



2016 Yr 11 Specialist Mathematics
Matrices & Transformations of the Plane
Technology Access & A4 Summary Sheet Test

Name:

Time allowed: 45 minutes

Total Marks: / 45

Section A. Multiple Choice Questions. Clearly circle your answer (2 marks each)

- 1 If **A** is a 3×4 matrix, and **B** is a 4×3 matrix, the resulting matrix **AB**:
- A** is a 4×4 matrix
 - B** is a 3×4 matrix
 - C** is a 3×3 matrix
 - D** is a 6×8 matrix
 - E** cannot be determined
- 2 The inverse of matrix $\mathbf{A} = \begin{bmatrix} 2 & 2 \\ 3 & 3 \end{bmatrix}$:
- A** is $\begin{bmatrix} -2 & -2 \\ -3 & -3 \end{bmatrix}$
 - B** is $\frac{1}{12} \begin{bmatrix} 3 & -2 \\ -3 & 2 \end{bmatrix}$
 - C** is $\begin{bmatrix} 2 & -2 \\ -3 & 3 \end{bmatrix}$
 - D** is $\begin{bmatrix} 3 & -2 \\ -3 & 2 \end{bmatrix}$
 - E** does not exist
- 3 If $\mathbf{A} = \begin{bmatrix} a & b \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} c \\ d \end{bmatrix}$ and $\mathbf{C} = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$, which of the following cannot be determined?
- A** **AB**
 - B** **AC**
 - C** **BA**
 - D** **BC**
 - E** **CB**
- 4 If **A** and **B** are matrices such that $\mathbf{AY} = \mathbf{B}$, then **Y** equals:
- A** $\mathbf{BA}^{-1}$
 - B** $\mathbf{B}^{-1}\mathbf{A}^{-1}$
 - C** $\mathbf{B}^{-1}\mathbf{A}$
 - D** $\mathbf{A}^{-1}\mathbf{B}$
 - E** $\mathbf{A}^{-1}\mathbf{B}^{-1}$

- 5 The image of the point $(2, -3)$ under the transformation $(x, y) \rightarrow (2x + 3y, x - y)$ is
- A $(-5, 5)$
 B $(5, 5)$
 C $(-5, -1)$
 D $(5, -1)$
 E $(5, -5)$
- 6 The matrix $\begin{bmatrix} 0 & 2 \\ 1 & 0 \end{bmatrix}$ corresponds to
- A a dilation by factor of 2 from the y -axis followed by a reflection in the line $y = x$
 B a dilation by factor of 2 from the x -axis followed by a reflection in the line $y = x$
 C a dilation by factor of 2 from the y -axis followed by a reflection in the x -axis.
 D a dilation by factor of 2 from the y -axis followed by a reflection in the y -axis.
 E a dilation by factor of 2 from the x -axis followed by a reflection in the y -axis
- 7 The matrix that corresponds to dilation by a factor of 2 from the x -axis followed by a reflection in the y -axis
- A $\begin{bmatrix} 0 & 2 \\ 1 & 0 \end{bmatrix}$
 B $\begin{bmatrix} 0 & 2 \\ -1 & 0 \end{bmatrix}$
 C $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$
 D $\begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix}$
 E $\begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix}$
- 8 The rule for the transformation that is a translation by $\begin{bmatrix} 2 \\ -4 \end{bmatrix}$ followed by a rotation by 90° clockwise is
- A $(x, y) \rightarrow (y - 2, -x - 4)$
 B $(x, y) \rightarrow (-y + 2, x + 4)$
 C $(x, y) \rightarrow (x - 2, -y - 4)$
 D $(x, y) \rightarrow (y - 4, -x - 2)$
 E $(x, y) \rightarrow (x + 2, -y + 4)$

- 9 A transformation has matrix $\begin{bmatrix} 0 & -1 \\ 2 & 0 \end{bmatrix}$. The image of the line $x + 2y = 3$ under this transformation has equation
- A** $4x - y = 6$
B $y - 4x = 6$
C $2x - 2y = 3$
D $2x + 2y = 3$
E $2y - 2x = 3$
- 10 A transformation has matrix $\begin{bmatrix} a & -1 \\ 3 & a \end{bmatrix}$ and maps the unit square to a parallelogram of area 6 units.
- Therefore, a can have values of:
- A** ± 2
B $\pm\sqrt{3}$
C $\pm\sqrt{5}$
D $\pm\sqrt{6}$
E $\pm\sqrt{7}$

Section B. Short Answer Questions (total 25 marks)

- 1 If matrix $\mathbf{A} = \begin{bmatrix} 1 & 3 \\ 2 & 0 \\ -2 & -1 \end{bmatrix}$ and matrix $\mathbf{B} = \begin{bmatrix} -2 & 1 \\ 3 & 1 \end{bmatrix}$ explain why matrix $\mathbf{BA}$ cannot be found.

1 mark

- 2 If $\mathbf{A} = \begin{bmatrix} 3 & -2 \\ -2 & -1 \end{bmatrix}$ and $\mathbf{K} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$, solve $\mathbf{AX} = \mathbf{K}$ where $\mathbf{X} = \begin{bmatrix} x \\ y \end{bmatrix}$. Express your answer with whole number elements.

2 marks

- 3 If $\mathbf{A} = \begin{bmatrix} 3 & 2 \\ 1 & 6 \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} 3 & 4 \\ 2 & 6 \end{bmatrix}$ and $\mathbf{C} = \begin{bmatrix} 3 & 1 \\ -2 & -2 \end{bmatrix}$, find $\mathbf{X}$ such that $\mathbf{AX} + \mathbf{B} = \mathbf{C}$. Express your answer with whole number elements.

2 marks

4 Given matrices $\mathbf{A} = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} a & \frac{-1}{4} \\ \frac{-1}{2} & b \end{bmatrix}$, find the values of a and b if $\mathbf{A}^{-1} = \mathbf{B}$.

2 marks

5 The rule for a transformation is $(x, y) \rightarrow (x - y, -x + 2y)$.

a Find the matrix of this transformation and hence find the image of the point $(-2, 3)$.

2 marks

b Find the rule for the inverse transformation and hence find the point (x, y) that is mapped to the point $(2, -1)$.

2 marks

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

2 marks

- 7 Find the transformation matrix that will correspond to a reflection in the x -axis then a dilation by a factor of 2 from the y -axis.

2 marks

- 8 The straight line with equation $2x - 3y = 6$ is transformed by the rule $(x, y) \rightarrow (x + 3y, 2y)$. Find the equation of its image.

3 marks

- 9 Find the rule for the transformation that will reflect the point (x, y) in the x -axis and then translate the result by vector $\begin{bmatrix} 2 \\ -3 \end{bmatrix}$.

2 marks

- 10** For what value(s) of a does the matrix $\begin{bmatrix} 3a & -2 \\ 1 & 2 \end{bmatrix}$ map the unit square to a parallelogram of area 5 square units?

2 marks

- 11** Find the rule for the transformation that will reflect the plane in the line $y = x + 2$ and hence find the image of the point $(4,3)$ under this transformation.

3 marks