Name:	School:	Target Grade:

PARADIGM

SECONDARY 4 E Math WA1

MOCK EXAM PAPER (Sets and Matrices)

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a nice comfortable spot without distraction.

2. Be fully focused for the whole duration of the test.

3. Speed is KING. Finish the paper as soon as possible then return-back to Check Your Answers.

4. As you are checking your answers, always find ways to VALIDATE your answer.

5. Avoid looking through line by line as usually you will not be able to see your Blind Spot.

6. If there is no alternative method, cover your answer and REDO the question.

7. Give non-exact answers to 3 significant figures, or 1 decimal place for angles in degree, or 2 decimal place for $$$, unless a different level of accuracy is specified in the question.

Wish you guys all the best in this test.

You can do it.

I believe in you.

Team Paradigm

If you are struggling in this paper, it's an indication to work harder!
If you need support and personalised guidance, you can find us here www.mathtutor.com.sg

PARADIGM [Turn Over]

Name: _____ Class: _____ Date: _____

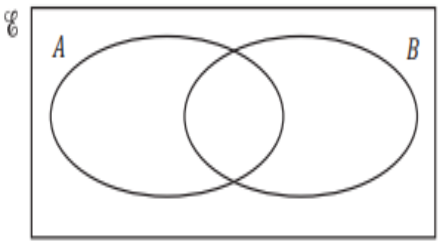
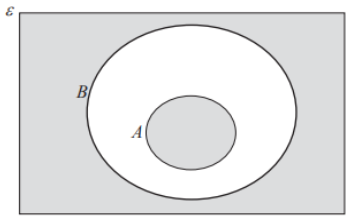
Secondary 4 E Mathematics
WA1 Mock Paper

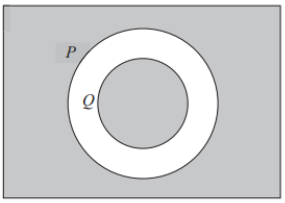
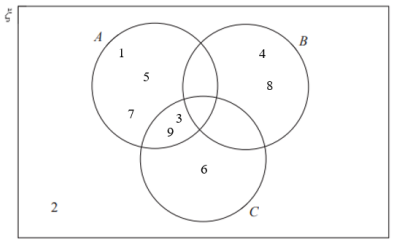
40

Topic: Sets and Matrices

Duration: 60 mins

Sets

1	(a) On the Venn diagram, shade the region which represent $(A \cup B') \cap (A' \cup B)$  (b) $E = \{(x, y): x + y \leq 10\}$ $A = \{(0,1)(1,2), (1,4), (1,5)\}$ $B = \{1,0), (1,2), (1,3), (2,1), (3,7)\}$ Underlined the correct statement from the list below. $A \cap B = (1, 2)$ $\{1,5\} \subset A$ $\emptyset \subset B$ $(2,6)\, \epsilon\, (A \cup B)'$ $A \subset B$	[1] [2]
2	$\varepsilon = \{x: x$ is an integer, $4 < x \leq 20\}$ $A = \{x: x$ is a factor of $12\}$ $B = \{x: x$ is a multiple of $2\}$ (a) Find (i) $A \cap B$ (ii) $(A \cup B)'$ (b) (i) Is A a proper subset of B? Explain. (ii) Write down the set notation to represent your answer in (b)(i) (c) Use set notation to describe the shaded region 	[1] [1] [1] [1] [1]

3	(a) On the Venn diagram, shade the region which represents $Q \cup P'$. (b) $\xi = \{\text{integers } x: 1 \leq x \leq 9\}$. The Venn diagram shows the elements of ξ and three sets A, B and C.  Use one of the symbols below to complete each statement. $\emptyset \quad \subset \quad \not\subset \quad \notin \quad \epsilon \quad \xi$ (i) $\{4.8\}$___ B (ii) 9____ C (iii) $B \cap C =$ _____  	[1] [1] [1] [1]

Matrices

1 Henry is a yoga instructor. He offers session for Basic and Intermediate students on weekdays and at weekends. Each student has a 10-week block of sessions with one session per week. The matrix **S** shows the number of students he coaches each week in one 10-week block.

$$\mathbf{S} = \begin{matrix} \text{Basic} & \text{Intermediate} \\ \begin{pmatrix} 6 & 9 \\ 3 & 5 \end{pmatrix} & \begin{matrix} \text{Weekday} \\ \text{Weekend} \end{matrix} \end{matrix}$$

(a) Evaluate the matrix $\mathbf{T} = 10\mathbf{S}$. [1]

(b) Henry charges \$50 for each basic session and \$80 for each Intermediate session. Represent the session charges in a 2×1 column matrix **F**. [1]

(c) Evaluate the matrix $\mathbf{Q} = \mathbf{TF}$. [2]

(d) State what the elements of **Q** represent. [1]

(e) Henry wants to attract more students, so in the next 10-week block he reduces his prices by 10%. For this block of sessions, on weekdays he has 10 Basic students and 5 intermediate students. On weekends he has 6 basic students and 4 Intermediate students. Calculate the total amount of money he earns for this 10-week block sessions. [3]

2 (a) Given that $\mathbf{P} = \begin{pmatrix} w & 1 \\ 0 & 2 \end{pmatrix}$ and $\mathbf{P}^2 = \begin{pmatrix} 6w-9 & w+2 \\ 0 & 4 \end{pmatrix}$ where w is a constant. Find the value(s) of w. [2]

(b) A waffle maker produces three different types of waffles: Red bean, Chocolate and Peanut, for distribution to its outlets at various locations.
The table below shows the quantity delivered to each location each time.

