YEARMATRICESTEST

Name: _________________________________________

Skills /41 Analysis /19 TOTAL: /60 60 mins

SECTION A: Multiple Choice  (10 x 1 marks = 10 marks)

Questions 1-6 are to be answered using the following matrices:

\[ P = \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}, \quad Q = \begin{bmatrix} -1 \\ 1 \end{bmatrix}, \quad R = \begin{bmatrix} 3 & -1 \end{bmatrix}, \quad S = \begin{bmatrix} 3 & 1 & -1 \\ 1 & 0 & 1 \end{bmatrix}, \quad T = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \]

1. The row matrix is:

A. P  B. Q  C. R  D. S  E. T

2. Which matrix has an order of (2×1)?

A. P  B. Q  C. R  D. S  E. T

3. The following matrix product is not defined:

A. PQ  B. PS  C. QR  D. ST  E. RT

4. The order of product matrix RS will be:

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

5. -10S is equal to:

A. \[ \begin{bmatrix} 30 & 10 & -10 \\ -10 & 0 & 10 \end{bmatrix} \]  B. \[ \begin{bmatrix} -30 & 10 & -10 \\ -10 & 0 & 10 \end{bmatrix} \]  C. \[ \begin{bmatrix} -30 & -10 & 10 \\ -10 & 0 & 10 \end{bmatrix} \] 

D. \[ \begin{bmatrix} -30 & 10 & -10 \\ -10 & 0 & 10 \end{bmatrix} \]  E. \[ \begin{bmatrix} -30 & -10 & 10 \\ -10 & -10 & 10 \end{bmatrix} \]

6. \( P^{-1} \) is equal to:

A. 1  B. \[ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \]  C. \[ \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix} \]  D. \[ \begin{bmatrix} 0.5 & 0 \\ -0.5 & 1 \end{bmatrix} \]  E. \[ \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix} \]
Questions 7-10 are to be answered using the following matrices:

\[ J = \begin{bmatrix} 5 & 3 \\ 1 & 4 \end{bmatrix} \quad K = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad L = \begin{bmatrix} -4 & -3 \\ -3 & 4 \end{bmatrix} \quad M = \begin{bmatrix} -3 & 1 \\ 6 & -2 \end{bmatrix} \quad N = \begin{bmatrix} 8 & -3 \\ 3 & -8 \end{bmatrix} \]

7. The singular matrix is:

A. J  
B. K  
C. L  
D. M  
E. N

8. The determinant of N is:

A. \begin{bmatrix} 0.15 & -0.05 \\ 0.05 & -0.15 \end{bmatrix}  
B. -55  
C. \(-\frac{1}{73}\)  
D. \(-\frac{1}{55}\)  
E. -73

9. Select the false statement.

A. JK = KJ  
B. JK = J  
C. KJ = K  
D. J \times J^{-1} = K  
E. KL = L

10. \begin{bmatrix} 11 & -4 \\ -3 & -6 \end{bmatrix} is the result of:

A. M + N  
B. N - M  
C. M - N  
D. M \times N  
E. N \times M

SECTION B: Short Answer  
(31 marks)

1. During the 2014 AFL Preliminary Finals, Sydney kicked 19 goals & 22 behinds, North Melbourne kicked 9 goals & 11 behinds, Hawthorn kicked 15 goals & 7 behinds and Port Adelaide kicked 13 goals & 16 behinds. Represent this information as a (4×2) matrix.
2. If \( A = \begin{bmatrix} 5 & -2 \\ 3 & 0 \end{bmatrix} \) and \( B = \begin{bmatrix} 1 & -0.5 \\ -6 & 7 \end{bmatrix} \), calculate the following:

\[ a) \ A + B \quad b) \ \frac{1}{2}B \quad c) \ 2(B-A) \]

(3 marks)

3. Calculate the value of the pronumerals, given that

\[ \begin{bmatrix} 4 & 6 \\ a & 6 \end{bmatrix} + \begin{bmatrix} b & 2 \\ 5 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 8 \\ -2 & c \end{bmatrix} \]

\[ a = \quad \quad \quad b = \quad \quad \quad c = \quad \quad \quad \]

(3 marks)

4. Calculate \( J \) given that \( 3J = \begin{bmatrix} -9 & 0 \\ 30 & 27 \end{bmatrix} \)

\[ J = \begin{bmatrix} \quad \quad \\ \quad \quad \end{bmatrix} \]

(1 mark)

5. Two matrices can only be multiplied together if: __________________________

______________________________

______________________________

(1 mark)
6. If \( G = \begin{bmatrix} 3 & 2 \\ 0 & 1 \\ -2 & 4 \end{bmatrix} \) and \( H = \begin{bmatrix} 0.5 & 2 \\ -2 & 0 \end{bmatrix} \), calculate the product matrix \( GH \).

