AQA IGCSE FM "Full Coverage": Matrix Algebra

This worksheet is designed to cover one question of each type seen in past papers, for each AQA IGCSE Further Maths topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Perform scalar multiplication of a matrix.

[AQA IGCSE FM June2016-P1 Q2]

$$4 \begin{pmatrix} 1 - 2a \\ a \end{pmatrix} = \begin{pmatrix} b \\ 12 \end{pmatrix}$$

Work out the values of a and b .

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Question 2

Categorisation: Multiply 2×2 matrices (including powers of matrices)

[AQA IGCSE FM June2014-P2 Q8 Edited]

$$\mathbf{M} = \begin{pmatrix} -2 & -1 \\ 3 & 1 \end{pmatrix}$$

Find $\mathbf{M}^3$

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Question 3

Categorisation: Multiply matrices, making use of trigonometric identities, e.g. $sin^2 x + cos^2 x \equiv 1$.

[AQA IGCSE FM Practice paper set 4 P2 Q16]

$$\mathbf{P} = \begin{pmatrix} \sin x & \cos x \\ -\cos x & \sin x \end{pmatrix} \qquad \mathbf{Q} = \begin{pmatrix} \sin x & -\cos x \\ \cos x & \sin x \end{pmatrix}$$

Work out $\mathbf{PQ}$. Give your answer in its simplest form.

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Question 4

Categorisation: Use matrix multiplication involving unknown constants to form and solve simultaneous equations.

[AQA IGCSE FM Practice paper set 4 P1 Q17]

$$\begin{pmatrix} 2 & a \\ 1 & -3 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

Work out all possible pairs of values of a and b.

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Question 5

Categorisation: Recognise the identity matrix I.

[AQA IGCSE FM Practice paper set 3 P2 Q5]

$$\begin{pmatrix} -7 & 4 \\ 5 & -3 \end{pmatrix} \begin{pmatrix} -3 & -4 \\ -5 & t \end{pmatrix} = \mathbf{I}$$

Work out the value of t .

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Question 6

Categorisation: Understand that matrix multiplication is not commutative, i.e. $AB \neq BA$ in general.

[AQA IGCSE FM Practice paper set 2 P2 Q16]

Matrix $\mathbf{P} = \begin{pmatrix} 2 & 3 \\ a & b \end{pmatrix}$ Matrix $\mathbf{Q} = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$

You are given that $\mathbf{PQ} = \mathbf{QP}$

Work out the values of a and b.

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Question 7

Categorisation: Transform a coordinate using a matrix to find the image.

[AQA IGCSE FM SAM P2 Q20a]

Matrix $\mathbf{A} = \begin{pmatrix} 4 & 3 \\ 1 & 1 \end{pmatrix}$

Work out the image of point $P(2, -1)$ using transformation matrix $\mathbf{A}$.

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Question 8

Categorisation: Using a known coordinate and its image after a transformation to determine unknown values in the matrix.

[AQA IGCSE FM Practice paper set 3 P1 Q6]

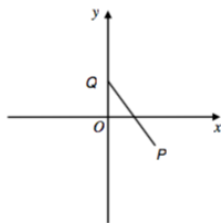The matrix $\begin{pmatrix} a & b \\ -a & 2b \end{pmatrix}$ maps the point $(5,4)$ onto the point $(1,17)$

Work out the values of a and b .

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Question 9

Categorisation: Transform other geometric entities, e.g. a straight line, using a matrix.

[AQA IGCSE FM SAM P2 Q20b Edited]

Matrix $\mathbf{A} = \begin{pmatrix} 4 & 3 \\ 1 & 1 \end{pmatrix}$

The image of point $P(2, -1)$ using transformation matrix $\mathbf{A}$ is $(5,1)$.
Point Q is $(0,1)$. Line PQ is transformed to line PQ using matrix $\mathbf{A}$.

Work out the length of PQ.
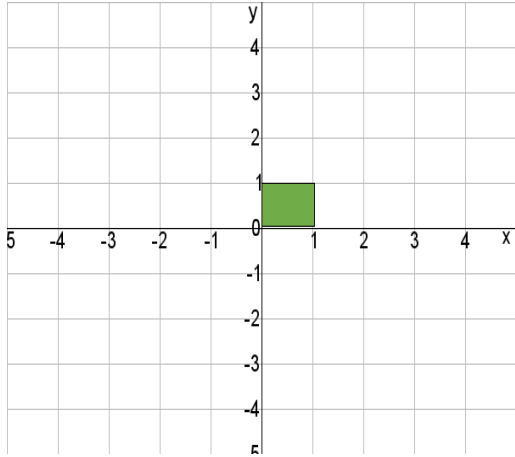
$PQ = $ .... units

Question 10
Categorisation: Transform the unit square using a matrix.

[AQA IGCSE FM Practice paper set 3 P2 Q17a Edited]
The unit square is shaded on the grid.

On the grid, draw the image of the unit square after it is transformed using the matrix $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$

Question 11
Categorisation: Recognise that PQ represents the transformations Q followed by P.

[AQA IGCSE FM June2012-P2 Q22]

The transformation matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ maps point P to point Q.

