Year 11 General Maths
PRACTICE SAC
MATRICES

Student name: _____

Multiple-choice questions

1 $B = \begin{bmatrix} 3 & 8 & 7 \\ 4 & 6 & 1 \\ 2 & 5 & 4 \\ 1 & 9 & 2 \end{bmatrix}$ The order of matrix B is:

A 3

B 4

C 12

D 3×4

E 4×3

2 Car sales during a 3-month period for three different models A, B and C were recorded in matrix form.

$$\begin{array}{l} \\ \textbf{\textit{model A}} \\ \textbf{\textit{model B}} \\ \textbf{\textit{model C}} \end{array} \begin{array}{c} \begin{array}{ccc} \textit{April} & \textit{May} & \textit{June} \end{array} \\ \begin{bmatrix} 3 & 2 & 5 \\ 6 & 8 & 9 \\ 4 & 1 & 7 \end{bmatrix} \end{array}$$

The number of model C sold in June was:

A 1

B 4

C 5

D 7

E 9

3 For three towns, J, K and L the matrix gives the number of roads directly connecting one town to another.

$$\begin{matrix} J & K & L \\ \begin{bmatrix} 0 & 2 & 3 \\ 2 & 0 & 1 \\ 3 & 1 & 0 \end{bmatrix} & \begin{matrix} J \\ K \\ L \end{matrix} \end{matrix}$$

The total number of roads directly connecting town J to other towns is:

A 0

B 2

C 3

D 5

E 10

Use the matrices X and Y in Questions 4 and 5.

$$X = \begin{bmatrix} 5 & -4 \\ 3 & -2 \end{bmatrix} \qquad Y = \begin{bmatrix} 6 & -1 \\ -7 & 4 \end{bmatrix}$$

4 The matrix for $X - Y$ is:

A $\begin{bmatrix} 1 & 3 \\ -10 & 6 \end{bmatrix}$

B $\begin{bmatrix} -1 & -5 \\ 10 & -6 \end{bmatrix}$

C $\begin{bmatrix} -1 & -3 \\ 4 & -6 \end{bmatrix}$

D $\begin{bmatrix} -1 & -3 \\ 10 & -6 \end{bmatrix}$

E $\begin{bmatrix} -1 & -5 \\ -4 & 2 \end{bmatrix}$

5 The matrix $X - 2Y$ is:

A $\begin{bmatrix} -17 & -2 \\ 17 & -6 \end{bmatrix}$

B $\begin{bmatrix} -7 & -6 \\ -17 & -10 \end{bmatrix}$

C $\begin{bmatrix} -17 & -6 \\ 10 & -6 \end{bmatrix}$

D $\begin{bmatrix} -7 & -2 \\ 17 & -10 \end{bmatrix}$

E $\begin{bmatrix} -17 & 2 \\ -17 & -6 \end{bmatrix}$

Use the matrices M, N, P and Q in Questions 6 to 8.

$$M = \begin{bmatrix} 5 & 2 \\ 9 & 7 \end{bmatrix} \qquad N = \begin{bmatrix} 6 \\ 1 \end{bmatrix} \qquad P = \begin{bmatrix} 2 & 3 & 9 \\ 4 & 8 & 1 \end{bmatrix} \qquad Q = \begin{bmatrix} 4 & 7 \end{bmatrix}$$

6 Matrix multiplication is **not** defined for:

A *MP*

B *PM*

C *NQ*

D *QN*

E *QP*

7 The order of *MN* is:

A 1×2

B 2×1

C 2×2

D 4×3

E 3×4

8 The matrix multiplication *QP* gives the matrix:

A $\begin{bmatrix} 36 & 68 & 43 \end{bmatrix}$

B $\begin{bmatrix} 36 \\ 68 \\ 43 \end{bmatrix}$

C $\begin{bmatrix} 8 & 12 & 36 \end{bmatrix}$

D $\begin{bmatrix} 8 \\ 12 \\ 36 \end{bmatrix}$

E $\begin{bmatrix} 8 & 21 \\ 16 & 56 \end{bmatrix}$

9 The monthly sales each salesperson has made for four car brands is shown in the matrix S below.

$$S = \begin{array}{c} \\ Andrew \\ Blake \\ Cate \end{array} \begin{array}{c} \begin{array}{cccc} Ford & Holden & Kia & Toyota \end{array} \\ \begin{bmatrix} 9 & 11 & 8 & 13 \\ 8 & 7 & 5 & 4 \\ 10 & 6 & 14 & 12 \end{bmatrix} \end{array}$$

Using one of the following matrices to form a matrix product with S, choose the matrix product that would give the total number of sales of each brand of car.

$$W = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \qquad X = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix} \qquad Y = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \qquad Z = \begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}$$

A XS

B SY

C YS

D SW

E SZ

10 The matrix below shows when communication exists between people in the group Evan, Fiona, Greg and Han. Communication between two people is shown by a 1 and no communication by a 0.

$$\begin{array}{c} \begin{array}{cccc} E & F & G & H \end{array} \\ \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \end{array} \begin{array}{l} E \\ F \\ G \\ H \end{array}$$

How many people does Greg communicate with?

