The Book of Rijndaels*

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Abstract. This paper is the full book of the 240 dual ciphers of Rijndael, in which only the constants differ from Rijndael. See: "*In How Many Ways Can You Write Rijndael?*", http://eprint.iacr.org.

Dual Cipher #1 (original Rijndael)

Dual cipher by 02_x, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i).

Dual Cipher #2

Dual cipher by 03_x, primitive polynomial $11D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 64_x$ $(03_x, 02_x)$, $(0D_x, 0B_x, 0E_x, 09_x)$.

Note: In this dual cipher the matrix A^R is lower triangular.

Dual Cipher #3 ($Rijndael^{128}$)

Dual cipher by 04_x, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 36_x$ (FA_x, FB_x), (14_x, EC_x, EE_x, 17_x).

Dual Cipher #4

Dual cipher by 05_x, primitive polynomial $11D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 24_x$ $(84_x, 85_x)$, $(14_x, 93_x, 90_x, 16_x)$.

Dual Cipher #5

Dual cipher by 06_x, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 82_x$ ($9C_x$, $9D_x$), (10_x, 12_x, $8C_x$, $8F_x$).

Dual Cipher #6

Dual cipher by 07_x, irreducible polynomial $13F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ FC_x ($E4_x$, $E5_x$), (11_x, 12_x, $F5_x$, $F7_x$).

Dual Cipher #7

Dual cipher by 08_x, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 0 0 0 \\ 0 0 1 1 1 0 0 1 \\ 0 0 1 0 0 1 1 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 0 1 0 1 0 0 0 \\ 0 0 1 0 0 1 0 1 \\ 0 1 0 0 0 1 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 0 0 1 1 1 1 \\ 0 0 0 1 1 1 1 0 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 1 0 0 0 1 \\ 0 0 0 1 1 1 1 1 \\ 0 0 1 0 0 0 1 0 \\ 0 0 0 0 1 0 0 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 1 1 \\ 0 0 0 0 0 0 1 1 \\ 0 1 0 0 0 1 0 1 \\ 0 0 0 0 1 0 1 0 \\ 0 0 1 0 1 0 1 0 \\ 0 0 0 0 1 1 0 1 \\ 0 0 0 1 0 1 1 0 \\ 0 0 0 0 0 1 1 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 1 0 1 \\ 0 1 1 0 0 0 0 1 \\ 0 0 0 1 1 0 0 0 \\ 0 0 0 0 0 0 1 1 \\ 0 1 0 0 0 1 0 1 \\ 0 1 0 1 0 1 0 0 \\ 0 1 0 1 0 1 0 1 \\ 0 0 0 1 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 1 0 1 1 0 \\ 1 1 0 1 1 1 1 1 \\ 1 1 1 1 1 0 1 0 \\ 0 0 1 1 0 1 0 0 \\ 0 1 1 0 1 0 0 0 \\ 0 1 1 1 0 1 1 1 \\ 1 0 0 0 1 1 1 1 \\ 1 1 1 0 1 1 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 40_x $(89_x, 88_x)$, $(8A_x, 65_x, 03_x, ED_x)$.

Dual Cipher #8

Dual cipher by 09_x, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 1 0 0 1 0 \\ 0 0 0 1 1 0 0 1 \\ 0 0 0 0 1 0 1 0 \\ 0 0 0 0 1 0 0 0 \\ 0 1 0 0 1 0 0 0 \\ 0 1 1 0 1 1 0 0 \\ 0 1 1 0 0 0 0 1 \\ 0 1 0 0 0 1 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 1 1 0 1 1 1 \\ 0 0 0 1 1 0 0 0 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 1 1 1 1 1 \\ 0 0 0 1 0 0 0 0 \\ 0 0 0 1 1 0 0 1 \\ 0 0 1 1 0 0 0 0 \\ 0 0 0 0 1 1 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 0 \\ 0 0 0 0 0 0 1 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 0 1 0 1 0 \\ 0 0 1 0 0 1 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 0 0 1 0 0 0 1 \\ 0 0 0 0 0 1 1 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 0 0 1 0 1 \\ 0 0 1 1 0 0 0 1 \\ 0 1 0 0 1 0 0 1 \\ 0 0 0 1 0 1 1 1 \\ 0 1 0 0 0 1 0 1 \\ 0 1 0 1 0 1 0 0 \\ 0 1 0 1 0 1 0 1 \\ 0 0 0 1 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 1 0 0 0 1 \\ 0 1 1 1 0 1 1 0 \\ 1 1 0 0 0 1 1 0 \\ 1 0 1 1 0 1 0 1 \\ 0 1 1 1 1 1 0 0 \\ 1 1 1 0 0 0 1 0 \\ 0 1 1 0 0 1 0 1 \\ 1 0 0 1 0 0 1 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 55_x ($F1_x$, $F0_x$), ($F3_x$, 62_x, 02_x, 92_x).

Dual Cipher #9

Dual cipher by $0A_x$, irreducible polynomial $13F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $D6_x$ (CA_x, CB_x), (03_x, 86_x, $C9_x$, $4D_x$).

Dual Cipher #10

Dual cipher by $0B_x$, primitive polynomial $12B_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow BD_x$ ($A6_x$, $A7_x$), (02_x, $F9_x$, $A4_x$, $5E_x$).

Dual Cipher #11

Dual cipher by $0E_x$, primitive polynomial 171_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 1 0 1 1 1 1 1 \\
0 0 1 0 0 0 1 0 \\
0 1 0 1 1 1 0 1 \\
0 0 0 0 1 1 1 1 \\
0 0 1 1 0 0 1 1 \\
0 1 0 1 1 0 1 0 \\
0 1 0 1 0 0 0 0 \\
0 0 1 1 1 0 0 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 0 0 1 0 0 1 0 \\
0 1 0 0 0 1 0 1 \\
0 1 1 1 0 0 1 0 \\
0 1 0 0 0 1 1 1 \\
0 0 1 1 0 1 0 0 \\
0 0 0 1 1 0 0 1 \\
0 0 1 1 0 0 1 0 \\
0 0 0 0 1 1 1 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 0 0 0 1 1 0 0 \\
0 0 0 0 0 0 1 0 \\
0 1 0 0 0 1 1 0 \\
0 0 0 0 0 0 0 1 \\
0 0 1 0 1 1 1 1 \\
0 0 0 0 1 1 1 0 \\
0 0 0 1 1 0 0 1 \\
0 0 0 0 0 1 0 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 1 0 0 0 1 0 0 \\
0 1 1 1 0 0 0 1 \\
0 0 0 1 1 1 0 0 \\
0 1 0 0 0 1 1 1 \\
0 1 0 1 0 1 0 1 \\
0 0 0 1 0 0 0 1 \\
0 1 0 0 0 0 0 0 \\
0 0 0 1 0 0 0 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 1 1 0 1 0 1 0 \\
1 0 1 1 0 0 1 0 \\
1 1 0 0 0 0 1 0 \\
1 1 1 1 0 1 1 0 \\
0 0 0 0 1 0 0 0 \\
1 1 1 0 0 0 1 0 \\
0 0 0 1 1 1 1 0 \\
1 0 1 0 0 0 1 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 52_x$ $(65_x, 64_x)$, $(91_x, 66_x, F4_x, 02_x)$.

