

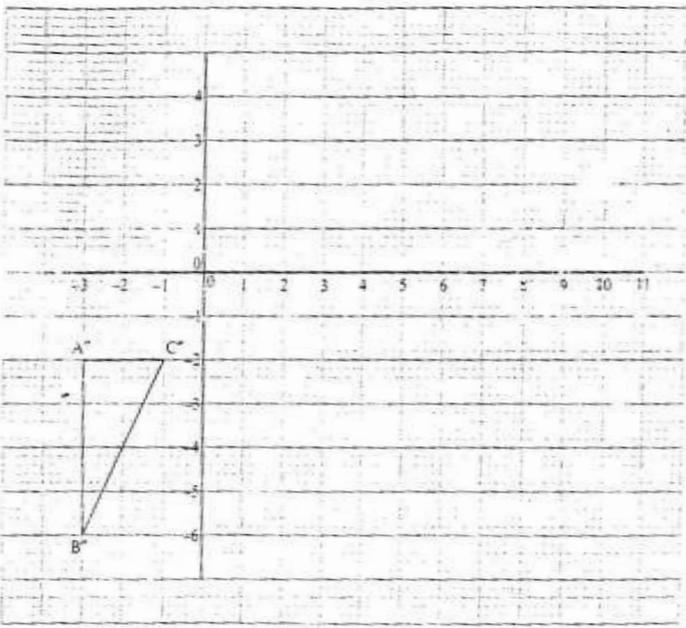
MATRICES AND TRANSFORMATIONS

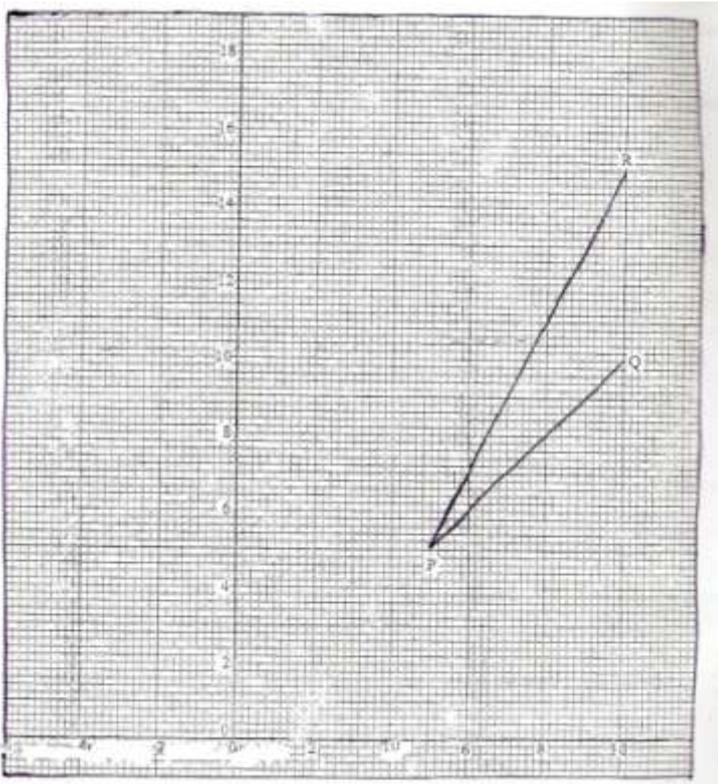
KCSE 1989 – 2012 Form 4 Mathematics
Answer all the questions

