VCE School Assessed Coursework: SAC

Students Name:

Sacred Heart College Yarrawonga

VCE Study:	Further Mathematics
Unit:	4
Outcomes:	1, 2 and 3
Assessment Task	Module 1 Matrices SAC - 2020
Date:	Tuesday 16th June and Wednesday 17th June
Time:	10 mins reading 40 mins writing
Instructions:	Students to circle the correct answer on the answer sheet or enter the correct answer on the google form.
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.

Question 1

For the matrix $A = \begin{bmatrix} 3 & 4 & 9 & 3 \\ 7 & 6 & 1 & 5 \\ 8 & 10 & 12 & 14 \end{bmatrix}$ the element $a_{2,3}$ is

A. 1
B. 4
C. 6
D. 10
E. 12

Questions 2 and 3 refer to the following information.

$$A = \begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix} \qquad B = \begin{bmatrix} -6 & -2 \\ 3 & 1 \end{bmatrix} \qquad C = \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix}$$

Question 2

$A + C =$

A. $\begin{bmatrix} 4 & 4 \\ 1 & -1 \end{bmatrix}$ **B.** $\begin{bmatrix} -2 & 0 \\ 6 & 0 \end{bmatrix}$ **C.** $\begin{bmatrix} -6 & 0 \\ 1 & 1 \end{bmatrix}$ **D.** $\begin{bmatrix} 4 & 4 \\ 5 & -1 \end{bmatrix}$ **E.** $\begin{bmatrix} -4 & 8 \\ 2 & 6 \end{bmatrix}$

Question 3

$AB + AC =$

A. $\begin{bmatrix} -22 & 2 \\ -17 & 1 \end{bmatrix}$ **B.** $\begin{bmatrix} -22 & 18 \\ -19 & 11 \end{bmatrix}$ **C.** $\begin{bmatrix} -34 & -2 \\ 17 & 11 \end{bmatrix}$ **D.** $\begin{bmatrix} -22 & 2 \\ -19 & -1 \end{bmatrix}$ **E.** $\begin{bmatrix} 60 & -180 \\ 70 & -210 \end{bmatrix}$

Question 4

Given that $\begin{bmatrix} 2 & 1 \\ -3 & -6 \end{bmatrix} A = \begin{bmatrix} 0 & 3 \\ 3 & 0 \end{bmatrix}$,

A is equal to

A. $\begin{bmatrix} 0 & 3 \\ -1 & 0 \end{bmatrix}$ **B.** $\begin{bmatrix} -2 & 2 \\ 6 & 6 \end{bmatrix}$ **C.** $\frac{1}{3}\begin{bmatrix} 1 & 6 \\ -2 & -3 \end{bmatrix}$ **D.** $\frac{1}{3}\begin{bmatrix} -3 & -2 \\ 6 & 1 \end{bmatrix}$ **E.** $\begin{bmatrix} 2 & -2 \\ -6 & -6 \end{bmatrix}$

Question 5

The solution to the matrix equation

$$\begin{bmatrix} 3 & 2 & -1 \\ 1 & 5 & 1 \\ 2 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 9 \end{bmatrix}$$

is given by

A. $\begin{bmatrix} 0 \\ 1 \\ 9 \end{bmatrix}$ **B.** $\begin{bmatrix} 2 \\ 1 \\ 4 \end{bmatrix}$

C. $\begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$ **D.** $\begin{bmatrix} 1 \\ 3 \\ -2 \end{bmatrix}$

E. $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$

Question 6

For the matrix equation $AX = B$, matrix $B = \begin{bmatrix} 7 & 4 \\ 2 & 3 \\ 5 & 1 \end{bmatrix}$.

If matrix X is a square matrix then the order of matrix A is

A. (2×1)
B. (2×2)
C. (2×3)
D. (3×1)
E. (3×2)

Question 7

Which one of the following does **not** equal $\begin{bmatrix} 2 & 8 \\ 6 & 10 \end{bmatrix}$?

A. $2 \times \begin{bmatrix} 1 & 4 \\ 3 & 5 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 5 \\ 4 & 3 \end{bmatrix} + \begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix}$

C. $\begin{bmatrix} 7 & 10 \\ 9 & 12 \end{bmatrix} - \begin{bmatrix} 5 & 2 \\ 3 & 2 \end{bmatrix}$

D. $\begin{bmatrix} 2 & 8 \\ 6 & 10 \end{bmatrix} - 0 \times \begin{bmatrix} 5 & 9 \\ 3 & 2 \end{bmatrix}$

E. $\begin{bmatrix} 4 & 14 \\ 10 & 12 \end{bmatrix} - 2 \times \begin{bmatrix} 1 & 3 \\ 2 & 2 \end{bmatrix}$

Question 8

Campers who holiday each year near a remote beach can stay at two sites A and B.
The Parks Service who register each campers stay, develop a transition matrix T to try and predict where the campers will stay in future years.