Dual Cipher #12

Dual cipher by $0F_x$, irreducible polynomial 177_x, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 47_x$ $(62_x, 63_x)$, $(EF_x, 60_x, 8D_x, 03_x)$.

Dual Cipher #13 ($Rijndael^{64}$)

Dual cipher by 10_x, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 1 0 0 0 0 1 0 \\
0 0 1 1 1 1 1 0 \\
0 1 0 0 0 0 1 1 \\
0 1 1 1 0 1 1 0 \\
0 0 1 0 0 1 0 1 \\
0 0 1 0 0 0 1 0 \\
0 1 1 1 0 0 1 0 \\
0 0 1 0 0 1 1 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 0 1 1 0 1 1 1 \\
0 0 1 1 1 1 1 0 \\
0 0 0 0 1 1 0 1 \\
0 0 1 1 1 0 0 0 \\
0 1 1 0 1 1 1 0 \\
0 0 0 1 0 0 1 0 \\
0 0 0 0 1 0 0 1 \\
0 0 0 1 0 1 1 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 0 0 0 1 0 1 0 \\
0 0 0 0 1 0 1 1 \\
0 1 0 0 0 1 0 0 \\
0 0 0 0 1 1 1 1 \\
0 0 1 0 1 0 0 1 \\
0 0 0 0 0 1 1 0 \\
0 0 0 1 0 1 0 0 \\
0 0 0 0 0 0 1 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 0 0 1 0 1 0 1 \\
0 1 1 1 0 0 0 0 \\
0 0 0 1 1 1 0 0 \\
0 1 0 1 0 0 1 0 \\
0 1 0 0 0 0 0 1 \\
0 1 0 1 0 0 0 0 \\
0 1 0 1 0 1 0 0 \\
0 1 0 1 0 1 0 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 0 0 1 0 0 0 0 \\
1 1 0 1 0 1 0 0 \\
1 0 0 1 1 1 1 1 \\
1 0 0 0 0 0 1 1 \\
1 0 1 1 0 1 1 1 \\
1 1 0 1 1 0 1 0 \\
1 1 1 1 0 1 0 0 \\
1 1 1 1 0 1 1 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 39_x$ $(4D_x, 4C_x)$, $(06_x, B1_x, 4B_x, FD_x)$.

Dual Cipher #14

Dual cipher by 11_x, primitive polynomial $11D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 2C_x$ ($5E_x$, $5F_x$), (06_x, DC_x, 58_x, 83_x).

Dual Cipher #15

Dual cipher by 12_x, primitive polynomial 169_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\ 0\ 1\ 0\ 0\ 1\ 1\ 1 \\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0 \\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 1 \\ 0\ 0\ 1\ 1\ 0\ 1\ 0\ 0 \\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1 \\ 0\ 1\ 0\ 0\ 1\ 0\ 1\ 0 \\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 1 \\ 0\ 0\ 1\ 1\ 0\ 1\ 0\ 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\ 0\ 1\ 1\ 0\ 0\ 1\ 1 \\ 0\ 1\ 1\ 0\ 1\ 0\ 1\ 1 \\ 0\ 0\ 1\ 1\ 1\ 0\ 0\ 0 \\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 1 \\ 0\ 1\ 1\ 1\ 0\ 1\ 1\ 0 \\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1 \\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 1 \\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\ 0\ 0\ 0\ 1\ 1\ 1\ 0 \\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1 \\ 0\ 1\ 0\ 0\ 0\ 1\ 1\ 1 \\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 1 \\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0 \\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 1 \\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1 \\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\ 0\ 0\ 0\ 0\ 1\ 0\ 1 \\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 1 \\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0 \\ 0\ 1\ 0\ 0\ 0\ 1\ 1\ 1 \\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1 \\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1 \\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1 \\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0 \\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 1 \\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 0 \\ 0\ 0\ 1\ 1\ 1\ 1\ 1\ 1 \\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 1 \\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1 \\ 0\ 1\ 1\ 0\ 0\ 1\ 0\ 0 \\ 0\ 1\ 1\ 0\ 1\ 0\ 0\ 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 9B_x$ $(22_x, 23_x)$, $(ED_x, 06_x, CF_x, 25_x)$.

Dual Cipher #16

Dual cipher by 13_x, primitive polynomial 169_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow E3_x$ (30_x, 31_x), (92_x, 06_x, $A2_x$, 37_x).

Dual Cipher #17

Dual cipher by 14_x, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 0 0 1 0 \\ 0 0 0 0 1 1 0 1 \\ 0 1 1 0 1 0 1 0 \\ 0 1 1 1 1 0 1 0 \\ 0 1 1 1 1 0 0 1 \\ 0 0 0 0 0 1 0 0 \\ 0 1 0 1 0 1 0 1 \\ 0 0 1 0 1 1 1 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 0 1 1 1 0 \\ 0 0 1 0 0 1 0 1 \\ 0 1 0 1 1 0 0 1 \\ 0 0 1 1 0 0 0 0 \\ 0 1 0 1 0 1 1 1 \\ 0 0 0 0 0 1 0 0 \\ 0 0 0 0 1 0 1 1 \\ 0 0 0 1 0 0 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 1 \\ 0 0 0 0 1 0 1 0 \\ 0 1 0 0 0 1 1 1 \\ 0 0 0 0 1 1 0 0 \\ 0 0 1 0 0 0 0 0 \\ 0 0 0 0 1 1 1 1 \\ 0 0 0 1 0 0 1 1 \\ 0 0 0 0 0 1 1 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 1 0 1 0 0 \\ 0 0 1 0 0 0 0 1 \\ 0 0 0 0 1 0 0 0 \\ 0 0 0 1 0 1 1 0 \\ 0 0 0 0 0 1 0 1 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 1 0 0 0 0 1 1 \\ 1 1 0 1 0 0 0 1 \\ 1 1 0 1 1 0 0 1 \\ 0 0 1 0 1 0 0 0 \\ 0 1 1 0 0 0 1 0 \\ 0 0 0 1 1 1 1 1 \\ 0 0 0 0 0 0 1 0 \\ 0 1 0 1 0 0 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 33_x$ $(5D_x, 5C_x)$, $(04_x, C5_x, 59_x, 99_x)$.