1.	<p>1989 Q12 P2</p> <p>The point (5, 2) undergoes the transformation $\begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$ followed by a translation $\begin{bmatrix} -6 \\ 11 \end{bmatrix}$.</p> <p>Determine the coordinates of the image. (3 marks)</p>
2.	<p>2. 1990 Q16 P1</p> <p>The vertices of a triangle ABC are A(-1, -4), B (3,3) and C (2, 5). Find the image of the triangle under the transformation whose matrix is $\begin{pmatrix} 4 & -2 \\ 6 & -3 \end{pmatrix}$</p> <p>Draw the triangle and its image on the same axis. (Grid was provided) (3 marks)</p>
3.	<p>1990 Q21 P2</p> <p>A parallelogram whose vertices are A (1, 0), B (3,0), C (4, 2) and D (2,2) is mapped onto a parallelogram A' B' C' D' by a transformation whose matrix is M. Under the transformation the images of A and C are A' (0, 1) and C' (-2, 4) respectively.</p> <p>i) Find matrix M (3 marks)</p> <p>ii) Plot the parallelogram ABCD on its image on the given grid (3 marks)</p>
	<p>iii) A' B' C' D' is mapped onto ABCD by a transformation T. Obtain the matrix for T. (2 marks)</p>
4.	<p>1991 Q4 P1</p> <p>The image of a point A, under the transformation represented by the matrix</p> <p>$T = \begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix}$ is A' (-2, 4). Find the coordinates of a. (3 marks)</p>
5.	<p>1991 Q21 P2</p> <p>A rectangle OABC has the vertices O (0, 0), A (2,0), B (2, 3) and C (0, 3). O' A' B' C' is the image of OABC under the translation given by $\begin{bmatrix} 0 \\ 4 \end{bmatrix}$. O'' A'' B'' C'' is the image of O' A' B' C' under the transformation given by the matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$.</p> <p>Draw the rectangles OABC, O' A' B' C' and O'' A'' B'' C'' on the grid provided. (grid was provided). (6 marks)</p> <p>Use your diagram to find the centre of rotation which maps OABC onto O'' A'' B'' C'' (2 marks)</p>
6.	<p>1992 Q18 P1</p> <p>A point p (x', y') is the image of a point p(x, y) under a transformation, T, given by the matrix $\begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}$.</p> <p>a) Express x' and y' in terms of x and y (3 marks)</p>
	<p>b) If a point Q and its image Q' under the transformation T lie on the same line $y=mx$, Find two possible values of m (5 marks)</p>

7.	<p>1993 Q12 P1</p> <p>A transformation is represented by the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$. This transformation maps a triangle ABC of the area 3cm^2 onto another triangle A'B'C'. Find the area of triangle A'B'C'.</p>
8.	<p>3. 1993 Q19 P1</p> <p>A transformation T_1 maps the triangle ABC whose coordinates are A (-2, 0), B(1, -2) C (0, 1) onto triangle A'B'C' whose coordinates A'(2, 4), B'(4,1), and C'(1, 2).</p> <p>Another transformation T_2 maps the same triangle ABC onto triangle A''B''C'' whose coordinates are A'' (4, 2), B'' (1,4), C'' (2,1).</p> <p>a) On the same axes plot triangle ABC, A'B'C' and A''B''C'' (2 marks)</p> <p>b) Determine</p> <p>i) T_1</p> <p>ii) T_2</p> <p>iii) the matrix of T such that $TT_1 = T_2$ (6 marks)</p>
9.	<p>1994 Q23 P1</p> <p>A rectangle ABCD with vertices A (2, 0), B (4,0), C (4, 4) and D (2,4) is given a stretch transformation with line $x = 2$ as the invariant and point (4, 0) being mapped onto point (6,0). The image A'B'C'D' of the rectangle is enlarged with a scale factor of -2, centre origin, followed by a reflection in the line $y = 0$. On the grid below plot the images of the rectangle ABCD after the successive transformation. (Grid was provided)</p> <p>a) Describe the transformation which map the third image onto the first image (2marks)</p> <p>b) Describe the single matrix that will map the matrix on the third image onto the first image (2 marks)</p>
10.	<p>1994 Q7 P2</p> <p>Determine the matrix of transformation that represents the following transformation: Reflection in $x + y = 0$, followed by a positive quarter turnabout (0, 0) (2marks)</p>
11.	<p>1995 Q 23 P1</p> <p>On the grid provided on the opposite page ABCE is a trapezium</p> <p>(a) ABCD is mapped onto A 'B 'C 'D' by a positive quarter turn. Draw the image A'B'C 'D' on the grid. (1 mark)</p> <p>(b) A transformation maps $\begin{bmatrix} -2 & -1 \\ 1 & -1 \end{bmatrix}$ A 'B 'C 'D' onto A "B "C "D"</p> <p>(i) Obtain the coordinates of A "B" C" D " on the grid (2 marks)</p>
	<p>(ii) Plot the image A" B "C "D" on the grid (1mark)</p> <p>(c) Determine a single matrix that maps A "B "C "D" (4 marks)</p>

