VCE School Assessed Coursework: SAC

Students Name:

Sacred Heart College Yarrawonga

VCE Study:	General Mathematics
Unit:	4
Outcomes:	1, 2 and 3
Assessment Task	Matrices Modelling Task Part 1
Date:	Monday 22nd July (A) Tuesday 23rd July (B)
Time:	5 mins reading 55 mins writing
Instructions:	Students to answer all questions in the spaces provided. **Round to two decimal places unless instructed otherwise**
Conditions:	Silent, individual work
Permitted Materials:	Pens, Pencils, Ruler, Eraser, TIInspire CAS calculator, Bound Notes
Marks allocated:	/20

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the room.

I understand I must not intentionally or unintentionally disclose any details on this SAC or imply what is or is not included, or in any way gain an unfair advantage for myself over other

students. If I do, I understand that disciplinary action will occur and my result will be downgraded. In fairness to fellow students it is my responsibility to inform the VCE office if I am aware that information about the SAC is being passed on, or that a student has gained unfair advantage.

Student Signature: Date:

Question 1

The matrix $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ is an example of

A. a diagonal matrix
B. a symmetric matrix
C. a triangular matrix
D. a permutation matrix
E. an identity matrix

Question 2

Consider the matrix M below.

$$M = \begin{bmatrix} 11 & 17 \\ 23 & 41 \\ 21 & 35 \end{bmatrix}$$

The element m_{21} is

A. 11
B. 17
C. 21
D. 23
E. 41

Question 3

The matrix $\begin{bmatrix} 4 & 0 & 2 \\ 0 & 1 & 5 \\ 2 & 5 & 9 \end{bmatrix}$ is an example of a

A. triangular matrix

B. unit matrix

C. symmetric matrix

D. binary matrix

E. column matrix

Question 4

A permutation matrix is used to rearrange the word AGENT as shown in the matrix product below.

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} \times \begin{bmatrix} A \\ G \\ E \\ N \\ T \end{bmatrix}$$

The resulting arrangement is

A. TANGE

B. GENTA

C. GANTE

D. TEGAN

E. NEGAT

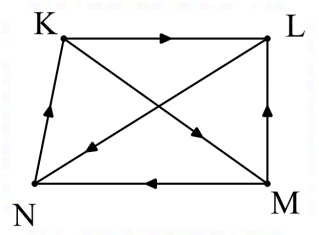
Question 5

In a round robin table tennis tournament, Kira (K), Lang (L), Mahila (M) and Nazeem (N) each play each other only once.

The diagram below shows the results of the games.

The arrows in the diagram indicate the winner of each game.

For example, the arrow from N to K indicates that Nazeem defeats Kira.



The matrix showing two-step dominance is

A.

		loser			
		K	L	M	N
winner	K	0	1	1	0
	L	1	0	0	1
	M	0	1	0	1
	N	1	0	1	0

B.

		loser			
		K	L	M	N
winner	K	0	0	1	0
	L	1	0	0	1
	M	0	2	0	0
	N	1	0	0	1

C.

		loser			
		K	L	M	N
winner	K	0	1	0	0
	L	1	0	0	1
	M	0	1	0	0
	N	1	0	0	1

D.

		loser			
		K	L	M	N
winner	K	0	1	0	2
	L	1	0	0	0
	M	0	1	0	0
	N	1	0	0	1

E.

	loser			
	K	L	M	N

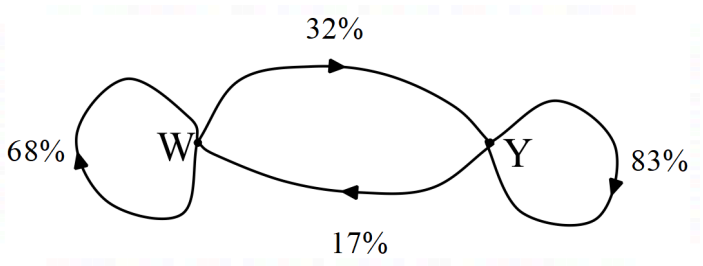
	K	[0 0 1 0 2 0 0 1 0 1 1 0 1
winner	L	
	M	
	N	

Question 6

The Ranges Film Club shows one film each month at both Warburn (W) and Yarragrove (Y) cinemas.

Club members can choose the cinema in which they will watch the film.

The transition diagram below shows how club members change the cinema they attend from one month to the next.



The transition matrix that provides the same information as the transition diagram is

A.

	This month			
	W	Y		
T =	[0.32	0.17	0.68 W	Next
			Y	month

B.

