PERTH MODERN SCHOOL
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Unit 2 Specialist Mathematics Test 4 2022
Matrices, Transformations and Trigonometry

Student name: _____ Teacher name: _____

Task type: Response

Time allowed for this task: 40 minutes

Number of questions: 11

Materials required: Formula Sheet

Standard items: Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: 1 A4 Page of Notes (Double Sided), NO CALCULATOR ALLOWED

Marks available: 38 marks

Task weighting: 10 %

Formula sheet provided: Yes

Note: All part questions worth more than 2 marks require working to obtain full marks.

Question 1 **[2 Marks]**

The table below shows information about two matrices, A and B

Matrix	Size	Rule
A	2×2	$a_{ij} = 2i + j$
B	2×2	$b_{ij} = i - j$

The element in row i and column j of matrix A is a_{ij}
The element in row i and column j of matrix B is b_{ij}

Calculate $A + B$

Question 2 **[2 Marks]**

Calculate $\begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \mathrm{L} \\ \mathrm{E} \\ \mathrm{A} \\ \mathrm{P} \\ \mathrm{S} \end{bmatrix} =$

Question 3 **[2 Marks]**

Write the single matrix that corresponds to a dilation by a factor of 2 from the *x*-axis followed by a rotation 90˚ degrees clockwise about the origin.

Question 4 **[2 Marks]**

Let $\sec(x) = 3$, where $\frac{3\pi}{2} \leq x \leq 2\pi$. Calculate the exact value of $\cot(x)$

Question 5 **[3 Marks]**

Use matrices to solve the pair of the simultaneous equations below:

$3x - 2y = 10$

$2x - 5y = 7$

Question 6 **[2 Marks]**

For which value(s) of a will the simultaneous equations below have a unique solution.

$5x + ay = 20$

$2ax + 4y = -13$

Question 7 **[3 Marks]**

If $A = \begin{bmatrix} 3 & 4 \\ 2 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 \\ 1 & 6 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & -1 \\ 2 & 2 \end{bmatrix}$, find $\boldsymbol{X}$ such that $A\boldsymbol{X} + B = C$

Question 8 **[3 Marks]**

The matrix $\begin{bmatrix} a & b \\ b & a \end{bmatrix}$ transforms the point $(3, 4)$ to the point $(11, 10)$. Find the values of a and b.

Question 9 **[7 Marks = 2, 3, 2]**

If $\cos(A) = -\frac{3}{5}$ where $\frac{\pi}{2} \leq A \leq \pi$ and $\sin(B) = -\frac{5}{13}$ where $\frac{3\pi}{2} \leq B \leq 2\pi$, calculate the following as exact values.

a) $\cot(A)$

b) $\tan(2B)$

c) $cos\,(A + B)$

Question 10 **[6 Marks = 3, 3]**

Prove the following identities.

a) $\cot\theta - \tan\theta = 2\cot(2\theta)$

b) $\sin(2\theta) = \frac{2\tan\theta}{1+tan^2\theta}$

Question 11 **[6 Marks = 3, 3]**

Solve each of the following equations for $0 \leq x \leq 2\pi$ (give exact values)

a) $\sin(3x)\cos(x) - \cos(3x)\sin(x) = \frac{\sqrt{3}}{2}$

b) $\sqrt{3}\sin x + \cos x = 1$

END OF TEST

Extra working space