A 0

B 1

C 2

D 3

E 4

11 The inverse of $A = \begin{bmatrix} 7 & 8 \\ 4 & 5 \end{bmatrix}$ is:

A $\begin{bmatrix} -7 & 4 \\ 8 & -5 \end{bmatrix}$

B $\frac{1}{3}\begin{bmatrix} -7 & 4 \\ 8 & -5 \end{bmatrix}$

C $\begin{bmatrix} -7 & -8 \\ -4 & -5 \end{bmatrix}$

D $\begin{bmatrix} 5 & -8 \\ -4 & 7 \end{bmatrix}$

E $\frac{1}{3}\begin{bmatrix} 5 & -8 \\ -4 & 7 \end{bmatrix}$

12 $\begin{aligned} 5x + 2y &= 28 \\ 3x - 7y &= 25 \end{aligned}$

The first step in the matrix method for solving the above simultaneous equations is:

A $\begin{bmatrix} 5x & 2y \\ 3x & -7y \end{bmatrix} = \begin{bmatrix} 28 \\ 25 \end{bmatrix}$

$\begin{bmatrix} 5x \end{bmatrix} \begin{bmatrix} 2y \end{bmatrix} \begin{bmatrix} 28 \end{bmatrix}$

B $\begin{vmatrix} \\ 3x \end{vmatrix} + \begin{vmatrix} \\ -7y \end{vmatrix} = \begin{vmatrix} \\ 25 \end{vmatrix}$

C $\begin{bmatrix} x \end{bmatrix} \begin{bmatrix} 5 & 2 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 28 \\ 25 \end{bmatrix}$

D $\begin{bmatrix} 5 & 2 \\ 3 & -7 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 28 \\ 25 \end{bmatrix}$

E $\begin{bmatrix} 5x & 2y \end{bmatrix} + \begin{bmatrix} 3x & -7y \end{bmatrix} = \begin{bmatrix} 28 & 25 \end{bmatrix}$

13

There are 30 children in a Year 6 class. Each week every child participates in one of three activities: cycling (C), orienteering (O) or swimming (S). The activities that the children select each week change according to the transition matrix opposite.

$$T = \begin{array}{c} \\ C \\ O \\ S \end{array} \begin{array}{c} \begin{array}{ccc} C & O & S \end{array} \\ \begin{bmatrix} 0.5 & 0.3 & 0.3 \\ 0.1 & 0.6 & 0.2 \\ 0.4 & 0.1 & 0.5 \end{bmatrix} \end{array} \begin{array}{l} \text{This week} \\ \\ \\ \\ \text{Next week} \end{array}$$

From the transition matrix it can be concluded that:

A in the first week of the program, ten children do cycling, ten children do orienteering and ten children do swimming.

B at least 50% of the children do not change their activities from the first week to the second week.

C in the long term, all of the children will choose the same activity.

D orienteering is the most popular activity in the first week

E 50% of the children will do swimming each week.

Extended-response question

1. sales at two farms are recorded in matrix T. With each sheep sold 2 bales of hay were given free. Four bales were given with each goat and six with each llama. The selling price \$, for each sheep, goat or llama and H, the number of free bales of hay, is shown in matrix V.

$$T = \begin{array}{c} \\ \textbf{\textit{farm C}} \\ \textbf{\textit{farm D}} \end{array} \begin{array}{c} \begin{array}{ccc} \textbf{\textit{Sheep}} & \textbf{\textit{Goats}} & \textbf{\textit{Llamas}} \end{array} \\ \begin{bmatrix} 200 & 110 & 50 \\ 150 & 140 & 65 \end{bmatrix} \end{array}$$

$$V = \begin{array}{c} \\ \textbf{\textit{Sheep}} \\ \textbf{\textit{Goats}} \\ \textbf{\textit{Llamas}} \end{array} \begin{array}{c} \begin{array}{cc} \textbf{\$} & \textbf{\textit{H}} \end{array} \\ \begin{bmatrix} 150 & 2 \\ 300 & 4 \\ 500 & 6 \end{bmatrix} \end{array}$$

a How many llamas were sold by farm D?

b Which farm sold the most animals?

c Find the matrix TV and label its rows and columns.

d How many bales of hay were given away by farm D?

e What was the total value of the sales for farm C?

f What information is given by the element in row 1, column 2 of matrix TV?

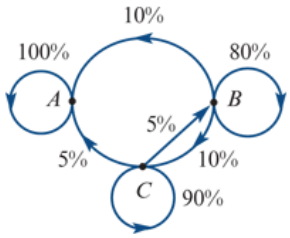
g What was the total value of sales of farm C plus farm D?

2.

On Windy Island, sea birds are observed nesting at three sites: A, B and C. The following transition matrix and accompanying transition diagram can be used to predict the movement of these sea birds between these sites from year to year.

$$T = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 1.0 & 0.10 & 0.05 \\ 0 & 0.80 & 0.05 \\ 0 & 0.10 & 0.90 \end{bmatrix} \end{array} \begin{array}{l} \\ A \\ B \\ C \end{array}$$

This year (columns) / *Next year* (rows)



a What percentage of sea birds nesting at site B this year were expected to nest at:

- **i** site A next year?
- **ii** site B next year?
- **iii** site C next year?

b This year, 850 sea birds were observed nesting at site B. How many of these are expected to:

- **i** still nest at site B next year ?
- **ii** move to site A to nest next year?

c This year, 1150 sea birds were observed nesting at site A. How many of these birds are expected to nest at:

- **i** site A next year?
- **ii** site B next year?
- **iii** site C next year?

d What does the '1' in column A, row A of the transition matrix indicate?