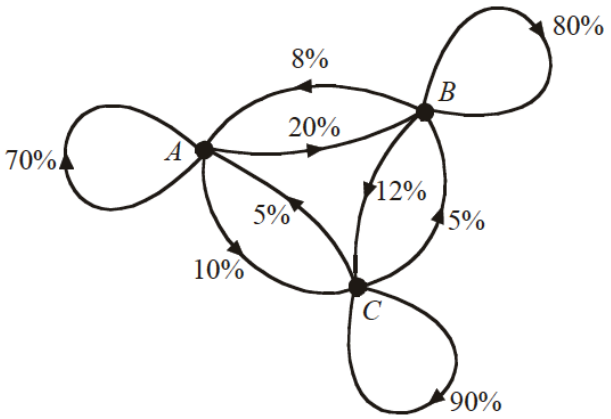
$$T = \begin{array}{c} \text{one year} \\ \begin{matrix} A & B \end{matrix} \\ \begin{bmatrix} 0.8 & 0.1 \\ 0.2 & 0.9 \end{bmatrix} \begin{matrix} A \\ B \end{matrix} \end{array} \text{ next year}$$

In 2009 there were a total of 200 campers at the sites and 120 of these were at site A.
The number of campers expected to be camping at site B in 2010 is

A. 76
B. 80
C. 96
D. 98
E. 104

Question 9

A research company records the viewing habits of a large group of people who watch one of three 6pm news bulletins available on channels A, B and C. The following transition diagram shows the percentages who stay with the same channel the next night or move to another channel.



A corresponding transition matrix could be

A.

one night

$$\begin{matrix} & A & B & C \\ \end{matrix}$$
$$\begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.8 & 0.08 & 0.1 \\ 0.9 & 0.05 & 0.05 \end{bmatrix} \begin{matrix} A \\ B \\ C \end{matrix}$$

B next night

B.

one night

$$\begin{matrix} & A & B & C \\ \end{matrix}$$
$$\begin{bmatrix} 0.7 & 0.08 & 0.9 \\ 0.2 & 0.8 & 0.05 \\ 0.1 & 0.12 & 0.05 \end{bmatrix} \begin{matrix} A \\ B \\ C \end{matrix}$$

B next night

C.

one night

$$\begin{matrix} & A & B & C \\ \end{matrix}$$
$$\begin{bmatrix} 0.7 & 0.8 & 0.9 \\ 0.2 & 0.12 & 0.05 \\ 0.1 & 0.08 & 0.05 \end{bmatrix} \begin{matrix} A \\ B \\ C \end{matrix}$$

B next night

D.

one night

$$\begin{matrix} & A & B & C \\ \end{matrix}$$
$$\begin{bmatrix} 0.7 & 0.2 & 0.12 \\ 0.08 & 0.8 & 0.05 \\ 0.1 & 0.05 & 0.9 \end{bmatrix} \begin{matrix} A \\ B \\ C \end{matrix}$$

B next nigh

E.

one night

$$\begin{matrix} & A & B & C \\ \end{matrix}$$
$$\begin{bmatrix} 0.7 & 0.08 & 0.05 \\ 0.2 & 0.8 & 0.05 \\ 0.1 & 0.12 & 0.9 \end{bmatrix} \begin{matrix} A \\ B \\ C \end{matrix}$$

B next night

Question 10

Secondary students who wished to attend an outdoor camp had to attend one session a week in either running, weights or swimming. Teachers noticed over time that 90% of students who attended a particular session one week attended the same session the next week.
They also noticed that

- 3% who attended weights one week attended running the next
- 4% who attended running one week attended swimming the next
- 5% who attended swimming one week attended weights the next

A transition matrix that could represent this information is

A.

$$\begin{array}{c} \\ R \\ W \\ S \end{array}\begin{array}{c} \text{this week} \\ \begin{bmatrix} 0.9 & 0.3 & 0.5 \\ 0.6 & 0.9 & 0.5 \\ 0.4 & 0.7 & 0.9 \end{bmatrix} \\ R \quad W \quad S \end{array} \text{ next week}$$

B.

$$\begin{array}{c} \\ R \\ W \\ S \end{array}\begin{array}{c} \text{this week} \\ \begin{bmatrix} 0.9 & 0.03 & 0.05 \\ 0.06 & 0.9 & 0.05 \\ 0.04 & 0.07 & 0.9 \end{bmatrix} \\ R \quad W \quad S \end{array} \text{ next week}$$

C.