Dual Cipher #18

Dual cipher by 15_x, irreducible polynomial $13F_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 1 1 0 0 1 \\ 0 1 0 1 1 1 0 1 \\ 0 1 1 0 1 0 1 1 \\ 0 1 0 1 0 1 0 0 \\ 0 0 0 0 0 1 1 0 \\ 0 0 1 0 1 0 1 0 \\ 0 1 1 1 1 0 1 1 \\ 0 0 1 0 1 1 1 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 0 0 0 1 0 1 \\ 0 0 1 1 0 1 1 1 \\ 0 1 0 0 1 0 1 0 \\ 0 0 1 0 0 0 1 0 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 0 0 1 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 0 0 1 0 0 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 1 0 \\ 0 0 0 0 1 0 0 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 0 1 1 0 1 \\ 0 0 1 0 1 1 1 1 \\ 0 0 0 0 1 1 1 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 1 1 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 1 0 0 0 1 \\ 0 1 1 1 0 1 0 1 \\ 0 0 0 0 1 1 0 0 \\ 0 1 0 1 0 0 1 0 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 0 \\ 0 0 0 1 0 1 0 0 \\ 0 1 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 1 0 1 1 1 1 0 \\ 1 1 0 1 1 0 1 0 \\ 1 1 0 0 1 1 1 1 \\ 0 1 1 1 1 0 0 1 \\ 0 0 1 1 1 0 1 0 \\ 0 1 0 1 1 1 0 0 \\ 0 1 0 0 0 1 1 0 \\ 0 1 0 0 0 1 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 20_x ($4F_x$, $4E_x$), (05_x, AE_x, $4A_x$, $E0_x$).

Dual Cipher #19

Dual cipher by 16_x, irreducible polynomial 177_x, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 57_x$ (ED_x, EC_x), ($C3_x$, $E9_x$, $2E_x$, 05_x).

Dual Cipher #20

Dual cipher by 17_x, primitive polynomial 171_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 43_x (92_x, 93_x), ($A8_x$, 97_x, $3A_x$, 04_x).

Dual Cipher #21

Dual cipher by 18_x, primitive polynomial 165_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 1 0 1 1 0 0 0 \\
0 1 0 0 1 0 0 1 \\
0 1 0 0 0 0 0 0 \\
0 0 1 1 1 0 0 0 \\
0 1 0 0 0 0 1 0 \\
0 1 0 1 1 1 1 1 \\
0 0 1 0 0 0 0 1 \\
0 1 0 0 0 0 1 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 0 1 1 1 0 1 1 \\
0 0 1 0 0 0 0 0 \\
0 0 0 0 1 0 1 1 \\
0 1 1 1 0 0 1 0 \\
0 1 1 0 1 0 0 1 \\
0 0 0 1 1 1 1 0 \\
0 0 1 0 1 0 0 0 \\
0 0 0 0 1 0 0 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 0 0 0 1 1 1 1 \\
0 0 0 0 0 0 1 0 \\
0 1 0 0 1 0 0 0 \\
0 0 0 0 0 0 1 1 \\
0 0 1 0 0 1 0 0 \\
0 0 0 0 1 1 1 0 \\
0 0 0 1 1 1 1 1 \\
0 0 0 0 0 1 0 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 1 0 1 0 1 0 0 \\
0 0 1 1 0 1 0 1 \\
0 1 0 1 1 0 0 1 \\
0 1 0 1 0 1 1 0 \\
0 0 0 1 0 1 0 1 \\
0 1 0 1 0 0 0 1 \\
0 1 0 0 0 0 0 0 \\
0 1 0 1 0 0 0 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 0 1 0 1 0 0 1 \\
0 0 0 0 1 0 1 1 \\
1 0 1 0 0 1 0 0 \\
1 1 0 1 0 0 0 1 \\
1 0 0 0 0 0 1 0 \\
1 1 1 0 1 0 0 0 \\
1 0 0 1 0 1 0 1 \\
1 0 1 0 0 1 1 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 26_x ($B7_x$, $B6_x$), ($9F_x$, 60_x, 28_x, $D6_x$).

Dual Cipher #22

Dual cipher by 19_x, primitive polynomial 163_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 35_x$ (DA_x, DB_x), ($E6_x$, 66_x, $3C_x$, BD_x).

Dual Cipher #23

Dual cipher by $1A_x$, primitive polynomial $11D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 3B_x$ ($9C_x$, $9D_x$), (87_x, 45_x, $1B_x$, $D8_x$).

Dual Cipher #24 ($Rijndael^{32}$)

Dual cipher by $1B_x$, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 2F_x$ ($E4_x$, $E5_x$), ($F8_x$, 51_x, $1C_x$, $B4_x$).

Dual Cipher #25

Dual cipher by $1C_x$, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 0\,1\,0\,1\,1\,1\,1\,0 \\ 0\,1\,1\,1\,0\,1\,0\,0 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,0\,1\,1\,0\,0\,1\,1 \\ 0\,1\,0\,0\,0\,0\,1\,0 \\ 0\,1\,1\,0\,1\,0\,1\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,1\,1\,0\,0\,1\,0 \\ 0\,0\,1\,0\,1\,1\,1\,1 \\ 0\,1\,0\,1\,1\,1\,0\,1 \\ 0\,1\,1\,0\,1\,0\,1\,0 \\ 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,1\,1\,1\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,1\,0\,0\,1\,1\,0\,0 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,0\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,1\,0\,1 \\ 0\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,1\,1\,1\,0\,1\,1\,0 \\ 1\,1\,1\,0\,1\,0\,1\,0 \\ 1\,1\,1\,1\,1\,0\,1\,0 \\ 1\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,0\,1\,0\,0\,0\,0 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 1\,1\,1\,1\,0\,1\,0\,0 \\ 1\,1\,1\,1\,1\,1\,0\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 34_x$ (CD_x, CC_x), $(E0_x, 84_x, 2D_x, 48_x)$.

Dual Cipher #26

Dual cipher by $1D_x$, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 27_x $(A1_x, A0_x)$, $(99_x, FA_x, 38_x, 5A_x)$.

Dual Cipher #27

Dual cipher by $1E_x$, primitive polynomial 169_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 53_x (CD_x, CC_x), (97_x, $6A_x$, $5A_x$, $A6_x$).

Dual Cipher #28

Dual cipher by $1F_x$, primitive polynomial 169_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 1 1 0 0 0 \\ 0 0 1 0 0 0 1 0 \\ 0 0 0 0 0 0 1 1 \\ 0 0 0 1 1 1 1 0 \\ 0 0 0 0 0 0 0 1 \\ 0 1 1 0 0 1 0 1 \\ 0 0 0 1 1 0 1 1 \\ 0 1 0 0 1 0 1 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 0 1 1 1 0 0 \\ 0 1 1 1 1 1 1 0 \\ 0 1 1 0 1 0 0 0 \\ 0 1 1 1 1 1 0 1 \\ 0 1 0 1 1 1 1 1 \\ 0 0 0 1 1 0 1 0 \\ 0 0 1 0 1 0 0 0 \\ 0 0 0 0 1 0 0 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 1 0 \\ 0 0 0 0 0 0 1 1 \\ 0 1 0 0 0 1 1 1 \\ 0 0 0 0 1 1 1 1 \\ 0 0 1 0 0 0 0 0 \\ 0 0 0 0 1 0 0 1 \\ 0 0 0 1 1 1 0 1 \\ 0 0 0 0 0 1 1 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 1 0 1 \\ 0 0 1 0 0 0 0 1 \\ 0 0 0 0 1 0 0 0 \\ 0 1 0 0 0 1 1 1 \\ 0 0 0 1 0 0 0 1 \\ 0 1 0 0 0 0 0 1 \\ 0 1 0 1 0 1 0 1 \\ 0 0 0 1 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 1 1 1 0 1 1 0 \\ 1 0 0 1 0 0 1 0 \\ 0 1 1 0 0 0 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 0 0 1 1 0 0 0 \\ 0 1 0 0 0 1 0 0 \\ 0 0 1 1 0 1 1 1 \\ 0 0 0 1 0 0 0 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x,$
$09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as
follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 46_x$ $(A1_x, A0_x)$, $(E9_x, 6A_x, 48_x, CA_x)$.

