**IGCSE Further Maths – Matrices**

**Exercise 1 – Matrix Multiplication (questions from AQA Worksheets)**

**Question 1**

Work out

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** |  | **(b)** |  | **(c)** | 2 |
| **(d)** |  | **(e)** | 6 | **(f)** |  |

**Question 2**

**A** = **B** =  **C** = 

Work out

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** | **AB** | **(b)** | **BC** | **(c)** | 3**A** |
| **(d)** | **BA** | **(e)** | −**C** | **(f)** | **B** |

**Question 3**

**P** = **Q** =  **C** = 

Work out

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** | **P** 2 | **(b)** | **QP** | **(c)** | 5**Q** |
| **(d)** | **PC** | **(e)** | **IQ** | **(f)** | 3**I** |

**Question 4**

Work out

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** |  | **(b)** |  | **(c)** |  |
| **(d)** |  | **(e)** |  | **(f)** |  |

**Question 5 (Non-calculator)**

Work out, giving your answers as simply as possible.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** |  | **(b)** |  | **(c)** |  |
| **(d)** |  | **(e)** |  | **(f)** |  |

**Question 6**

Work out, giving your answers as simply as possible.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** |  | **(b)** |  | **(c)** |  |
| **(d)** |  | **(e)** |  | **(f)** |  |

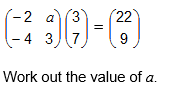
**Question 7**

Work out, giving your answers as simply as possible.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **(a)** |  | **(b)** |  | **(c)** |  |
| **(d)** |  | **(e)** |  | **(f)** |  |

**Exercise 1b**

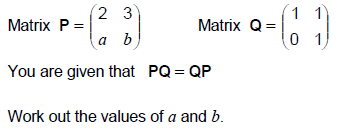
**Question 1**



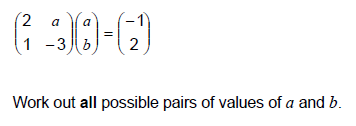
**Question 2**

1. Work out  **Give your answer in terms of .**
2. **If**  where is the identity matrix, work out the values of .

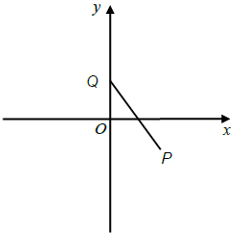
**Question 3**



**Question 4**



**Exercise 2**

1. [Jan 2013 Paper 2 Q15] Describe fully the **single** transformation represented by the matrix
2. [Set 2 Paper 1 Q4] The transformation matrix maps the point onto the point . Work out the values of and .
3. [Set 3 Paper 1 Q6] The matrix maps the point onto the point . Work out the values of and .
4. [Worksheet 2 Q5] Work out the image of the point *D* (−1, 2) after transformation by the matrix
5. [Worksheet 2 Q6] The point *A*(*m*, *n*) is transformed to the point *A*′ (−2, 0) by the matrix   
   Work out the values of *m* and *n*.
6. [Worksheet 2 Q8] Describe fully the transformation given by the matrix
7. [Worksheet 2 Q9] The unit square *OABC* is transformed by the matrix to the square *OA*′*B*′*C*′.  
   The area of *OA*′*B*′*C*′ is 27. Work out the exact value of *h*.
8. [Specimen Paper 2 Q20] (a) Matrix   
   Work out the image of point using transformation matrix .  
   (b) Point is   
    Line is transformed to line using matrix .  
      
    Work out the length of .

**Exercise 3**

1. Point is transformed by the matrix followed by a further transformation by the matrix .  
   (i) Work out the matrix for the combined transformation.  
   (ii) Work out the co-ordinates of the image point of .
2. Point is transformed by the matrix followed by a further transformation by the matrix .  
   (i) Work out the matrix for the combined transformation.  
   (ii) Work out the co-ordinates of the image point of .
3. The unit square is reflected in the -axis followed by a rotation through centre the origin. Work out the matrix for the combined transformation.
4. The unit square is enlarged, centre the origin, scale factor 2 followed by a reflection in the line . Work out the matrix for the combined transformation.
5. [Jan 2013 Paper 2 Q17] represents a reflection in the -axis. represents a reflection in the line .  
   Work out the matrix that represents a reflection in the -axis followed by a reflection in the line .
6. [June 2012 Paper Q22] The transformation matrix maps a point to . The transformation matrix maps point to point .  
   Point is . Work out the coordinates of point .
7. [Set 1 Paper Q14b] The unit square OABC is transformed by reflection in the line followed by enlargement about the origin with scale factor 2. What is the matrix of the combined transformation?
8. and .  
   The point is transformed by matrix to . Show that lies on the line   
   .