	This month			
	W	Y		
T =	[0.32	0.83	0.68 W	Next
			Y	month

C.

	This month			
	W	Y		
T =	[0.17	0.68	0.32 W	Next
			Y	month

D.

	This month			
	W	Y		
T =	[0.68	0.32	0.17 W	Next
			Y	month

E.

	This month			
	W	Y		
$T =$	[0.68	0.17	0.32 W	Next
			Y	month

Question 7

The daily maximum temperature at a regional town for two weeks is displayed in the table below.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 1	20 °C	17 °C	23 °C	20 °C	18 °C	19 °C	30 °C
Week 2	29 °C	27 °C	28 °C	21 °C	20 °C	20 °C	22 °C

This information can also be represented by matrix M, shown below.

$$M = \begin{bmatrix} 20 & 17 & 23 & 20 & 18 & 19 & 30 \\ 29 & 27 & 28 & 21 & 20 & 20 & 22 \end{bmatrix}$$

Element m_{21} indicates that

A. the temperature was 29 °C on Monday in week 2.
B. the temperature was 17 °C on Tuesday in week 1.
C. the lowest temperature for these two weeks was 17 °C.
D. the highest temperature for these two weeks was 29 °C.
E. week 2 had a higher average maximum temperature than week 1.

Question 8

Matrix P is a permutation matrix and matrix Q is a column matrix.

$$P = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \qquad Q = \begin{bmatrix} t \\ e \\ a \\ m \\ s \end{bmatrix}$$

When Q is multiplied by P, which three letters change position?

A. t, e, a

B. e, a, m

C. a, m, s

D. m, s, t

E. e, a, s

Question 9

How many of the following statements are true?

- All square matrices have an inverse.
- The inverse of a matrix could be the same as the transpose of that matrix.
- If the determinant of a matrix is equal to zero, then the inverse does not exist.
- It is possible to take the inverse of an identity matrix.

A. 0

B. 1

C. 2

D. 3

E. 4

Question 10

A species of bird has a life span of three years.

The females in this species do not reproduce in their first year but produce an average of four female offspring in their second year, and three in their third year.

The Leslie matrix, L, below is used to model the female population distribution of this species of bird.

$$L = \begin{bmatrix} 0 & 4 & 3 \\ 0.2 & 0 & 0 \\ 0 & 0.4 & 0 \end{bmatrix}$$

The element in the second row, first column states that on average 20% of this population will

A. be female.

B. never reproduce.

C. survive into their second year.

D. produce offspring in their first year.

E. live for the entire lifespan of three years.

Question 11

The element in row *i* and column *j* of matrix N is n_{ij}. The elements in matrix N are determined using the rule $n_{ij} = 3i - j$

Matrix N could not be

A. $[2\ 1\ 5\ 4]$

B. $[2\ 1\ 5\ 4]$

C. $[2]$

D. $[2\ 1\ 0\ 5\ 4\ 3\ 8\ 7\ 6]$

E. $[2\ 1\ 0]$

Question 12

A is a matrix such that $3\times[2\ 3\ 0\ -1] + A = [9\ 7\ 1\ 1]$

The matrix A is

A. $[3\ -2\ 1\ 4]$

B. $[7\ 4\ 1\ 2]$

C. $[3\ -2\ 0\ 3]$

D. $[3\ 7\ -2\ 1]$

E. $[4\ 3\ -2\ 1]$

Question 13

Consider the matrix recurrence relation $S_{n+1} = T \times S_n + M$ where

$$T = \begin{bmatrix} 0.7 & 0.1 & 0.1 \\ 0.1 & 0.9 & 0.1 \\ 0.2 & 0 & 0.8 \end{bmatrix}, \quad S_4 = \begin{bmatrix} 10 \\ 20 \\ 40 \end{bmatrix}, \quad S_5 = \begin{bmatrix} 20 \\ 30 \\ 40 \end{bmatrix}$$ and M is a column matrix.

Matrix S_6 is closest to

A. $\begin{bmatrix} 13 \\ 23 \\ 34 \end{bmatrix}$

B. $\begin{bmatrix} 14.8 \\ 25.4 \\ 29.8 \end{bmatrix}$

C. $\begin{bmatrix} 21 \\ 33 \\ 36 \end{bmatrix}$

D. $\begin{bmatrix} 21.8 \\ 32.4 \\ 35.8 \end{bmatrix}$

E. $\begin{bmatrix} 28 \\ 40 \\ 42 \end{bmatrix}$

Question 14

Consider the matrix A where $A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 2 & 1 \end{bmatrix}$.