Dual Cipher #29

Dual cipher by 20_x, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $0E_x$ ($8E_x$, $8F_x$), ($E9_x$, 84_x, 67_x, $0B_x$).

Dual Cipher #30

Dual cipher by 21_x, primitive polynomial $1E7_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 09_x ($F6_x$, $F7_x$), (97_x, FA_x, 61_x, $0D_x$).

Dual Cipher #31

Dual cipher by 22_x, primitive polynomial $18D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&0&1&0&1&0&0 \\ 0&1&1&0&0&0&0&0 \\ 0&0&1&1&0&0&0&1 \\ 0&1&0&1&0&1&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&1&1&0&0&1&1&0 \\ 0&0&1&0&1&0&0&1 \\ 0&0&1&1&1&0&1&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&1&1&0&1&1 \\ 0&1&0&1&1&1&0&0 \\ 0&0&0&1&1&1&0&0 \\ 0&0&1&1&0&1&1&1 \\ 0&0&0&1&0&1&0&1 \\ 0&1&1&1&0&0&0&0 \\ 0&0&1&1&0&1&0&0 \\ 0&0&0&0&1&0&1&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&0&1&1&0 \\ 0&1&0&0&1&0&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&0&0&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&0&0&1 \\ 0&0&0&0&1&1&0&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&1&0&1&0&0 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&1&1&1&0&1 \\ 0&1&0&1&0&0&1&1 \\ 0&1&0&1&0&1&0&0 \\ 0&1&0&1&0&1&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&1&1&1&1&0&0 \\ 0&1&1&0&1&1&0&0 \\ 0&1&1&0&1&1&1&0 \\ 0&0&0&1&0&0&0&0 \\ 1&1&1&1&0&0&0&0 \\ 0&0&0&0&0&1&0&0 \\ 0&1&1&1&0&0&0&0 \\ 1&1&1&0&1&1&0&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow B3_x$ $(2B_x, 2A_x)$, $(B7_x, 7A_x, 9C_x, 50_x)$.

Dual Cipher #32

Dual cipher by 23_x, primitive polynomial $1F5_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&1&0&1&1&1 \\ 0&1&1&0&1&0&0&0 \\ 0&1&1&1&0&1&1&0 \\ 0&1&1&0&1&1&1&0 \\ 0&1&1&0&0&1&1&1 \\ 0&1&0&1&1&1&0&1 \\ 0&0&0&1&0&0&1&0 \\ 0&0&1&1&1&0&1&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&0&0&0&1&1 \\ 0&1&0&0&1&1&1&0 \\ 0&0&0&1&1&0&1&1 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&1&1&1&0&1&1&1 \\ 0&0&1&0&0&1&1&1 \\ 0&0&0&0&1&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&1&1&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&0&1&0&1&1&1&0 \\ 0&0&0&0&1&1&1&0 \\ 0&0&0&1&1&0&1&0 \\ 0&0&0&0&1&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&1&0&1&1&0&1 \\ 1&1&1&0&1&0&1&0 \\ 1&0&0&1&1&0&1&1 \\ 1&0&0&0&0&0&1&1 \\ 0&1&1&0&1&0&0&0 \\ 1&0&0&1&0&1&1&1 \\ 1&1&1&0&0&1&0&1 \\ 1&0&0&1&0&0&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow DF_x$ $(3E_x, 3F_x)$, $(DA_x, 7B_x, E4_x, 44_x)$.

Dual Cipher #33

Dual cipher by 24_x, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow CE_x$ $(1C_x, 1D_x)$, $(79_x, E8_x, 65_x, F5_x)$.

Dual Cipher #34

Dual cipher by 25_x, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 1 1 1 0 0 \\ 0 1 0 1 1 1 1 1 \\ 0 0 1 0 0 1 1 1 \\ 0 1 0 0 1 0 1 0 \\ 0 1 1 0 0 1 0 0 \\ 0 0 1 1 1 1 0 0 \\ 0 0 1 1 0 1 1 0 \\ 0 0 1 0 0 1 0 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 1 1 1 1 1 0 \\ 0 0 0 1 0 1 1 0 \\ 0 1 1 0 1 1 0 0 \\ 0 0 1 1 1 1 0 1 \\ 0 0 1 0 0 1 1 1 \\ 0 1 1 1 0 0 1 0 \\ 0 0 1 0 0 0 0 1 \\ 0 0 0 1 1 1 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 1 \\ 0 0 0 0 0 1 0 0 \\ 0 1 0 0 0 1 1 0 \\ 0 0 0 0 0 0 1 0 \\ 0 0 1 0 1 1 1 0 \\ 0 0 0 0 1 0 0 0 \\ 0 0 0 1 0 0 1 1 \\ 0 0 0 0 1 0 0 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 0 0 0 0 1 \\ 0 1 1 1 0 0 0 0 \\ 0 1 0 1 1 1 0 0 \\ 0 0 0 1 0 1 1 1 \\ 0 0 0 0 0 1 0 0 \\ 0 1 0 0 0 0 0 0 \\ 0 0 0 1 0 0 0 0 \\ 0 0 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 0 1 1 0 1 1 \\ 1 1 1 1 1 1 0 1 \\ 1 1 0 1 1 0 1 1 \\ 0 0 0 1 1 1 1 1 \\ 0 0 0 0 1 1 0 0 \\ 1 0 0 1 0 0 0 0 \\ 0 0 1 0 1 0 1 1 \\ 1 1 1 1 1 1 1 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $A3_x$ ($1B_x$, $1A_x$), (79_x, 96_x, 62_x, $8C_x$).

Dual Cipher #35

Dual cipher by 26_x, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 20_x $(74_x, 75_x)$, $(BE_x, 6D_x, CA_x, 18_x)$.

Dual Cipher #36

Dual cipher by 27_x, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 33_x (72_x, 73_x), ($D4_x$, $6D_x$, $A6_x$, $1E_x$).

Dual Cipher #37

Dual cipher by 28_x, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
1 & 1 & 1 & 1 & 1 & 1 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $F9_x$ (36_x, 37_x), (83_x, $B3_x$, $B5_x$, 84_x).