(1 mark)

7. a) Fill in the blanks using two of the words given as options below.

<table>
<thead>
<tr>
<th>SCALAR</th>
<th>IDENTITY</th>
<th>DETERMINANT</th>
<th>INVERSE</th>
</tr>
</thead>
</table>

“\( \text{When a matrix is multiplied by its } \underline{\text{__________________________}}, \ an \underline{\text{__________________________} \text{ matrix is produced}}. \)”

b) Provide an example of the matrix identified in part a).

(2 + 1 = 3 marks)

8. \( C = \begin{bmatrix} 1 & 6 \\ -2 & -2 \end{bmatrix} \) and \( D = \begin{bmatrix} -5 & 10 \\ -4 & 8 \end{bmatrix} \)

a) For which matrix, \( C \) or \( D \), does an inverse matrix not exist? Why?

(2 marks)
b) Justify your response to part a) with relevant workings.

c) For the other matrix, calculate its determinant and inverse matrix. You do not need to show workings.

9. If \( N = \begin{bmatrix} -4 & 5 \\ 1 & -3 \end{bmatrix} \) then \( N^{-1} = k \begin{bmatrix} -3 & -5 \\ -1 & -4 \end{bmatrix} \).

The value of \( k \) is: _______________

(1 mark)

10. In one week, a maths store sold 14 calculators for a total of $1140. The newest model of graphics calculators cost $85 each, and last year’s models cost $75 each.

a) Define the two variables.

Let \( x = \)

Let \( y = \)

b) Form 2 linear equations to represent this information.

(2 + 2 = 4 marks)
c) Rewrite the two equations in matrix form.

d) The solution is given by the equation \( X = A^{-1}C \). Label your matrices accordingly.

e) Find \( X \), and hence calculate how many of each type of calculator were sold.

\((2 + 1 + 3 = 6 \text{ marks})\)
SECTION C: Analysis (19 marks)

1. The College uniform shop does a mid-year stocktake on jumpers, blazers and shirts sold to Middle School and Senior School students. This is shown as matrix $T$ below. The cost ($) of each clothing item is shown below as matrix $C$.

<table>
<thead>
<tr>
<th></th>
<th>Jumpers</th>
<th>Blazers</th>
<th>Shirts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle School</td>
<td>29</td>
<td>18</td>
<td>42</td>
</tr>
<tr>
<td>Senior School</td>
<td>17</td>
<td>9</td>
<td>33</td>
</tr>
</tbody>
</table>

$T = \begin{bmatrix} 29 & 18 & 42 \\ 17 & 9 & 33 \end{bmatrix}$

$C = \begin{bmatrix} \text{Jumpers} & 36 \\ \text{Blazers} & 90 \\ \text{Shirts} & 25 \end{bmatrix}$

a) How many shirts were sold to Middle School students?

b) What is $T_{2,1}$ and what does it represent?

c) Of the three types of clothing sold, which item did the uniform shop sell the most of?

d) Calculate matrix $TC$ and label its rows and columns.

$(1 + 2 + 1 + 3 = 7 \text{ marks})$
e) i) Did the uniform shop receive a greater income from Middle School or Senior School sales?

ii) What was this income?

iii) What was the total income received by the uniform shop?

\((1 + 1 + 1 = 3 \text{ marks})\)

2. The prices of pizzas vary in three different restaurants. At *Domino's*, a Meat-lovers costs $6, a Margherita costs $5, a Vegetarian costs $4.50 and a Supreme costs $7. At *Pizza Hut*, a Meat-lovers costs $6, a Margherita costs $7, a Vegetarian costs $5 and a Supreme costs $5. At *Crust*, a Meat-lovers costs $5, a Margherita costs $6, a Vegetarian costs $6 and a Supreme costs $6.

a) Write this information in a labelled \((3 \times 4)\) matrix, called \(C\).

\((2 \text{ marks})\)
b) The students in Year 1 order 8 Meat-lovers, 4 Margheritas, 6 Vegetarian and 12 Supreme pizzas. The students in Year 2 order 6 Meat-lovers, 12 Margheritas, 8 Vegetarian and 4 Supreme pizzas. Write this information in a labelled (4 × 2) matrix, called $P$. 

(2 marks)

c) Calculate the matrix product of $C$ and $P$ to answer the following questions:

i) The total cost for Year 1 to eat at Pizza Hut: ___________________

ii) The total cost for Year 2 to eat at Crust: ___________________

iii) Which pizza restaurant is cheapest for Year 1: ___________________

(2 + 1 + 1 + 1 = 5 marks)

END OF TEST