$$\begin{array}{c} \\ R \\ W \\ S \end{array}\begin{array}{c} \text{this week} \\ \begin{bmatrix} 0.9 & 0.9 & 0.9 \\ 0.03 & 0.04 & 0.05 \\ 0.07 & 0.06 & 0.05 \end{bmatrix} \\ R \quad W \quad S \end{array} \text{ next week}$$

D.

$$\begin{array}{c} \\ R \\ W \\ S \end{array}\begin{array}{c} \text{this week} \\ \begin{bmatrix} 0.9 & 0.05 & 0.04 \\ 0.03 & 0.9 & 0.06 \\ 0.07 & 0.05 & 0.9 \end{bmatrix} \\ R \quad W \quad S \end{array} \text{ next week}$$

E.

$$\begin{array}{c} \\ R \\ W \\ S \end{array}\begin{array}{c} \text{this week} \\ \begin{bmatrix} 0.9 & 0.03 & 0.07 \\ 0.9 & 0.04 & 0.06 \\ 0.9 & 0.05 & 0.05 \end{bmatrix} \\ R \quad W \quad S \end{array} \text{ next week}$$

Question 11

Given the matrices $A = \begin{bmatrix} 1 & 4 \\ 2 & -3 \\ 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 1 & 3 \end{bmatrix}$, $C = \begin{bmatrix} 2 & 0 \\ 1 & -5 \end{bmatrix}$ and $D = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 5 & 3 \\ 4 & -1 & 2 \end{bmatrix}$

then the product matrix of the order 3×2 is a result of

A. $A \times B \times C \times D$
B. $C \times A$
C. $A \times D$
D. $D \times A$
E. $A \times A \times C$

Question 12

If matrix $D = \begin{bmatrix} 4 & 6 & -3 \\ 2 & 0 & 1 \\ 6 & 12 & 3 \end{bmatrix}$ and matrix $E = \begin{bmatrix} 8 \\ 3 \\ 1 \end{bmatrix}$, the order of the matrix product, ED, is

A. (3×1)

B. (1×3)

C. (3×3)

D. undefined

E. 0

Question 13

A computer supplies store has three types of inkjet cartridges priced at \$10, \$13 and \$23 and three types of laser toner cartridges priced at \$50, \$85 and \$125. The owner of the store wishes to mark down the prices of the inkjet cartridges by 8% and mark up the prices of the laser toner cartridges by 5%.

The **new prices** of **each of** the inkjet cartridges and **each of** the laser toner cartridges as a suitable matrix is **best calculated** using

A. $\begin{bmatrix} 10 & 50 \\ 13 & 85 \\ 23 & 125 \end{bmatrix} \times \begin{bmatrix} 0.92 \\ 1.05 \end{bmatrix}$

B. $\begin{bmatrix} 10 & 50 \\ 13 & 85 \\ 23 & 125 \end{bmatrix} \times \begin{bmatrix} 0.92 & 0 \\ 0 & 1.05 \end{bmatrix}$

C. $\begin{bmatrix} 10 & 13 & 23 \\ 50 & 85 & 125 \end{bmatrix} \times \begin{bmatrix} 0.92 & 0 \\ 0 & 1.05 \end{bmatrix}$

D. $\begin{bmatrix} 10 & 13 & 23 \\ 50 & 85 & 125 \end{bmatrix} \times \begin{bmatrix} 0.92 \\ 1.05 \end{bmatrix}$

E. $\begin{bmatrix} 10 & 50 \\ 13 & 85 \\ 23 & 125 \end{bmatrix} \times \begin{bmatrix} -8 \\ 5 \end{bmatrix}$

Question 14

Consider the following matrix *A*.

$$A = [2\ k\ \ -\ 3\ \ -\ 2\ ]$$

A is equal to its inverse A^{-1} for a particular value of *k*.

This value of *k* is

A. 1
B. $-\ 3$
C. 0
D. $-\ 1$
E. 3

Question 15

What is the order of this matrix?

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 2 & 0 \\ 3 & 3 & 0 \\ 4 & 5 & 0 \end{bmatrix}$$

A 4×2
B 3×2
C 3×3
D 4×3
E 3×4

Question 16

If $A = \begin{bmatrix} -5 & 0 \\ 3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -3 \\ -4 & 5 \end{bmatrix}$,

then $A + B$ equals:

A $\begin{bmatrix} -15 & 15 \\ 13 & -14 \end{bmatrix}$

B $\begin{bmatrix} -2 & -3 \\ -1 & -1 \end{bmatrix}$

C $\begin{bmatrix} -2 & -3 \\ -1 & 4 \end{bmatrix}$

D $\begin{bmatrix} -8 & -3 \\ -1 & -6 \end{bmatrix}$

E $\begin{bmatrix} -8 & 3 \\ 7 & -6 \end{bmatrix}$

Question 17

Given that the determinant of the matrix $\begin{bmatrix} 5 & a \\ -3 & 9 \end{bmatrix}$ is 30, the value of a is

A. 5

B. 4

C. -4

D. -5

E. 3

Question 18

The small townships of Yarragrove, Milville and Warburn have a film society. The number of soci members in each town for the years 2016 to 2018 are shown in the table below.