Dual Cipher #38

Dual cipher by 29_x, irreducible polynomial $1F9_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,0\,0\,0\,0\,1\,0\,1 \\ 0\,0\,1\,0\,0\,1\,0\,0 \\ 0\,1\,1\,0\,1\,0\,0\,0 \\ 0\,0\,0\,1\,0\,1\,1\,0 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,1\,0\,0\,0\,0\,1\,0 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,0\,0\,1\,0\,1\,0\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,1\,1\,1\,1\,1\,1\,1 \\ 0\,0\,0\,0\,0\,1\,1\,1 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,1\,1\,1\,1\,1\,1\,0 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,1\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,0\,0\,1\,0\,0\,1\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,0 \\ 0\,0\,0\,0\,1\,0\,1\,1 \\ 0\,0\,1\,0\,1\,1\,1\,1 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,1\,1\,0\,1\,0 \\ 0\,0\,0\,0\,1\,0\,0\,1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,0\,0\,0\,0\,0\,0\,1 \\ 0\,1\,1\,0\,0\,0\,0\,0 \\ 0\,1\,0\,1\,1\,0\,0\,0 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1\,0\,1\,1\,0\,0\,1\,0 \\ 1\,1\,1\,1\,0\,1\,1\,1 \\ 1\,1\,1\,0\,0\,0\,0\,1 \\ 1\,0\,1\,1\,1\,1\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,0 \\ 1\,0\,1\,1\,0\,0\,1\,1 \\ 1\,0\,1\,1\,0\,1\,0\,1 \\ 1\,0\,0\,0\,0\,0\,1\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 86_x$ $(24_x, 25_x)$, $(FD_x, DF_x, D9_x, FA_x)$.

Dual Cipher #39

Dual cipher by $2A_x$, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 0 0 0 1 0 1 0 \\ 0 1 0 0 1 0 1 0 \\ 0 1 1 0 1 1 1 1 \\ 0 0 0 1 0 1 1 1 \\ 0 0 1 1 1 1 0 0 \\ 0 0 0 1 0 1 0 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 1 0 1 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 0 0 0 0 0 1 \\ 0 1 0 0 0 0 0 1 \\ 0 0 0 1 1 1 1 1 \\ 0 1 1 1 1 0 1 1 \\ 0 0 0 1 0 1 0 1 \\ 0 1 1 1 1 0 0 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 1 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 1 0 \\ 0 0 0 0 1 0 0 1 \\ 0 1 0 0 1 1 1 0 \\ 0 0 0 0 0 0 1 1 \\ 0 0 1 0 0 1 1 1 \\ 0 0 0 0 0 0 0 1 \\ 0 0 0 1 0 0 1 1 \\ 0 0 0 0 1 1 1 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 0 0 1 \\ 0 0 1 0 0 0 0 1 \\ 0 1 0 0 1 0 0 1 \\ 0 0 0 1 0 0 1 0 \\ 0 1 0 0 0 1 0 0 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 1 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 1 0 1 0 0 1 0 \\ 0 0 0 0 0 1 1 0 \\ 1 0 0 0 0 1 1 1 \\ 1 1 1 1 0 0 1 0 \\ 1 0 0 1 0 1 1 1 \\ 1 1 1 0 1 1 1 0 \\ 1 1 1 0 1 0 1 1 \\ 1 0 1 0 1 1 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $F4_x$ (06_x, 07_x), ($7F_x$, $6D_x$, 79_x, $6A_x$).

Dual Cipher #40

Dual cipher by $2B_x$, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → $8D_x$ $(06_x, 07_x)$, $(7F_x, 6D_x, 79_x, 6A_x)$.

Dual Cipher #41

Dual cipher by $2C_x$, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,0\,1\,0\,1\,0\,1 \\ 0\,1\,1\,0\,1\,0\,0\,1 \\ 0\,0\,1\,0\,1\,1\,1\,1 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,1\,1\,0\,0\,1\,0 \\ 0\,1\,1\,1\,0\,0\,1\,1 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,1\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,1\,1\,1\,0\,0 \\ 0\,1\,1\,0\,1\,0\,1\,0 \\ 0\,1\,1\,1\,0\,0\,0\,1 \\ 0\,0\,1\,0\,0\,1\,1\,0 \\ 0\,1\,1\,0\,1\,1\,1\,1 \\ 0\,0\,0\,1\,0\,0\,1\,1 \\ 0\,0\,0\,1\,0\,0\,0\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,0\,1\,0\,0\,1 \\ 0\,1\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,0\,1\,0\,0\,1\,1\,1 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,0\,1\,1 \\ 0\,0\,0\,0\,1\,1\,1\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,1\,0\,0\,1\,0 \\ 0\,1\,0\,0\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,0 \\ 0\,0\,0\,0\,0\,1\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,0\,1\,0\,1\,0\,0\,0 \\ 1\,0\,0\,1\,0\,0\,0\,1 \\ 0\,1\,1\,0\,0\,0\,0\,0 \\ 0\,0\,1\,1\,1\,0\,1\,1 \\ 0\,0\,1\,0\,0\,0\,1\,1 \\ 1\,1\,1\,0\,0\,1\,1\,0 \\ 0\,0\,1\,0\,1\,0\,0\,1 \\ 0\,1\,0\,1\,0\,0\,1\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 92_x$ $(E2_x, E3_x)$, $(12_x, C6_x, F0_x, 25_x)$.

Dual Cipher #42

Dual cipher by $2D_x$, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ ED_x $(9A_x, 9B_x)$, $(12_x, AC_x, 88_x, 37_x)$.

Dual Cipher #43

Dual cipher by $2E_x$, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ BC_x $(F7_x, F6_x)$, $(09_x, E3_x, FE_x, 15_x)$.

Dual Cipher #44

Dual cipher by $2F_x$, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow D7_x$ $(8F_x, 8E_x)$, $(0E_x, 9B_x, 81_x, 15_x)$.

Dual Cipher #45

Dual cipher by 30_x, primitive polynomial $1C3_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $0A_x$ ($B8_x$, $B9_x$), (54_x, 92_x, EC_x, $2B_x$).

Dual Cipher #46

Dual cipher by 31_x, primitive polynomial $1A9_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $0C_x$ ($D2_x$, $D3_x$), (41_x, ED_x, 93_x, $3E_x$).

Dual Cipher #47

Dual cipher by 32_x, irreducible polynomial $18B_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&1&0&1&0&1&1 \\ 0&1&1&0&1&1&1&0 \\ 0&0&1&0&1&1&1&0 \\ 0&0&1&0&1&1&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&1&1&1&1&0&0&0 \\ 0&0&0&1&1&1&0&0 \\ 0&0&0&1&0&0&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&1&1&1&0&1&1 \\ 0&1&1&0&0&0&0&0 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&1&1&1&1 \\ 0&1&1&1&1&0&0&0 \\ 0&1&1&1&0&1&0&1 \\ 0&0&1&1&1&1&1&0 \\ 0&0&0&0&1&1&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&0&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&1&1&0&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&1&0&1&1&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&0&0&0&0&1&0 \\ 1&0&0&0&0&1&1&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&0&0&1&0&0 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&1&0&0&0&0 \\ 0&0&0&0&0&1&1&1 \\ 1&1&1&1&1&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 6B_x$ $(33_x, 32_x)$, $(D2_x, DE_x, E1_x, EC_x)$.