The element in row i and column j of matrix A is a_{ij}.

Matrix A has been created using the rule

A. $a_{ij} = 2i - 1$

B. $a_{ij} = 2 - j$

C. $a_{ij} = 2i - j$

D. $a_{ij} = 2j - i$

E. $a_{ij} = i + j - 1$

Question 15

Consider the following three matrices *M*, *N* and *P*.

$$M = \begin{bmatrix} 1 & 4 \end{bmatrix}, \quad N = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix}, \quad P = \begin{bmatrix} 6 \\ 1 \end{bmatrix}$$

Consider also the four matrix operations given by

$$M + P \qquad N + M \times P$$

$$N + P \times M \qquad M + N \times P$$

The number of these matrix operations that are defined is

A. 0
B. 1
C. 2
D. 3
E. 4

Question 16

Matrix E is a 2×3 matrix, and matrix F is a 2×4 matrix.

The order of $E^{\mathrm{T}} \times 2F$ is

A. 2×3

B. 3×4

C. 4×2

D. 2×4

E. 3×2

Question 17

$$3M + 2N = \begin{bmatrix} 1 & -2 & 22 \\ 25 & 39 & 12 \end{bmatrix}$$

If $N = \begin{bmatrix} -1 & 2 & 5 \\ 2 & 3 & 6 \end{bmatrix}$, matrix M is

A. $\begin{bmatrix} 1 & -2 & 4 \\ 7 & 11 & 0 \end{bmatrix}$

B. $\begin{bmatrix} -1 & -6 & 12 \\ 21 & 33 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 3 & -6 & 12 \\ 21 & 33 & 0 \end{bmatrix}$

D. $\begin{bmatrix} -2 & 4 & 10 \\ 4 & 6 & 12 \end{bmatrix}$

E. $\begin{bmatrix} -1/3 & -2 & 4 \\ 7 & 11 & 0 \end{bmatrix}$

Question 18

The matrix sum $\begin{bmatrix} 0 & -4 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 5 & 4 \\ -2 & 2 \end{bmatrix}$ is equal to

A. $\begin{bmatrix} 5 & 0 \\ 0 & 7 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 0 \\ 0 & 7 \end{bmatrix}$

C. $\begin{bmatrix} 5 & -4 \\ 0 & 7 \end{bmatrix}$

D. $\begin{bmatrix} 0 & 5 & -4 & 4 \\ 2 & -2 & 5 & 2 \end{bmatrix}$

E. $\begin{bmatrix} 0 & -4 & 5 & 4 \\ 2 & 5 & -2 & 2 \end{bmatrix}$

Question 19

A sample of 500 households are monitored for their television-watching habits.

The number of households watching three leading television shows on a Sunday night is recorded on the matrix below. The shows are *I'm a Student, Get Me Out of Here* (*S*), *Masterchess* (*M*) and *The Brick* (*B*).

$$T = \begin{array}{c} \\ S \\ M \\ B \end{array} \begin{array}{c} \begin{array}{ccc} \textit{this Sunday} & & \\ S & M & B \end{array} \\ \begin{bmatrix} 0.81 & 0.08 & 0.06 \\ 0.10 & 0.77 & 0.02 \\ 0.09 & 0.15 & 0.92 \end{bmatrix} \end{array} \begin{array}{l} S \\ M \\ B \end{array} \textit{ next Sunday}$$

It is found that on the third Sunday, 125 households were watching *I'm a Student*, *Get Me Out of Here,* 212 were watching *Masterchess*, and the rest were watching *The Brick*.

The number of households watching *Masterchess* on the first Sunday is closest to

A. 111

B. 154

C. 163

D. 317

E. 374

Question 20

Teachers A, B, C and D are on a roster to supervise after-school activities from Monday to Friday.

The order of supervision follows the transition matrix, T, shown below.

$$T = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \end{array} \begin{array}{l} \text{this day} \\ \\ \\ \\ \\ \text{next day} \end{array}$$

Teacher A supervised first on Monday of the first week.

Which one of the following statements is **not** true?

A. In the second week, Teacher C supervises twice.

B. The supervisor on Monday will always supervise on the Friday of the same week.

C. Teacher D will supervise on the third Tuesday.

D. In the first four weeks, all teachers supervise the same number of days.

E. The fifth supervision day for Teacher B will be on Friday of the third week.

SHC General Mathematics Unit 4 Matrices

Answer Sheet for Multiple Choice Questions

Name:_____

*****Please circle the correct answer.**

Question					
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E

7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E