	2016	2017	2018
Yarragrove	132	114	138
Milville	76	83	79
Warburn	92	106	97

If membership fees are \$60 in 2016, \$65 in 2017 and \$70 in 2018, which of the following matrix products will give the membership fees collected from each of the towns over the three years?

A.
$$\begin{bmatrix} 132 & 76 & 92 \\ 114 & 83 & 106 \\ 138 & 79 & 97 \end{bmatrix} \begin{bmatrix} 60 \\ 65 \\ 70 \end{bmatrix}$$

B.
$$\begin{bmatrix} 132 & 114 & 138 \\ 76 & 83 & 79 \\ 92 & 106 & 97 \end{bmatrix} \begin{bmatrix} 60 & 65 & 70 \end{bmatrix}$$

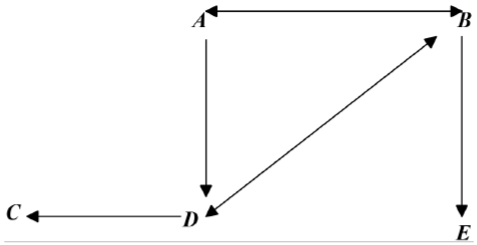
C.
$$\begin{bmatrix} 132 & 114 & 138 \\ 76 & 83 & 79 \\ 92 & 106 & 97 \end{bmatrix} \begin{bmatrix} 60 \\ 65 \\ 70 \end{bmatrix}$$

D.
$$\begin{bmatrix} 97 & 114 & 138 \\ 76 & 83 & 79 \\ 92 & 106 & 132 \end{bmatrix} \begin{bmatrix} 60 \\ 65 \\ 70 \end{bmatrix}$$

E.
$$\begin{bmatrix} 132 & 114 & 60 \\ 76 & 83 & 65 \\ 92 & 106 & 75 \end{bmatrix} \begin{bmatrix} 92 \\ 106 \\ 97 \end{bmatrix}$$

Question 19

Five property owners in a bushfire prone area have set up a communication system to warn each other in case of fire. The system is shown by the communication diagram below.



Indicating communication by a 1 and non-communication by 0, the communication matrix which represents this diagram would be

A.

	from A	B	C	D	E	
	0	1	0	0	0	A
	1	0	0	1	0	B
	0	0	0	1	0	C
	1	1	0	0	0	D
	0	1	0	0	0	E

to

B.

	from A	B	C	D	E	
	0	1	0	0	0	A
	1	0	0	1	0	B
	0	0	0	1	1	C
	1	1	0	0	0	D
	0	1	0	0	0	E

to

C.

	from A	B	C	D	E	
	0	1	0	0	0	A
	1	0	1	1	0	B
	0	0	0	1	0	C
	1	1	0	0	0	D
	0	1	0	0	0	E

to

D.

	from A	B	C	D	E	
	0	1	0	0	0	A
	1	0	0	1	0	B
	0	0	0	1	0	C
	0	1	0	0	0	D
	0	1	0	0	0	E

to

E.

	from A	B	C	D	E	
	0	1	0	0	0	A
	1	0	0	1	0	B
	0	0	0	1	0	C
	1	1	1	0	0	D
	0	1	0	0	0	E

to

Question 20

Consider the matrix relation below:

$$A_{n+1} = H \times A_n + B \text{ where } H = \begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.1 & 0.5 & 0.4 \\ 0.2 & 0.3 & 0.5 \end{bmatrix}, \; B = \begin{bmatrix} 100 \\ 200 \\ 300 \end{bmatrix} \text{ and } A_3 = \begin{bmatrix} 1407 \\ 1651 \\ 1742 \end{bmatrix}$$

The matrix A_1 in this relationship would be

A. $\begin{bmatrix} 1780 \\ 2070 \\ 2151 \end{bmatrix}$

B. $\begin{bmatrix} 1240 \\ 1430 \\ 1530 \end{bmatrix}$

C. $\begin{bmatrix} 1100 \\ 1200 \\ 1300 \end{bmatrix}$

D. $\begin{bmatrix} 1000 \\ 1000 \\ 1000 \end{bmatrix}$

E. $\begin{bmatrix} 1589 \\ 1863 \\ 1948 \end{bmatrix}$

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