Dual Cipher #48

Dual cipher by 33_x, irreducible polynomial $1F3_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 6B_x$ (20_x, 21_x), ($B8_x$, $B2_x$, 98_x, 93_x).

Dual Cipher #49

Dual cipher by 34_x, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\
1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $A0_x$ ($E5_x$, $E4_x$), ($D7_x$, 96_x, 32_x, 72_x).

Dual Cipher #50

Dual cipher by 35_x, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 1 0 0 0 0 0 \\ 0 0 0 0 0 1 1 1 \\ 0 1 0 0 0 0 0 1 \\ 0 1 1 0 1 0 0 0 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 1 1 1 1 0 \\ 0 0 1 0 1 0 1 0 \\ 0 1 1 0 0 1 1 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 0 1 1 0 1 1 \\ 0 0 1 1 1 0 1 0 \\ 0 1 1 0 0 0 0 1 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 0 1 0 1 1 \\ 0 1 1 1 0 0 1 0 \\ 0 0 1 0 1 0 0 0 \\ 0 0 0 1 1 0 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 1 \\ 0 0 0 0 1 1 1 1 \\ 0 1 0 0 1 0 1 1 \\ 0 0 0 0 0 0 0 1 \\ 0 0 1 0 1 1 0 0 \\ 0 0 0 0 0 1 1 0 \\ 0 0 0 1 1 1 1 1 \\ 0 0 0 0 1 1 0 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 0 0 1 0 0 \\ 0 0 1 1 0 1 0 1 \\ 0 0 0 0 1 0 0 1 \\ 0 1 0 0 0 0 1 0 \\ 0 1 0 1 0 1 0 0 \\ 0 1 0 1 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 1 0 0 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 0 0 0 1 1 \\ 0 0 0 0 1 1 0 0 \\ 1 0 1 1 1 1 1 1 \\ 1 1 0 0 1 1 0 1 \\ 1 1 0 1 1 0 1 0 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 0 1 0 0 1 \\ 0 0 0 0 0 0 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow CC_x$ ($9D_x$, $9C_x$), (BC_x, $E8_x$, 21_x, 74_x).

Dual Cipher #51

Dual cipher by 36_x, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 04_x$ $(D4_x, D5_x)$, $(95_x, AF_x, 41_x, 7A_x)$.

Dual Cipher #52

Dual cipher by 37_x, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 05_x$ (BE_x, BF_x), (EA_x, $C4_x$, 54_x, $7B_x$).

Dual Cipher #53

Dual cipher by 38_x, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 11_x (90_x, 91_x), ($F1_x$, 96_x, 61_x, 07_x).

Dual Cipher #54

Dual cipher by 39_x, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,1\,0\,0\,1\,0\,1 \\ 0\,1\,1\,1\,1\,1\,0\,0 \\ 0\,1\,1\,1\,0\,1\,0\,0 \\ 0\,1\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,1\,0\,0\,0\,1\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,1\,0\,0\,1\,0\,1\,0 \\ 0\,0\,1\,1\,1\,0\,1\,0 \\ 0\,0\,1\,0\,0\,0\,1\,0 \\ 0\,1\,0\,1\,0\,1\,1\,0 \\ 0\,1\,1\,0\,0\,0\,0\,0 \\ 0\,1\,1\,0\,1\,1\,1\,0 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,0\,1\,1\,1\,1 \\ 0\,1\,0\,0\,1\,0\,1\,1 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,1\,0\,1\,1\,0\,0 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,0\,0\,0\,1\,1\,0\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,1\,0\,0 \\ 0\,0\,1\,1\,0\,1\,0\,1 \\ 0\,0\,0\,0\,1\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,1\,0 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,0\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,1\,1\,0\,1\,0\,1\,0 \\ 1\,0\,0\,0\,1\,1\,1\,0 \\ 1\,0\,1\,0\,1\,0\,0\,1 \\ 1\,1\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,1\,0\,1\,0\,0\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 10_x$ (EE_x, EF_x), $(89_x, E8_x, 67_x, 07_x)$.

Dual Cipher #55

Dual cipher by $3A_x$, irreducible polynomial $1F3_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&1&0&1&1&1 \\ 0&1&1&1&1&0&0&1 \\ 0&0&1&1&1&0&1&1 \\ 0&1&1&0&0&1&0&0 \\ 0&0&0&0&1&1&1&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&1&0&1&1&0&0 \\ 0&0&0&0&1&1&0&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&1&0&0&0&1&0 \\ 0&1&1&1&1&1&0&1 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&0&0&1&0&1 \\ 0&1&1&0&1&1&1&1 \\ 0&1&1&0&1&1&1&0 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&1&0&1&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&1&1&0&0 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&0&0&1&1&0 \\ 0&0&1&0&1&0&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&0&0&1&1&0&0&0 \\ 0&0&0&0&1&0&1&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&1&0&1&0&0 \\ 0&1&1&1&0&0&0&1 \\ 0&0&0&1&1&1&0&0 \\ 0&1&0&0&0&1&1&1 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&0&0&0&1&0&1&0 \\ 0&1&0&1&1&0&1&1 \\ 1&0&1&1&1&0&0&1 \\ 0&1&0&1&0&1&1&1 \\ 1&1&0&1&1&0&1&1 \\ 0&0&0&1&1&0&1&0 \\ 0&0&0&1&1&0&0&1 \\ 1&1&0&0&1&1&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow C7_x$ ($2A_x$, $2B_x$), ($2C_x$, 68_x, 06_x, 43_x).

Dual Cipher #56

Dual cipher by $3B_x$, irreducible polynomial $18B_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow AD_x$ $(3F_x, 3E_x)$, $(39_x, 69_x, 06_x, 57_x)$.

Dual Cipher #57

Dual cipher by $3C_x$, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 17_x$ (CB_x, CA_x), $(30_x, 19_x, FB_x, D3_x)$.

Dual Cipher #58

Dual cipher by $3D_x$, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 16_x$ ($A7_x$, $A6_x$), (22_x, $1F_x$, 85_x, $B9_x$).

Dual Cipher #59

Dual cipher by $3E_x$, primitive polynomial $1F5_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 52_x ($9F_x$, $9E_x$), (43_x, 76_x, DC_x, $E8_x$).

Dual Cipher #60

Dual cipher by $3F_x$, primitive polynomial $18D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 47_x$ ($E6_x$, $E7_x$), (57_x, 71_x, $B1_x$, 96_x).

Dual Cipher #61

Dual cipher by 40_x, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 08_x $(3E_x, 3F_x)$, $(4D_x, FA_x, 73_x, C5_x)$.

Dual Cipher #62

Dual cipher by 41_x, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 0F_x$ $(2B_x, 2A_x)$, $(5E_x, 84_x, 75_x, AE_x)$.

