

VCE School Assessed Coursework: SAC

Students Name:

Sacred Heart College Yarrawonga



VCE Study:	Further Mathematics
Unit:	4
Outcomes:	1, 2 and 3
Assessment Task	Matrices SAC
Date:	Wednesday 28 th June
Time:	5 mins reading 25 mins writing
Instructions:	Students to complete all tasks on this paper.
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:

Sacred Heart College Further Mathematics – Multiple Choice

The following matrices are needed for Questions 1 to 9

$$U = \begin{bmatrix} 0 & 1 & 2 & 1 \\ 7 & 2 & 4 & 4 \\ 0 & 0 & 1 & 3 \\ 4 & -8 & 0 & -2 \end{bmatrix} \quad V = \begin{bmatrix} 8 \\ 2 \\ 1 \\ 0 \end{bmatrix} \quad W = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \quad X = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix} \quad Y = \begin{bmatrix} 1 & 4 \end{bmatrix}$$

- 1 In matrix U , element u_{34} equals:
A -4
B -2
C 0
D 1
E 3
- 2 The matrices that can be raised to a power are:
A U only
B V only
C X only
D U and W only
E W and X only
- 3 $\det(W) =$
A 1
B 2
C 3
D 4
E not defined

4 $UU^{-1} =$

A $\begin{bmatrix} 0 & 1 & 2 & 1 \\ 7 & 2 & 4 & 4 \\ 0 & 0 & 1 & 3 \\ 4 & 8 & 0 & 2 \end{bmatrix}$

B $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

C $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

D $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

E not defined

5 The following matrix product is **not** defined:

A UV

B XU

C WX

D VX

E YW

6 The product XV equals:

A $\begin{bmatrix} 3 & 1 \end{bmatrix}$

B $\begin{bmatrix} -1 & 2 \end{bmatrix}$

C $\begin{bmatrix} -1 \\ 2 \end{bmatrix}$

D $\begin{bmatrix} 32 & 10 & -1 & 0 \\ 16 & 6 & 4 & 0 \end{bmatrix}$

E not defined

7 If $Z = XY$, the order of matrix Z is

A 3×3

B 3×4

C 4×2

D 4×4

E none of the above

8 The binary matrix is:

A U

B V

C W

D X

E none of the matrices given

9 The permutation matrix is:

A U

B V

C W

D X

E none of the matrices given

10 $4 \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} - 2 \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} =$

A $\begin{bmatrix} 2 & 0 \\ 2 & 2 \end{bmatrix}$

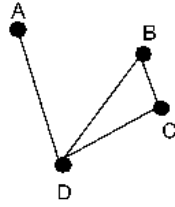
B $\begin{bmatrix} 2 & 2 \\ 6 & 6 \end{bmatrix}$

C $\begin{bmatrix} 4 & 2 \\ 2 & 6 \end{bmatrix}$

D $\begin{bmatrix} 4 & 2 \\ 2 & 2 \end{bmatrix}$

E $\begin{bmatrix} 4 & -2 \\ 2 & -6 \end{bmatrix}$

- 11 The diagram below shows the rail links between four cities. Using a '1' to indicate that a rail link exists between two cities and a '0' to indicate that there is no rail link, a matrix that could be used to indicate the rail links between the cities is:



A

$$\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

B

$$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

C

$$\begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

D

$$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

E

$$\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

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	<i>Left-handed</i>	<i>Right-handed</i>	<i>Total</i>
Male	3	25	28
Female	4	27	31
Total	7	52	59

The table above shows the number of left-handed and right-handed males and females in a group of 59 people.

A matrix that lists the number of right-handed males and right-handed females is:

A $\begin{bmatrix} 3 & 25 \end{bmatrix}$

B $\begin{bmatrix} 4 & 27 & 31 \end{bmatrix}$

C $\begin{bmatrix} 25 \\ 27 \end{bmatrix}$

D $\begin{bmatrix} 25 \\ 27 \\ 52 \end{bmatrix}$

E $\begin{bmatrix} 3 & 25 \\ 4 & 27 \end{bmatrix}$

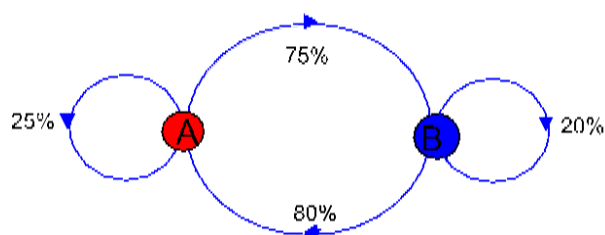
- 13 The matrix equation $\begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ generates the following pair of simultaneous linear equations:

- A** $\begin{aligned} 3x + y &= 1 \\ 2x &= 2 \end{aligned}$
- B** $\begin{aligned} 3x &= 1 \\ 2y &= 2 \end{aligned}$
- C** $\begin{aligned} 3x &= 1 \\ x + 2y &= 2 \end{aligned}$
- D** $\begin{aligned} x + 2y &= 3 \\ 3x + y &= 0 \end{aligned}$
- E** $\begin{aligned} 3x + y &= 1 \\ 2y &= 2 \end{aligned}$

- 14 Which of the following systems of linear equations has a unique solution?

