Name: Anne Sis Date: ___________

Year 11 Mathematics: Applications

Investigation 2, 2018

Baldivis
Secondary College

Topic – Matrices

In Class Component

____ / 30
= ____ %

Total Time:	*45 minutes*
Reading Time:	*5 minutes*
Working Time:	*40 minutes*
Equipment:	*SCSA Formula sheets, CAS calculator, Take Home Component*

Date out:	*Week ____ Date ____________*	**Date Due:**	*Week ____ Date ____________*
Take home component weighting:	*2.5% of the year*	**In-class component weighting:**	*5% of the semester*

AIM: *In this assessment, you will be investigating how matrices are used in real world settings. You can use your TI-Nspire CAS for this investigation, in particular the matrices function.*

[Scenario 1: 16 marks] The following statistics show a tally for the top 10 AFL kicks, taken from the 2017 seasons AFL results. The Coleman Medal is awarded yearly, to the AFL player, who kicks the most goals, in both home-and-away matches during that year. This data has been taken from two rounds only.

AFL Goal kicking Statistics for Season 2017

Players Name	Team	Goals	Behinds
Joshua Kennedy	West Coast	12	3
Taylor Walker	Adelaide	8	8
Josh Bruce	St Kilda	8	3
Luke Breust	Hawthorn	7	4
Jarrad Waite	North Melbourne	7	1
Jamie Cripps	West Coast	7	0
Matthew Pavlich	Fremantle	6	1
Cameron McCarthy	GWS	6	1
Shaun Higgins	North Melbourne	6	3
Jack Riewoldt	Richmond	6	4

1. **[2 marks]**
Use the information on AFL kicking statistics to create a 10 x 2 matrix in the space provided and call it Matrix R_2.

take ½ off for incorrect entries

Matrix R_2 = $\begin{bmatrix} 12 & 3 \\ 8 & 8 \\ 8 & 3 \\ 7 & 4 \\ 7 & 1 \\ 7 & 0 \\ 6 & 1 \\ 6 & 1 \\ 6 & 3 \\ 6 & 4 \end{bmatrix}$ ✓ ✓

2. **[1 mark]**
Given that a goal is worth 6 points and a behind is worth 1 point, create a 2 x 1 matrix and call it Matrix P.

Matrix P = $\begin{bmatrix} 6 \\ 1 \end{bmatrix}$ ✓

3. **[2 marks]**
Using the matrices above complete a matrix operation that would give you a resulting matrix that lists the current totals for the top 10 AFL players for 2017. Call this Matrix T.

$R_2 \times P = T$ ✓

$T = \begin{bmatrix} 75 \\ 56 \\ 51 \\ 46 \\ 43 \\ 42 \\ 37 \\ 37 \\ 39 \\ 40 \end{bmatrix}$ ✓

5

4. [5 marks: 2, 3]

If the following results were to happen for round 3, the number of behinds Josh Kennedy scored is unknown so we have represented it with variable X, create a 10 x 2 matrix for these results and call it Matrix R_3 then perform the following matrix operation $R_2 + R_3$

Players Name	Team	Goals	Behinds
Joshua Kennedy	West Coast	2	X
Taylor Walker	Adelaide	3	2
Josh Bruce	St Kilda	4	1
Luke Breust	Hawthorn	6	5
Jarrad Waite	North Melbourne	2	1
Jamie Cripps	West Coast	3	2
Matthew Pavlich	Fremantle	2	1
Cameron McCarthy	GWS	3	1
Shaun Higgins	North Melbourne	2	2
Jack Riewoldt	Richmond	1	3

Matrix R_3 = $\begin{bmatrix} 2 & x \\ 3 & 2 \\ 4 & 1 \\ 6 & 5 \\ 2 & 1 \\ 3 & 2 \\ 2 & 1 \\ 3 & 1 \\ 2 & 2 \\ 1 & 3 \end{bmatrix}$ ✓ ✓