Dual Cipher #63

Dual cipher by 42_x, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 0 1 1 1 \\ 0 0 0 0 0 0 1 0 \\ 0 1 1 0 1 0 1 1 \\ 0 0 0 0 1 0 0 0 \\ 0 1 1 0 1 0 1 0 \\ 0 0 1 1 1 1 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 1 0 0 1 1 1 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 1 1 0 0 1 \\ 0 1 1 0 1 0 1 1 \\ 0 0 1 1 0 0 1 1 \\ 0 0 1 1 0 1 0 1 \\ 0 0 0 1 0 0 0 0 \\ 0 0 1 1 1 0 1 0 \\ 0 1 0 0 0 0 0 0 \\ 0 0 1 0 1 0 0 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 0 \\ 0 0 0 0 1 1 1 1 \\ 0 1 0 0 0 1 0 1 \\ 0 0 0 0 1 0 1 1 \\ 0 0 1 0 1 1 0 1 \\ 0 0 0 0 1 0 1 0 \\ 0 0 0 1 1 0 0 1 \\ 0 0 0 0 0 1 1 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 1 0 1 \\ 0 1 1 0 0 1 0 0 \\ 0 0 0 1 1 0 0 1 \\ 0 1 0 0 0 0 1 1 \\ 0 1 0 1 0 1 0 1 \\ 0 1 0 1 0 0 0 0 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 1 0 1 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 1 0 0 1 1 1 \\ 0 1 1 0 1 1 0 0 \\ 1 1 0 1 0 1 1 0 \\ 1 1 0 0 0 1 0 0 \\ 1 0 1 0 0 0 0 1 \\ 1 0 0 0 0 0 0 1 \\ 1 1 1 1 0 1 0 0 \\ 0 1 1 0 1 1 1 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow E2_x$ (95_x, 94_x), ($B4_x$, 15_x, 21_x, 81_x).

Dual Cipher #64

Dual cipher by 43_x, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 9A_x$ (EA_x, EB_x), ($D8_x$, 15_x, 32_x, FE_x).

Dual Cipher #65

Dual cipher by 44_x, irreducible polynomial $13F_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 37_x ($5A_x$, $5B_x$), (AB_x, $3B_x$, $F1_x$, 60_x).

Dual Cipher #66

Dual cipher by 45_x, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) → 25_x (48_x, 49_x), ($C1_x$, $2F_x$, 89_x, 66_x).

Dual Cipher #67

Dual cipher by 46_x, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 71_x $(19_x, 18_x)$, $(B4_x, A1_x, AD_x, B9_x)$.

Dual Cipher #68

Dual cipher by 47_x, primitive polynomial $15F_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 76_x$ ($1F_x$, $1E_x$), ($D8_x$, CD_x, $C7_x$, $D3_x$).

Dual Cipher #69

Dual cipher by 48_x, primitive polynomial 165_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 42_x ($2B_x$, $2A_x$), (77_x, $E8_x$, $5C_x$, $C2_x$).

Dual Cipher #70

Dual cipher by 49_x, primitive polynomial 163_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
1 & 0 & 1 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 56_x$ $(3E_x, 3F_x)$, $(70_x, 96_x, 4E_x, A9_x)$.

Dual Cipher #71

Dual cipher by $4A_x$, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 80_x ($2B_x$, $2A_x$), ($3A_x$, $B0_x$, 11_x, $9A_x$).

Dual Cipher #72

Dual cipher by $4B_x$, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ FF_x ($3E_x$, $3F_x$), ($2E_x$, DD_x, 10_x, $E2_x$).

Dual Cipher #73

Dual cipher by $4C_x$, primitive polynomial $11D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
1 & 1 & 1 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 26_x (11_x, 10_x), ($D1_x$, DC_x, $C0_x$, CC_x).

Dual Cipher #74 ($Rijndael^4$)

Dual cipher by $4D_x$, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 35_x $(10_x, 11_x)$, $(BA_x, B1_x, AA_x, A0_x)$.

Dual Cipher #75

Dual cipher by $4E_x$, primitive polynomial 169_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,1\,1\,0\,1\,1\,0 \\ 0\,1\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,1\,1\,0\,1\,0\,0\,1 \\ 0\,0\,0\,1\,0\,0\,1\,0 \\ 0\,0\,1\,1\,0\,0\,0\,0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,1\,0\,1\,0\,1\,1 \\ 0\,1\,1\,1\,1\,1\,1\,1 \\ 0\,1\,1\,0\,0\,1\,0\,0 \\ 0\,1\,1\,0\,0\,1\,0\,1 \\ 0\,0\,1\,1\,1\,1\,1\,1 \\ 0\,0\,1\,1\,0\,0\,1\,0 \\ 0\,1\,1\,0\,0\,1\,1\,1 \\ 0\,0\,1\,0\,0\,0\,0\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,1\,0\,0\,0\,1\,1\,1 \\ 0\,0\,0\,0\,1\,1\,1\,1 \\ 0\,0\,1\,0\,0\,0\,0\,0 \\ 0\,0\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,1\,1\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,0\,0\,0\,0\,1\,0\,1 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 0\,1\,0\,0\,0\,1\,1\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,1\,0\,1\,1\,0\,1\,0 \\ 0\,1\,0\,0\,1\,0\,1\,1 \\ 0\,0\,1\,0\,1\,1\,1\,1 \\ 1\,1\,0\,0\,0\,0\,1\,0 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 1\,0\,0\,1\,0\,0\,1\,1 \\ 1\,0\,0\,1\,1\,1\,1\,0 \\ 0\,0\,0\,0\,0\,0\,1\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 62_x $(33_x, 32_x)$, $(EB_x, 79_x, D8_x, 4B_x)$.

Dual Cipher #76

Dual cipher by $4F_x$, primitive polynomial 169_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 65_x (20_x, 21_x), (94_x, 79_x, $B4_x$, 58_x).

Dual Cipher #77

Dual cipher by 52_x, primitive polynomial 171_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ EF_x (94_x, 95_x), ($4B_x$, 66_x, DF_x, $F3_x$).

Dual Cipher #78

Dual cipher by 53_x, irreducible polynomial 177_x, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 91_x (EB_x, EA_x), $(58_x, 60_x, B3_x, 8A_x)$.

Dual Cipher #79

Dual cipher by 54_x, primitive polynomial 171_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 57_x (16_x, 17_x), ($3F_x$, $4C_x$, 29_x, $5B_x$).

Dual Cipher #80

Dual cipher by 55_x, irreducible polynomial 177_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 1 0 0 \\ 0 1 1 0 0 0 0 0 \\ 0 1 0 1 1 0 1 1 \\ 0 0 0 1 1 1 1 1 \\ 0 1 0 1 0 1 0 1 \\ 0 0 1 1 1 0 0 0 \\ 0 0 1 0 1 1 0 1 \\ 0 0 0 0 1 1 1 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 1 0 1 0 1 1 \\ 0 0 0 0 1 1 1 0 \\ 0 1 0 0 1 1 1 0 \\ 0 0 0 1 0 0 0 1 \\ 0 1 0 1 1 0 1 1 \\ 0 0 1 1 1 1 1 0 \\ 0 1 0 0 1 1 0 1 \\ 0 0 1 0 1 0 0 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 1 \\ 0 0 0 0 1 1 1 1 \\ 0 1 0 0 1 0 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 0 1 0 1 0 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 0 0 1 1 0 1 1 \\ 0 0 0 0 0 1 0 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 1 0 0 \\ 0 0 1 0 0 1 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 1 0 0 0 1 0 0 \\ 0 0 0 1 0 0 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 0 0 0 0 0 0 0 \\ 0 1 1 1 0 0 0 0 \\ 1 0 1 0 1 0 1 0 \\ 0 0 1 0 0 0 0 1 \\ 0 0 0 0 1 0 0 0 \\ 1 0 1 1 1 1 0 1 \\ 0 0 0 0 1 0 1 0 \\ 1 0 1 1 0 0 1 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 43_x (17_x, 16_x), ($2A_x$, $5F_x$, $3D_x$, 49_x).