	Chocolate	Red bean	Peanut
Outlet 1	225	140	125
Outlet 2	265	115	245
Outlet 3	245	125	175

(i) Represent the data in the above table by a 3×3 matrix A. [1]

(ii) Hence, find, by matrix multiplication, the total number of waffles delivered to each outlet. [2]

(c) The following table shows the selling price and the cost price of 1 unit of each type of waffle.

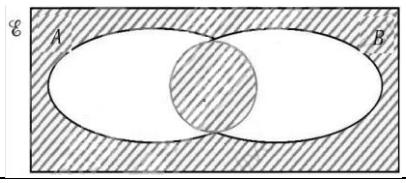
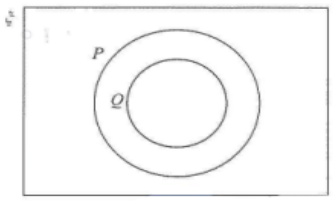
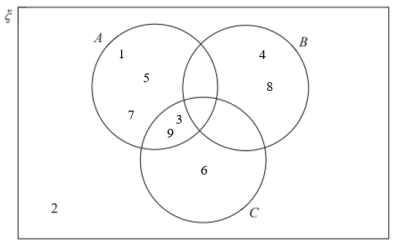
	Chocolate	Red bean	Peanut
Selling Price (\$)	1.20	0.80	1.00
Cost Price (\$)	0.60	0.50	0.40

(i) Represent the data in the above table by a matrix C such that AC gives the total selling price and total cost price of each outlet. Hence, evaluate AC. [3]

(ii) Find the profit earned by outlet 2. [1]

Answer Key

Sets

1	Ans: (a)  (b) $\emptyset \subset B$ and $(2,6)\ \epsilon\ (A\ \cup B)'$	
2	Ans: (a)(i) $A \subset B$, (a)(ii) $A \cup B'$, (b)(i) Yes, since every element in A is in B and set A is not equal to set B. (b)(ii) $\{6, 12\}$, (c) $\{5,7,9,11,13,15,17,19\}$	
3	Ans: (a)  (b)  (b)(i) $\{4,8\} \subset B$, (b)(ii) $9 \in C$, (b)(iii) $B \cap C = \emptyset$	

Matrices

1	(a) $T = 10S$ $T = 10\begin{pmatrix}6 & 9\\3 & 5\end{pmatrix}$ $T = 10\begin{pmatrix}60 & 90\\30 & 50\end{pmatrix}$ (b) $F = \begin{pmatrix}50\\80\end{pmatrix}$ (c) $Q = \begin{pmatrix}60 & 90\\90 & 50\end{pmatrix}\begin{pmatrix}50\\80\end{pmatrix}$ $Q = \begin{pmatrix}3000 + 7200\\1500 + 4000\end{pmatrix}$ $Q = \begin{pmatrix}10200\\5500\end{pmatrix}$ (e) Total amount of money earned $= (10 + 6)(50)(10)(0.9) + (5 + 4)(80)(10)(0.9)$ $= \$13680$ Ans: (a) $T = \begin{pmatrix}60 & 90\\30 & 50\end{pmatrix}$ (b) $F = \begin{pmatrix}50\\80\end{pmatrix}$ (c) $Q = \begin{pmatrix}10200\\5500\end{pmatrix}$ (d) The elements of **Q** represent the total amount of money. Henry collected for 10-week block sessions on weekdays and at weekends respectively. (e) $\$13680$	
2	(a) $\begin{pmatrix}w & 1\\0 & 2\end{pmatrix}\begin{pmatrix}w & 1\\0 & 2\end{pmatrix} = \begin{pmatrix}6w-9 & w+2\\0 & 4\end{pmatrix}$ $\begin{pmatrix}w^2 & w+2\\0 & 4\end{pmatrix} = \begin{pmatrix}6w-9 & w+2\\0 & 4\end{pmatrix}$ $w^2 = 6w - 9$ $w^2 - 6w + 9 = 0$ $(w-3)^2 = 0$ $w = 3$ (b)(i) $A = \begin{pmatrix}225 & 140 & 125\\265 & 115 & 245\\245 & 125 & 175\end{pmatrix}$ (ii) $\begin{pmatrix}225 & 140 & 125\\265 & 115 & 245\\245 & 125 & 175\end{pmatrix}\begin{pmatrix}1\\1\\1\end{pmatrix} = \begin{pmatrix}490\\625\\545\end{pmatrix}$ (c)(i) $C = \begin{pmatrix}1.20 & 0.60\\0.80 & 0.50\\1.00 & 0.40\end{pmatrix}$ or $C = \begin{pmatrix}0.60 & 1.20\\0.50 & 0.80\\0.40 & 1.00\end{pmatrix}$ $AC = \begin{pmatrix}225 & 140 & 125\\265 & 115 & 245\\245 & 125 & 175\end{pmatrix}\begin{pmatrix}1.20 & 0.60\\0.80 & 0.50\\1.00 & 0.40\end{pmatrix}$ or $AC = \begin{pmatrix}225 & 140 & 125\\265 & 115 & 245\\245 & 125 & 175\end{pmatrix}\begin{pmatrix}0.60 & 1.20\\0.50 & 0.80\\0.40 & 1.00\end{pmatrix}$ $= \begin{pmatrix}507 & 255\\655 & 314.50\\569 & 279.50\end{pmatrix}$ or $\begin{pmatrix}255 & 507\\314.50 & 655\\279.50 & 569\end{pmatrix}$ (ii) Profit earned by outlet 2 $= \$340.50$	