



Name: _____ () Class: _____ Date: _____

Topical Revision Worksheet 5

Topic: Matrices

Question 1 [2008 EOY, Q18] Only for SMTP		marks
(a)	If $\begin{pmatrix} 2a & 3 \\ -a & a \end{pmatrix}$ is singular, find the possible values of a .	[3]
Answer:	$a = 0$ or $a = -\frac{3}{2}$	
(b) (i)	It is given that $2ax + 3y = 15$ and $ay - ax = k$, where a and k are real constants and $a \neq 0$.	[2]
Answer:	$k = -\frac{15}{2}$	
(b) (ii)	Solve the simultaneous equations for x and y if $a = -1$ and $k = -5$.	[3]
Answer:	$x = 0$ and $y = 5$	
Question 2 [2009 EOY, Q6] Inverse matrices Only for SMTP		marks
Solve the following simultaneous equations using the matrix method $5x + 3y + 10 = 7x + 7y - 30 = 8x + 6y - 29$.		[5]
Answer	$x = 6, y = 7$	
Question 3 [2010 EOY, Q17 OR] Singular Matrices Only for SMTP		marks
(a)	If $\begin{pmatrix} 3a & 2 \\ a & -a \end{pmatrix}$ is singular, find the possible values of a .	[3]
Answer:	$a = 0$ or $a = -\frac{2}{3}$	
(b)	It is given that $3ax + 2y = 8$ and $ax - ay = k$, where a and k are real constants and $a \neq 0$.	[2]
(i)	Determine the value of k if there are infinitely many answers to the pair of simultaneous equations.	
Answer:	$k = \frac{8}{3}$	
(ii)	Use the matrix method to solve the simultaneous equations for x and y if $a = 1$ and $k = 6$.	[3]
Answer:	$x = 4$ and $y = -2$	

Question 4 [2011 EOY, Q5]	marks
Given that $\begin{pmatrix} 7 & -1 & -1 \\ -3 & m & 0 \\ -3 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ 3 & 4 & 3 \\ 3 & 3 & 4 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, show that $m = 1$. Answer: $(-3)(1) + m(4) + (0)(3) = 1$	[2]
$x + y + z = 1$ $3x + 4y + 3z = 2$ $3x + 3y + 4z = -3$ [only for SMTP] Hence solve the following simultaneous equations. Answer: $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 8 \\ -1 \\ -6 \end{pmatrix}$	[3]
Question 5 [2012 EOY, Q1] Only for SMTP	marks
Write down the inverse of the matrix $\begin{pmatrix} -2 & 7 \\ 3 & -10 \end{pmatrix}$ and use this to solve the simultaneous equations $7y - 2x - 8 = 0$, $3x - 10y + 11 = 0$. Answer: $\begin{pmatrix} 10 & 7 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 10 & 7 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} 8 \\ -11 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$	[4]
Question 6 [2013 EOY, Q3] Only for SMTP	marks
(i) Find $\mathbf{A}^{-1}$ and $\mathbf{B}^{-1}$, the inverses of the matrices $\mathbf{A} = \begin{bmatrix} 4 & 3 \\ 2 & 2 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix}$. Answer: $\mathbf{A}^{-1} = \begin{bmatrix} 1 & -1.5 \\ -1 & 2 \end{bmatrix}$ and $\mathbf{B}^{-1} = \begin{bmatrix} 1 & -4 \\ -1 & 5 \end{bmatrix}$	[2]
(ii) Use $\mathbf{A}^{-1}$ and $\mathbf{B}^{-1}$ from (i), to find the matrix $\mathbf{M}$ $\begin{bmatrix} 4 & 3 \\ 2 & 2 \end{bmatrix} \mathbf{M} \begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ 6 & 2 \end{bmatrix}$. Answer: $\begin{bmatrix} -2 & 5 \\ 4 & -12 \end{bmatrix}$	[3]

Question 7 [2014 EOY, Q4] (ii) Only for SMTP		marks									
Two outlets of a local bakery sold the following types of cakes on a particular day. <table><tr><td></td><td>Pandan cake</td><td>Chocolate cake</td></tr><tr><td>Outlet <i>A</i></td><td>100</td><td>120</td></tr><tr><td>Outlet <i>B</i></td><td>70</td><td>85</td></tr></table> The costs of baking a pandan cake and a chocolate cake are \$5 and \$6 respectively. In both outlets, each pandan cake was sold at \$<i>x</i>, and each chocolate cake was sold at \$<i>y</i>. It is given that $\mathbf{P} = \begin{pmatrix} 100 & 120 \\ 70 & 85 \end{pmatrix}$, $\mathbf{Q} = \begin{pmatrix} 5 \\ 6 \end{pmatrix}$ and $\mathbf{R} = \begin{pmatrix} x \\ y \end{pmatrix}$. (i) Write down an expression connecting P, Q and R, such that it represents the profit earned by each outlet on that particular day. Answer: $\mathbf{P}(\mathbf{R} - \mathbf{Q})$ or $\begin{pmatrix} 100 & 120 \\ 70 & 85 \end{pmatrix} \begin{pmatrix} x-5 \\ y-6 \end{pmatrix}$ or $\begin{pmatrix} 100 & 120 \\ 70 & 85 \end{pmatrix} \left[\begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 5 \\ 6 \end{pmatrix} \right]$			Pandan cake	Chocolate cake	Outlet <i>A</i>	100	120	Outlet <i>B</i>	70	85	[1]
	Pandan cake	Chocolate cake									
Outlet <i>A</i>	100	120									
Outlet <i>B</i>	70	85									
(ii) If the profits earned by Outlet <i>A</i> and Outlet <i>B</i> on that particular day were \$1710 and \$1205 respectively, find the selling price for each type of cake using the inverse matrix method. Answer: $x = 12.5, y = 14$ The price of pandan cake is \$12.50 each, and the price of chocolate cake is \$14 each.		[4]									

Question 8 [2015 EOY, Q7]	Marks												
A factory makes tables and chairs. The following table shows the breakdown of the amount of time taken, as well as the amount of wood and paint needed to produce each item. <table><tr><td></td><td>Time taken (hours)</td><td>Wood (number of blocks)</td><td>Paint (number of tins)</td></tr><tr><td>Table</td><td>6</td><td>4</td><td>3</td></tr><tr><td>Chair</td><td>3</td><td>3</td><td>2</td></tr></table> Labour costs \$10 per hour, while wood costs \$3 per block and each tin of paint costs \$5. It is given that $\mathbf{A} = \begin{pmatrix} 6 & 4 & 3 \\ 3 & 3 & 2 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 10 \\ 3 \\ 5 \end{pmatrix}$ and $\mathbf{C} = \mathbf{AB}$. (i) Evaluate $\mathbf{C}$ and explain what the numbers in $\mathbf{C}$ represent. Answer: $\mathbf{C} = \begin{pmatrix} 87 \\ 49 \end{pmatrix}$ the numbers represent the cost of producing one table and one chair (\$87 and \$49 respectively).		Time taken (hours)	Wood (number of blocks)	Paint (number of tins)	Table	6	4	3	Chair	3	3	2	[2]
	Time taken (hours)	Wood (number of blocks)	Paint (number of tins)										
Table	6	4	3										
Chair	3	3	2										
(ii) If the factory makes 20 tables and 50 chairs, represent the information as a row matrix $\mathbf{D}$. Evaluate $\mathbf{DC}$ and explain what the answer represents. Answer: $\mathbf{D} = (20 \ 50)$ $\mathbf{DC} = (4190)$, it represents the total cost (\$4190) of producing 20 tables and 50 chairs.	[3]												