12.	<p>1997 Q 23 P1 The figure on the grid shows a triangular shaped object ABC and its image A' B 'C'</p> <p>(a) (i) Describe fully the transformation that maps ABC and A 'B 'C'</p> <p>(ii) Find a 2 x 2 matrix that transforms triangle ABC onto triangle A 'B'C'</p> <p>(b) The matrix $P = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$ transforms triangle ABC onto A'' B'' C''</p> <p>(i) Find the coordinates of A ''B ''C''</p> <p>(ii) Draw the image A'' B'' C''</p> <p>(c) Find the area of triangle ABC</p> <p>(d) Hence find the area of the image A''B''C''</p>
13.	<p>1998 Q 19 P1 A quadrilateral ABCD has vertices A (4, -4), B(2, -4), C(6, -6) and D (4, -2)</p> <p>a) On the grid provided draw the quadrilateral ABCD.</p> <p>b) A' B 'C 'D' is the image of ABCD under positive quarter turn about the origin. On the same grid draw the image A'B'C'D</p> <p>c) A' B 'C' D' is the image of A' B 'C' D' under the transformation given by the matrix $\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$</p> <p>i) determine the coordinators of A''B ''C ''D''</p> <p>ii) On the same grid draw the quadrilateral A''B ''C ''D''</p> <p>d) Determine a single matrix that maps ABCD onto A''B ''C ''D''</p>
14.	<p>1999 Q 23 P2 The transformation R given by the matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ maps $\begin{bmatrix} 17 \\ 0 \end{bmatrix}$ to $\begin{bmatrix} 15 \\ 8 \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 17 \end{bmatrix}$ to $\begin{bmatrix} -8 \\ 15 \end{bmatrix}$</p> <p>Determine the matrix A giving a,b,c and d as fractions</p> <p>(a) Given that A represents a rotation through the origin determine the angle of rotation</p> <p>(b) S is a rotation though 180° about the point (2, 3). Determine the image of (1,0) under S followed by R.</p>
15.	<p>2000 Q 23 P2 The diagram on the grid provided below shows a trapezium ABCD On the same grid</p> <p>(a) (i) Draw the image A' B 'C 'D' of ABCD under a rotation of 90° clockwise about the origin . (ii) Draw the image A''B ''C ''D'' of A' B 'C 'D' under a reflection in line y = x. State coordinates of A''B ''C ''D''</p> <p>(b) A'''B '''C '''D''' is the image of A''B ''C ''D'' under the reflection in the line x=0. Draw the image A''''B ''''C ''''D'''' and state its coordinates.</p> <p>(c) Describe a single transformation that maps A''''B'''' C'''' D'''' onto ABCD.</p>

16.	<p>2001 Q 18 P1 The coordinates of the vertices of rectangle PQRS are P (1,1), Q (6,1), R (6,4) and S(1,4)</p> <p>(a) (i) Find the coordinates of the vertices of its image,P 'Q' R'S'under the transformation defined by the matrix $\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$</p> <p>(i) Draw the object and its image on the grade provided (ii) On the same grid draw the image, P''Q''R''S'' of P 'Q' R 'S' under the transformation given by $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$</p> <p>(b) Find a single matrix which will map P''Q''R''S'' onto PQRS</p>
17.	<p>2002 Q 22 P1 A triangle T whose vertices are A (2,3) B(5,3) and C (4,1) is mapped onto triangle T¹ whose vertices are A¹ (-4,3) B¹ (-1,3) and C¹ (x,y) by a transformation $M = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$</p> <p>Find the: (i)Matrix M of the transformation (ii)Coordinates of C₁</p> <p>b) Triangle T² is the image of triangle T¹ under a reflection in the line y = x.</p> <p>Find a single matrix that maps T and T² (8mks)</p>
18.	<p>2004 Q 21 P2 Triangle ABC is the image of triangle PQR under the transformation $M = \begin{bmatrix} 2 & 4 \\ 0 & 2 \end{bmatrix}$ Where P,Q and P map onto A, B, and C respectively.</p> <p>(a) Given the points P(5, -1), Q(6,-1) and R (4, -0.5), draw the triangle ABC on the grid provided below.</p>  <p>(b) Triangle ABC in part (a) above is to be enlarged scale factor 2 with centre at (11, -6) to map onto A 'B 'C'. Construct and label triangle A 'B 'C'. on the grid above.</p> <p>(c) By construction find the coordinates of the centre and the angle of rotation which can be used to rotate triangle A 'B 'C'. onto triangle A "B "C", shown on the grid above.</p>

