

YEAR 11 GENERAL MATHEMATICS 2014 – MATRICES TEST

Name: _____

Skills /25 Analysis /15 TOTAL: /40 45 mins

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

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

$$V = \begin{bmatrix} 2 & 5 \\ 3 & 6 \\ 4 & 7 \end{bmatrix} \quad I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad X = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \quad Y = \begin{bmatrix} 3 & -1 \\ -6 & 4 \end{bmatrix} \quad Z = \begin{bmatrix} -4 & 0 \\ -4 & -8 \end{bmatrix}$$

1. Which matrix has an order of (2x3)?

- A. V B. I C. X D. Y E. Z

2. Which statement about matrix I is **false**?

- A. I is an identity matrix B. $I \times Y = Y$ C. I is a square matrix
D. $I \times Y = W$ E. The order of I is (2x2)

3. $-2Z$ is equal to:

- A. $\begin{bmatrix} -8 & 0 \\ -8 & -16 \end{bmatrix}$ B. $\begin{bmatrix} 16 & 0 \\ 16 & 64 \end{bmatrix}$ C. $\begin{bmatrix} 8 & 0 \\ 8 & 16 \end{bmatrix}$ D. $\begin{bmatrix} -6 & 2 \\ 12 & -8 \end{bmatrix}$ E. Undefined

4. Which matrix product exists?

- A. IV B. XZ C. YV D. XY E. VX

5. $Y + Z =$

- A. $\begin{bmatrix} -1 & -1 \\ -10 & -4 \end{bmatrix}$ B. $\begin{bmatrix} -8 & 8 \\ 8 & -32 \end{bmatrix}$ C. $\begin{bmatrix} -12 & 4 \\ 36 & -28 \end{bmatrix}$ D. $\begin{bmatrix} -1 & -1 \\ -2 & -4 \end{bmatrix}$ E. $\begin{bmatrix} 7 & -1 \\ -2 & 12 \end{bmatrix}$

6. The $\det(Y)$ is equal to:

- A. $\frac{1}{6}$ B. 6 C. 18 D. $\frac{1}{18}$ E. -6

7. If $AX = B$, then X can be given by:

- A. AB^{-1} B. BA^{-1} C. B/A D. $A^{-1}B$ E. IA^{-1}

8. $S = \begin{bmatrix} 6 & -3 \\ 2 & 0 \end{bmatrix}$ is a singular matrix because:

- A. It is a square matrix B. $S_{2,2}$
 C. Its number of rows = number of columns D. Its identity matrix cannot be found
 E. $\det(S) = 0$

9. $\begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 4 \end{bmatrix}$ generates the following pairs of simultaneous equations:

- A. $x + y = 1$ B. $2x = 1$
 $x + 3y = 4$ $x + 3y = 4$
 C. $x + 4y = 0$ D. $x = 1$
 $x + 3y = 4$ $3x + y = 4$
 E. $x + y = 1$
 $3x + y = 4$

10. The linear equations $x - 5y = 4$ and $-2x + y = 3$ can be written in matrix form as:

- A. $\begin{bmatrix} 1 & 5 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ B. $\begin{bmatrix} 1 & -5 \\ -2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$
 C. $\begin{bmatrix} -5 & 1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ D. $\begin{bmatrix} 1 & 5 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$
 E. $\begin{bmatrix} 1 & -5 \\ -2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$

SECTION B: Short Answer (20 marks)

1. $X = \begin{bmatrix} 2 & 3 & -5 \end{bmatrix}$ and $Y = \begin{bmatrix} 11 & 3 & 1 \\ 9 & 1 & 3 \\ 5 & 3 & 6 \end{bmatrix}$

- a) The order of matrix X is _____ (1 mark)
 b) The order of matrix Y is _____ (1 mark)
 c) The order of matrix XY will be _____ (1 mark)

d) Calculate matrix XY and show your workings. (2 marks)

2. Given that $L = \begin{bmatrix} 8 & -2 \\ 9 & 4 \end{bmatrix}$ $M = \begin{bmatrix} 2 & 8 \\ 8 & -9 \end{bmatrix}$ $N = \begin{bmatrix} 1 & 9 \\ -2 & -3 \end{bmatrix}$

a) $L + N =$ (1 mark)

b) $M - N =$ (1 mark)

c) $3L =$ (1 mark)

d) $2N - 4M =$ (1 mark)

3. If $\begin{bmatrix} -11 & 3 \\ 8 & -6 \end{bmatrix} + \begin{bmatrix} a & b \\ -10 & 2 \end{bmatrix} = \begin{bmatrix} -5 & -4 \\ c & -4 \end{bmatrix}$ then

a) $a =$

b) $b =$

c) $c =$

(1 + 1 + 1 = 3 marks)

4. $T = \begin{bmatrix} 2 & 4 \\ 2 & 3 \end{bmatrix}$

a) i. Find $\det(T)$: (1 mark)

ii. $T^{-1} =$ (1 mark)

b) State the name of the matrix produced when T is multiplied by its inverse. (1 mark)

5. The following system of linear equations need to be solved using matrix methods:

$$\begin{aligned}x + 2y &= -4 \\3x - 2y &= 12\end{aligned}$$

a) Write the two equations in matrix form. (2 marks)

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

c) $A^{-1} = \begin{bmatrix} & \\ & \end{bmatrix}$ (1 mark)

d) Find X . (1 mark)

SECTION C: Analysis (15 marks)

1. Four peaches and 12 nectarines cost \$2.28. At the same shop, two peaches and 14 nectarines cost \$2.10. Using matrix methods, find the cost of each piece of fruit. (5 marks)

2. For three seasons each year, a travel agent accommodates a certain number of people in four different tours: Tours A, B, C and D. This is shown as matrix S below. The cost (\$) per tour, and the number of brochures printed for each person's information pack per tour, is shown below as matrix T .

		Tour	Tour	Tour	Tour
		A	B	C	D
S=	Autumn	50	65	45	30
	Spring	60	70	50	30
	Summer	55	85	70	40

		\$	brochure
T=	Tour A	250	3
	Tour B	315	5
	Tour C	380	6
	Tour D	420	8

- a) How many people are accommodated for in Spring for Tour D? (1 mark)
- b) In which season do most people travel? (1 mark)

- c) How many brochures are given in Tour B? (1 mark)
- d) Find matrix ST and label its rows and columns (3 marks)
- e) What was the total cost for Spring? (1 mark)
- f) How many brochures were printed in Autumn? (1 mark)
- g) State the value of $ST_{2,2}$ and explain what it represents. (2 marks)