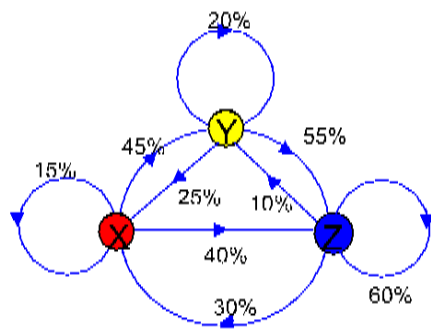
- I** $\begin{aligned} x - 3y &= 6 \\ 2x + 5y &= 3 \end{aligned}$ **II** $\begin{aligned} 4x - 3y &= 6 \\ 8x + 6y &= 3 \end{aligned}$ **III** $\begin{aligned} x - 3y &= 1 \\ 5x - 2y &= 3 \end{aligned}$
- A** I only
- B** I and II
- C** II only
- D** I and III
- E** none

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The transition matrix that can be used to represent the information in the diagram above is:

- A** To: $\begin{matrix} \text{From} \\ \text{A} & \text{B} \end{matrix} \begin{bmatrix} 0.75 & 0.80 \\ 0.25 & 0.20 \end{bmatrix}$
- B** To: $\begin{matrix} \text{From} \\ \text{A} & \text{B} \end{matrix} \begin{bmatrix} 0.75 & 0.25 \\ 0.80 & 0.20 \end{bmatrix}$
- C** To: $\begin{matrix} \text{From} \\ \text{A} & \text{B} \end{matrix} \begin{bmatrix} 0.25 & 0.80 \\ 0.75 & 0.20 \end{bmatrix}$
- D** To: $\begin{matrix} \text{From} \\ \text{A} & \text{B} \end{matrix} \begin{bmatrix} 0.75 & 0.20 \\ 0.25 & 0.80 \end{bmatrix}$
- E** To: $\begin{matrix} \text{From} \\ \text{A} & \text{B} \end{matrix} \begin{bmatrix} 0.75 & 0.80 \\ 0.20 & 0.25 \end{bmatrix}$



The transition matrix that can be used to represent the information in the diagram above is:

From				From				From						
X				Y				Z						
A To:	X	0.45	0.25	0.30	B To:	X	0.15	0.25	0.30	C To:	X	0.15	0.55	0.60
	Y	0.15	0.55	0.10		Y	0.45	0.20	0.10		Y	0.45	0.20	0.10
	Z	0.40	0.20	0.60		Z	0.40	0.55	0.60		Z	0.40	0.25	0.30

From				From							
X				Y				Z			
D To:	X	0.45	0.20	0.30	E To:	X	0.45	0.55	0.60		
	Y	0.15	0.25	0.10		Y	0.15	0.25	0.10		
	Z	0.40	0.55	0.60		Z	0.40	0.20	0.30		

The following information is needed for Questions 17 to 18

The recurrence relation, $S_0 = \begin{bmatrix} 50 \\ 50 \end{bmatrix}$, $S_{n+1} = T S_n$, where $T = \begin{bmatrix} 0.4 & 0.8 \\ 0.6 & 0.2 \end{bmatrix}$ can be used to

generate a sequence of matrices. In this sequence,

17 $S_1 =$

A $\begin{bmatrix} 40 \\ 60 \end{bmatrix}$

B $\begin{bmatrix} 50 \\ 50 \end{bmatrix}$

C $\begin{bmatrix} 60 \\ 40 \end{bmatrix}$

D $\begin{bmatrix} 44 \\ 56 \end{bmatrix}$

E $\begin{bmatrix} 56 \\ 44 \end{bmatrix}$

18 The steady state matrix is closest to:

A $\begin{bmatrix} 40 \\ 60 \end{bmatrix}$

B $\begin{bmatrix} 57 \\ 43 \end{bmatrix}$

C $\begin{bmatrix} 43 \\ 57 \end{bmatrix}$

D $\begin{bmatrix} 45 \\ 55 \end{bmatrix}$

$$B = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$$

The following information is needed for Questions 19 to 20

The recurrence relation,

$$S_0 = \begin{bmatrix} 50 \\ 50 \end{bmatrix}, S_{n+1} = T S_n + B, \text{ where } T = \begin{bmatrix} 0.4 & 0.8 \\ 0.6 & 0.2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 20 \\ 20 \end{bmatrix}$$

can be used to generate a sequence of matrices. In this sequence,

19 $S_1 =$

A $\begin{bmatrix} 20 \\ 40 \end{bmatrix}$

B $\begin{bmatrix} 40 \\ 20 \end{bmatrix}$

C $\begin{bmatrix} 30 \\ 30 \end{bmatrix}$

D $\begin{bmatrix} 40 \\ 60 \end{bmatrix}$

E $\begin{bmatrix} 50 \\ 50 \end{bmatrix}$

20 $S_2 =$

A $\begin{bmatrix} 8 \\ 12 \end{bmatrix}$

B $\begin{bmatrix} 12 \\ 8 \end{bmatrix}$

C $\begin{bmatrix} 20 \\ 40 \end{bmatrix}$

D $\begin{bmatrix} 40 \\ 20 \end{bmatrix}$

E $\begin{bmatrix} 56 \\ 44 \end{bmatrix}$

SHC Further 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