19.	<p>2005 Q 18 P2 Triangles ABC and A "B "C" are drawn on the Cartesian plane provided. Triangle ABC is mapped onto A "B" C" by two successive transformations $R = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ Followed by $\begin{bmatrix} p & 0 \\ -1 & 0 \end{bmatrix}$</p> <p>(a) Find R (4 marks) (b) Using the same scale and axes, draw triangle A "B "C", the image of triangle ABC under transformation R (2 marks) (c) Describe fully, the transformation represented by matrix R (2 marks)</p>
20.	<p>2006 Q 19 P2 Triangle ABC is shown on the coordinates plane below (a) Given that A (-6, 5) is mapped onto A' (6,-4) by a shear with y- axis invariant</p> <p>(i) draw triangle A' B' C', the image of triangle ABC under the shear (ii) Determine the matrix representing this shear (2 marks)</p> <p>(b) Triangle A' B' C' is mapped on to A" B" C" by a transformation defined by the matrix $\begin{bmatrix} -1 & 0 \\ 1\frac{1}{2} & -1 \end{bmatrix}$</p> <p>(i) Draw triangle A" B" C" (ii) Describe fully a single transformation that maps ABC onto A" B" C"</p>
21.	<p>2008 Q 10 P2 Points A(2,2) and B(4,3) are mapped onto A'(2,8) and B'(4,15) respectively by a transformation T. Find the matrix of T. (4mks)</p>
22.	<p>2009 Q 9 P2 The area of triangle FGH is 21cm². The triangle FGH is transformed using the matrix $\begin{bmatrix} 4 & 5 \\ 1 & 2 \end{bmatrix}$ Calculate the area of the image of triangle FGH (2 Marks)</p>
23.	<p>2009 Q 20 P2 Triangle PQR shown on the grid has vertices P(5,5) Q(10,10) and R(10,15)</p> 

	<p>(a) Find the coordinates of the points P', Q' and R', the images of P, Q and R respectively under transformation M whose matrix is $\begin{bmatrix} -0.6 & 0.8 \\ 0.8 & 0.6 \end{bmatrix}$ (2marks)</p> <p>(b) Given that M is a reflection (i) Draw triangle $P' Q' R'$ and the mirror line of the reflection (2marks) (ii) Determine the equation of the mirror line of the reflection (1 mark)</p> <p>(c) Triangle $P''Q''R''$ is the image of triangle $P' Q' R'$ under reflection N where N is a reflection in the y-axis (i) Draw triangle $P''Q''R''$ (1 mark) (ii) Determine a 2×2 matrix equivalent to the transformation NM (2 marks) (iii) Describe fully a single transformation that maps triangle PQR onto triangle $P''Q''R''$ (2 marks)</p>
24.	<p>2010 Q 10 P2 The point O, A and B have the coordinates $(0,0)$, $(4,0)$ and $(3,2)$ respectively Under shear represented by the matrix $\begin{bmatrix} 1 & k \\ 0 & 1 \end{bmatrix}$ triangle OAB maps onto triangle OAB'</p> <p>(a) Determine in terms of k, the x coordinates of point B' If (2mks) (b) OAB' is a right angled triangle in which angle $OB'A$ is acute, find two possible values of k. (2 marks)</p>
25.	<p>2011 Q 19 P2 The vertices of a rectangle are $A(-1,-1)$, $B(-4,-1)$, $C(-4,-3)$ and $D(-1,-3)$.</p> <p>a) On the grid provided, draw the rectangle and its image $A' B' C' D'$ Under a transformation whose matrix is $\begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$ (4 mks)</p> <p>b) $A'' B'' C'' D''$ is the image of $A' B' C' D'$ under a transformation matrix, $P = \begin{bmatrix} 1/2 & 1 \\ 1 & 1/2 \end{bmatrix}$</p> <p>i) Determine the coordinates of $A'' B'' C'' D''$ (2 mks)</p> <p>ii) On the same grid draw the quadrilateral $A'' B'' C'' D''$ (1 mk)</p> <p>c) Find the area of $ABCD$. (3 mks)</p>
26.	<p>2012 Q18 P2 $OABC$ is a parallelogram with vertices $O(0,0)$, $A(2,0)$, $B(3,2)$ and $C(1,2)$. $O'A'B'C'$ is the image of $OABC$ under the transformation matrix $\begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$</p> <p>(a) (i) Find the coordinates of $O'A'B'C'$ (2 marks) ii) On the grid provided draw $OABC$ and $O'A'B'C'$ (2 marks)</p> <p>(b) (i) Find $O''A''B''C''$, the image of $O'A'B'C'$ under the transformation matrix $\begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix}$ (2 marks) (ii) On the same grid draw $O''A''B''C''$. (1 mark)</p> <p>(c) Find the single matrix that maps $O''A''B''C''$ onto $OABC$. (3 marks)</p>