1. \((0580-S\ 2016-Paper\ 4/1-Q2)\)

(a)  

(i) Draw the image of triangle \(T\) after a translation by the vector \(\begin{pmatrix} 5 \\ -2 \end{pmatrix}\). \([2]\)

(ii) Draw the image of triangle \(T\) after a reflection in the line \(y = 1\). \([2]\)

(iii) Describe fully the single transformation that maps triangle \(T\) onto triangle \(Q\).

.........................................................................................................................................................

.........................................................................................................................................................\([3]\)
(b) \[ M = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, \quad N = \begin{pmatrix} 4 & 3 \\ 1 & k \end{pmatrix}, \quad P = \begin{pmatrix} 1 & 3 \\ 0 & 6 \end{pmatrix} \]

(i) Work out \( M + P \).

\[ \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} + \begin{pmatrix} 1 & 3 \\ 0 & 6 \end{pmatrix} \]

[1]

(ii) Work out \( PM \).

[2]

(iii) \( |M| = |N| \)

Find the value of \( k \).

\[ k = .......................... \] [3]

(c) (i) Describe fully the single transformation represented by the matrix \( \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \).

(ii) Find the matrix which represents a reflection in the line \( y = x \).

\[ \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \] [2]
2. (0580-5 2016-Paper 4/2-Q3)

(a) On the grid, draw the image of

(i) shape $A$ after a reflection in the line $x = 1$, [2]

(ii) shape $A$ after an enlargement with scale factor $-2$, centre $(0, 1)$, [2]

(iii) shape $A$ after the transformation represented by the matrix \[
\begin{pmatrix}
0 & -1 \\
1 & 0
\end{pmatrix}.
\] [3]

(b) Describe fully the single transformation represented by the matrix \[
\begin{pmatrix}
3 & 0 \\
0 & 3
\end{pmatrix}.
\] ............................................................................................................................................................................................. ............................................................................................................................................................................................. [3]
3. (0580-S 2016-Paper 4/3-Q6)

(a) (i) Draw the image of triangle $T$ after a reflection in the line $x = 0$.  

(ii) Draw the image of triangle $T$ after a rotation through $90^\circ$ clockwise about $(-2, -1)$.  

(iii) Describe fully the single transformation that maps triangle $T$ onto triangle $U$.  

(iv) Describe fully the single transformation that maps triangle $T$ onto triangle $V$.  

(b) (i) Find the matrix that represents the transformation in part (a)(i).  

\[
\begin{pmatrix}
& \\
& 
\end{pmatrix}
\]  

(ii) Describe fully the single transformation represented by the inverse of the matrix in part (b)(i).
4. (0580-S 2016-Paper 4/3-Q8)

\[ 
A = \begin{pmatrix} 2 & 0 \\ -1 & 5 \\ 3 & -4 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 3 \\ -1 & 5 \\ -4 \end{pmatrix} \quad C = \begin{pmatrix} 7 \\ -4 \end{pmatrix} \quad D = \begin{pmatrix} 2 \\ 5 \end{pmatrix} 
\]

(a) Work out each of the following if the answer is possible.
If a calculation is not possible, write “not possible” in the answer space.

(i) \( BA \) [1]

(ii) \( 2A \) [1]

(iii) \( CD \) [2]

(iv) \( DC \) [2]

(v) \( B^2 \) [2]

(b) Find \( B^{-1} \), the inverse of \( B \). [2]
5. (0580-W 2016-Paper 4/3-Q4)

(a) Draw the image when triangle $A$ is reflected in the line $x = 1$. [2]

(b) Draw the image when triangle $A$ is translated by the vector $\left(\frac{-2}{3}\right)$. [2]

(c) Draw the image when triangle $A$ is enlarged by scale factor 2 with centre (4, 5). [2]

(d) Describe fully the single transformation that maps triangle $A$ onto triangle $B$. [3]
6. (0580-W 2016 Paper 4/1-Q5)

(a) \( \mathbf{v} = \begin{pmatrix} -4 \\ -8 \end{pmatrix} \)

(i) Draw the image of triangle \( A \) after the translation by vector \( \mathbf{v} \). [2]

(ii) Calculate \( |\mathbf{v}| \).
(b) (i) Describe fully the single transformation that maps triangle $A$ onto triangle $B$.

...............................................................................................................................................[3]

...............................................................................................................................................[2]

(ii) Find the matrix that represents the transformation that maps triangle $A$ onto triangle $B$.

...............................................................................................................................................[1]

(iii) Calculate the determinant of the matrix in part (b)(ii).
7. \((0580-S\ 2017-Paper\ 4/2\ Q2)\)

(a) On the grid, draw the image of

(i) triangle \(T\) after translation by the vector \(\begin{pmatrix} 6 \\ -5 \end{pmatrix}\), \[2\]

(ii) triangle \(T\) after rotation through 90° anticlockwise with centre \((4, 10)\), \[2\]

(iii) triangle \(T\) after enlargement with scale factor \(\frac{1}{2}\), centre \((10, 0)\). \[2\]

(b) Describe fully the single transformation that is represented by the matrix \(\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}\). \[2\]

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(c) \( M = \begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}, \quad N = \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \quad P = \begin{pmatrix} 1 & 5 \end{pmatrix} \)

(i) Find

(a) \( MN \),

\[ MN = \]

\[ [2] \]

(b) \( NP \),

\[ NP = \]

\[ [2] \]

(c) \( M^{-1} \).

\[ M^{-1} = \begin{pmatrix} \_ & \_ \end{pmatrix} \]

\[ [2] \]

(ii) Write down a product of two of the matrices \( M, N \) and \( P \) which it is not possible to work out.

\[ \_ \_ \_ \_ \_ \_ \] \[ [1] \]
8. (0580-S 2017-Paper 4/1-Q3)

(a)  
(i) Draw the image of triangle $A$ after reflection in the line $x = 4$. [2]  
(ii) Draw the image of triangle $A$ after rotation of $90^\circ$ anticlockwise about $(0, 0)$. [2]  
(iii) Draw the image of triangle $A$ after translation by the vector $\left( \begin{array}{c} 1 \\ -5 \end{array} \right)$. [2]  

(b) Describe fully the single transformation that maps triangle $A$ onto triangle $B$.  
................................................................................................................................................................................................. [3]  
.................................................................................................................................................................................................

(c) Find the matrix that represents the transformation in part (a)(ii).  

\[
\begin{pmatrix} \text{ } & \text{ } \\
\text{ } & \text{ } \\
\end{pmatrix}
\] [2]
(d) Point $P$ has co-ordinates $(4, 1)$.

$F = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ and $G = \begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ represent transformations.

(i) Find $G(P)$, the image of $P$ after the transformation represented by $G$.

$(.................., ..................)$ [2]

(ii) Find $GF(P)$.

$(.................., ..................)$ [3]

(iii) Find the matrix $Q$ such that $GQ(P) = P$.

$\begin{pmatrix} \_ & \_ \\ \_ & \_ \end{pmatrix}$ [3]
9. (0580-S 2017-Paper 4/3-Q6)

(a) Describe fully the single transformation that maps shape A onto

(i) shape B.

.............................................................................................................................................................................. [2]

(ii) shape C.

.............................................................................................................................................................................. [3]

(b) Draw the image of shape A after rotation through 90° anticlockwise about the point (3, -1). [2]

(c) Draw the image of shape A after reflection in y = 1. [2]

(d) Describe fully the single transformation represented by the matrix \( \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \). [3]