{th} column of a 2×4 matrix A .

Write down matrix A if $a_{mn} = 4m - n$.

$$A = \begin{bmatrix} 4-1 & 4-2 & 4-3 & 4-4 \\ 8-1 & 8-2 & 8-3 & 8-4 \end{bmatrix} \quad \checkmark$$

$$= \begin{bmatrix} 3 & 2 & 1 & 0 \\ 7 & 6 & 5 & 4 \end{bmatrix} \quad \checkmark$$

each error $-\frac{1}{2}$

b) Matrix B has a square number of elements less than 65, but is not a square matrix. It is a rectangular matrix with 12 less columns than rows. What is the order of matrix B

Order is 16×4

✓ ✓

4 (2×2)

9 (3×3)

16 (4×4)

25 (5×5)

36 (6×6)

49 (7×7)

64 (8×8)

Question 4

[1, 1, 3, 1 = 6 marks]

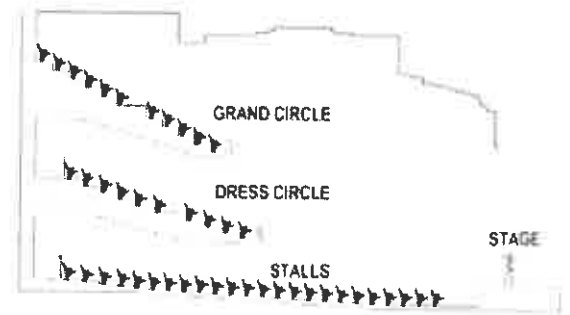
The table below shows the seat prices for three different seating areas of His Majesty's Theatre Perth.

- a) Represent this information as the 2×3 matrix C .

Ticket Cost	Grand Circle	Dress Circle	Stalls
Adult	\$170	\$150	\$120
Concession	\$155	\$130	\$90

$$C = \begin{matrix} & \begin{matrix} GC & DC & St \end{matrix} \\ \begin{matrix} A \\ C \end{matrix} & \begin{bmatrix} 170 & 150 & 120 \\ 155 & 130 & 90 \end{bmatrix} \end{matrix}$$

(✓)



The number of tickets sold for the Saturday night performance is given in the table below.

- b) Represent this information as the 3×2 matrix T .

$$T = \begin{matrix} & \begin{matrix} A & C \end{matrix} \\ \begin{matrix} GC \\ DC \\ St \end{matrix} & \begin{bmatrix} 158 & 122 \\ 287 & 153 \\ 97 & 103 \end{bmatrix} \end{matrix}$$

Tickets sold	Adult	Concession
Grand Circle	158	122
Dress Circle	287	153
Stalls	97	103

- c) Give the matrix that will show the total money made on ticket sales for each section of the theatre.

$$\begin{matrix} & \begin{matrix} A & C \end{matrix} \\ \begin{matrix} GC \\ DC \\ St \end{matrix} & \begin{bmatrix} 45770 \\ 62940 \\ 20910 \end{bmatrix} \end{matrix}$$

3×1

- d) What is the money made on total ticket sales for the Saturday night?

$$\$129,620$$