The transformation matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps point Q to point R.

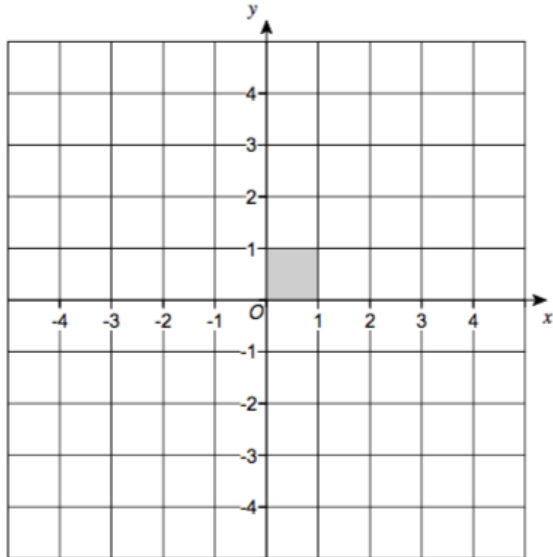Point R is $(-4,3)$

Work out the coordinates of point P.

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Question 12

Categorisation: Determine the matrix that results in a rotation of 90° clockwise or anti-clockwise (and understanding that the default direction is anti-clockwise when not specified).

[AQA IGCSE FM Practice paper set 3 P2 Q17b]

The unit square is shaded on the grid.

Work out the matrix that transforms the unit square by a 270 ° rotation about O.

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Question 13

Categorisation: Describe the geometric transformation represented by a matrix.

[AQA IGCSE FM Jan2013-P2 Q15]

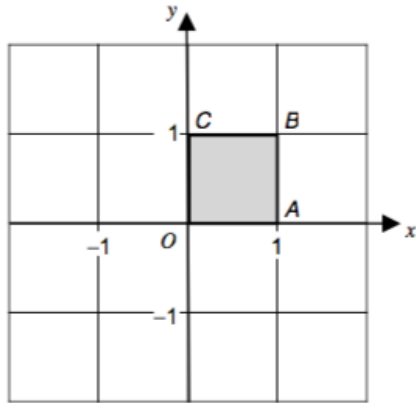Describe fully the single transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

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Question 14

Categorisation: Determine the matrix that represents a combination of two geometrically described transformations.

[AQA IGCSE FM Practice paper set 1 P1 Q14b]

The diagram shows the unit square OABC.

The unit square OABC is transformed by reflection in the line $y = x$ followed by enlargement about the origin with scale factor 2.

What is the matrix of the combined transformation?

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Question 15

Categorisation: Determine the combined effect of multiple applications of the same transformation.

[AQA IGCSE FM June2015-P2 Q20a]

The transformation matrix **P** represents a 90° anti-clockwise rotation about the origin.

Describe fully the single transformation represented by the matrix $\mathbf{P}^3$
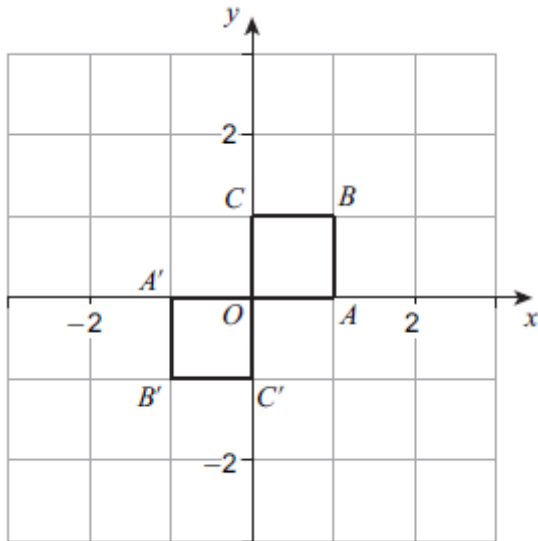
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Question 16

Categorisation: Determine the matrix that represents a rotation by 180°.

[AQA IGCSE FM June2014-P2 Q10a]

The unit square OABC has vertices

$O(0,0)$ $A(1,0)$ $B(1,1)$ $C(0,1)$

OABC is mapped to OA'B'C' under transformation matrix **M** .

Work out matrix **M** .

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Answers

Question 1

$a = 3$, $b = -20$

Question 2

$\begin{pmatrix} 1 & 0 \\ -6 & 1 \end{pmatrix}$

Question 3

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ or **I**

Question 4

$a = -1$, $b = -1$ or $a = -3$, $b = -\frac{5}{3}$

Question 5

$t = -7$

Question 6

$a = 0$, $b = 2$

Question 7

(5,1)

Question 8

$a = -1$, $b = 1.5$

Question 9

$PQ = $ 2 units

Question 10

Square drawn with vertices
(0,0), (0,3), (3,3), (3,0)

Question 11

(3,4)

Question 12

$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

Question 13

Rotation 90° (anticlockwise) about the origin.

Question 14

$\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$

Question 15

A 270° (anti-clockwise) rotation about the origin

Question 16

$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$