$R_2 + R_3$ = $\begin{bmatrix} 14 & x+3 \\ 11 & 10 \\ 12 & 4 \\ 13 & 9 \\ 9 & 2 \\ 10 & 2 \\ 8 & 2 \\ 9 & 2 \\ 8 & 5 \\ 7 & 7 \end{bmatrix}$ ✓ ✓ ✓

5

5. [4 marks]

Calculate the new total score for each player and show the matrix operation.

$$(R_2+R_3)\times P = \begin{bmatrix} x+87 \\ 76 \\ 76 \\ 87 \\ 56 \\ 62 \\ 50 \\ 56 \\ 53 \\ 49 \end{bmatrix}$$

6. [2 marks]

Work out what number of behinds Josh Kennedy of the West Coast Eagles, would have to score, in order to remain in the lead as the highest point scorer and explain your answer.

1 behind because a behind is worth 1 point making Josh Kennedy's total 88 and therefore the highest point scorer.

6

[Scenario 2: 14 marks] A financial planner was asked to set up a share portfolio for 3 different clients involving 3 different companies, the information has been entered into matrix A below.

$$\mathbf{A} = \begin{array}{c} \\ \text{Client A} \\ \text{Client B} \\ \text{Client C} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Company 1} & \text{Company 2} & \text{Company 3} \end{array} \\ \begin{bmatrix} 500 & 200 & 340 \\ 300 & 625 & 100 \\ 220 & 450 & 180 \end{bmatrix} \end{array}$$

In 2015 the shares were each worth

$$\mathbf{B_1} = \begin{array}{c} \text{Company 1} \\ \text{Company 2} \\ \text{Company 3} \end{array} \begin{bmatrix} \$4.15 \\ \$1.25 \\ \$0.70 \end{bmatrix}$$

3×1

In 2018 the shares are now worth

$$\mathbf{B_2} = \begin{array}{c} \text{Company 1} \\ \text{Company 2} \\ \text{Company 3} \end{array} \begin{bmatrix} \$5.75 \\ \$2.58 \\ \$0.64 \end{bmatrix}$$

7. Use matrix multiplication to determine the value of each client's portfolio in 2015 and 2018 [4 marks]

2015 = $A \times B_1 = \begin{bmatrix} \$2563 \\ \$2096.25 \\ \$1601.50 \end{bmatrix}$ ✓ ✓

2017 $A \times B_2 = \begin{bmatrix} \$3608.60 \\ \$3401.50 \\ \$2541.20 \end{bmatrix}$ ✓ ✓

8. Consider the matrix operations: $M = A \times (B_2 - B_1)$ and $M = (B_2 - B_1) \times A$

a) Which of these operations is possible and why? [2 marks]

$M = A \times (B_2 - B_1)$ ✓ ✓

matrix A has the dimensions of 3×3 so the only valid multiplication is if matrix A premultiplies $(B_2 - B_1)$ which has the dimensions of 3×1 because columns needs to equal rows.

b) If we called the output matrix of $(B_2 - B_1) = C$, Find matrix C and explain the element in C_{31} in relation to scenario 2. [4 marks]

$B_2 - B_1 = C$ ✓

$C = \begin{bmatrix} \$1.60 \\ \$1.33 \\ \$-0.06 \end{bmatrix}$

$C_{31} = \$ -0.06$ ✓

This element represents the decrease in stock worth for Company 3 by 6 cents from 2015 to 2018 ✓ ✓

b) Find matrix M using the correct operations from (a) and explain the findings. [4 marks]

$M = \begin{bmatrix} \$1045.60 \\ \$1305.25 \\ \$939.70 \end{bmatrix}$ ✓ ✓

These values represent the change in each clients stock portfolio worth from 2015 to 2018. ✓ ✓

Client A's portfolio grew by \$1045.60
Client B's portfolio grew by \$1305.25
Client C's portfolio grew by \$939.70

14