Dual Cipher #81

Dual cipher by 56_x, primitive polynomial 163_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 8F_x$ ($2E_x$, $2F_x$), (77_x, $E2_x$, 59_x, CD_x).

Dual Cipher #82

Dual cipher by 57_x, primitive polynomial 165_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $F7_x$ ($3A_x$, $3B_x$), (70_x, $9A_x$, $4A_x$, $A1_x$).

Dual Cipher #83

Dual cipher by 58_x, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&0&0&0&0 \\ 0&0&0&0&1&1&0&0 \\ 0&0&1&0&1&1&1&0 \\ 0&0&0&1&1&0&0&1 \\ 0&1&0&1&1&1&0&0 \\ 0&0&1&0&1&0&1&0 \\ 0&1&1&1&1&1&0&0 \\ 0&0&1&0&1&1&1&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&0&0&0&0 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&0&1&0&1&0 \\ 0&1&0&1&0&1&0&1 \\ 0&1&1&0&0&1&0&0 \\ 0&0&1&0&0&1&0&0 \\ 0&1&1&0&1&0&1&0 \\ 0&0&1&0&0&0&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&0&0&0&1 \\ 0&1&0&0&1&0&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&0&0&1&1&1&0&0 \\ 0&0&0&0&0&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&1 \\ 0&1&0&1&0&0&1&1 \\ 0&0&0&1&0&1&0&0 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&0&0&0&1 \\ 0&1&0&0&0&0&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&0&0&1&0&1&1 \\ 1&0&1&0&0&1&0&0 \\ 0&0&0&0&1&1&0&1 \\ 0&0&0&1&1&0&1&1 \\ 1&0&1&1&0&1&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&1&1&0&1&0&0&1 \\ 0&1&0&1&0&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 23_x $(50_x, 51_x)$, $(09_x, BD_x, 59_x, EC_x)$.

Dual Cipher #84

Dual cipher by 59_x, primitive polynomial $15F_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 31_x$ (44_x, 45_x), ($0E_x$, $D6_x$, $4A_x$, 93_x).

Dual Cipher #85

Dual cipher by $5A_x$, primitive polynomial 163_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\
1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 8D_x$ (AD_x, AC_x), (64_x, 13_x, $C9_x$, BF_x).

Dual Cipher #86

Dual cipher by $5B_x$, primitive polynomial 165_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $F4_x$ ($C7_x$, $C6_x$), (63_x, 13_x, $A4_x$, $D5_x$).

Dual Cipher #87 ($Rijndael^{16}$)

Dual cipher by $5E_x$, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\
1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow D3_x$ ($5E_x$, $5F_x$), ($B7_x$, $0D_x$, $E9_x$, 52_x).

Dual Cipher #88

Dual cipher by $5F_x$, primitive polynomial $11D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 0 1 0 0 \\ 0 0 0 1 1 1 1 0 \\ 0 1 1 1 1 1 0 1 \\ 0 1 1 0 1 1 1 1 \\ 0 0 1 1 1 0 1 0 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 0 1 1 0 1 \\ 0 0 1 1 0 1 0 0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 1 1 1 0 1 1 0 \\ 0 1 0 1 0 1 0 1 \\ 0 1 1 0 1 0 1 1 \\ 0 1 0 0 1 0 0 1 \\ 0 1 0 1 0 0 1 1 \\ 0 0 1 0 0 0 1 1 \\ 0 1 1 1 1 0 0 1 \\ 0 0 1 0 0 1 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 1 1 \\ 0 0 0 0 0 0 0 1 \\ 0 1 0 0 1 1 1 0 \\ 0 0 0 0 1 0 1 0 \\ 0 0 1 0 1 1 0 1 \\ 0 0 0 0 0 1 0 0 \\ 0 0 0 1 0 1 1 0 \\ 0 0 0 0 0 0 1 0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 1 0 1 0 0 0 0 \\ 0 0 1 1 0 1 0 0 \\ 0 1 0 1 1 1 0 1 \\ 0 0 0 0 0 1 1 1 \\ 0 0 0 1 0 0 0 1 \\ 0 0 0 0 0 1 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 1 0 0 0 0 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 0 0 0 0 0 1 \\ 0 1 0 1 1 0 0 0 \\ 0 1 0 1 1 1 0 0 \\ 1 1 0 1 0 0 0 1 \\ 1 1 0 0 1 0 0 1 \\ 0 1 1 0 0 0 0 0 \\ 0 1 1 0 1 1 0 0 \\ 0 0 1 1 0 1 1 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $B9_x$ ($4D_x$, $4C_x$), (DA_x, $0B_x$, 97_x, 47_x).

Dual Cipher #89

Dual cipher by 60_x, irreducible polynomial $1DD_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 3D_x$ ($3E_x$, $3F_x$), (30_x, 49_x, $0E_x$, 76_x).

Dual Cipher #90

Dual cipher by 61_x, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 1 0 1 \\ 0 1 1 0 0 1 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 1 0 1 1 0 0 1 \\ 0 0 1 0 0 0 0 1 \\ 0 1 0 0 1 0 0 1 \\ 0 0 1 0 1 1 1 0 \\ 0 0 0 0 1 0 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 0 0 1 0 0 1 \\ 0 0 1 0 0 1 0 1 \\ 0 0 1 0 1 0 0 0 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 1 0 0 1 1 0 1 \\ 0 1 1 0 0 1 1 0 \\ 0 0 1 0 0 0 0 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 1 \\ 0 0 0 0 0 1 0 0 \\ 0 1 0 0 0 1 1 0 \\ 0 0 0 0 0 0 1 0 \\ 0 0 1 0 1 1 1 0 \\ 0 0 0 0 1 0 0 0 \\ 0 0 0 1 0 0 1 1 \\ 0 0 0 0 1 0 0 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 0 0 0 0 1 \\ 0 1 1 1 0 0 0 0 \\ 0 1 0 1 1 1 0 0 \\ 0 0 0 1 0 1 1 1 \\ 0 0 0 0 0 1 0 0 \\ 0 1 0 0 0 0 0 0 \\ 0 0 0 1 0 0 0 0 \\ 0 0 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 0 1 1 1 1 1 0 \\ 0 0 1 1 0 0 0 0 \\ 0 0 0 1 1 1 1 0 \\ 1 1 0 1 1 0 0 0 \\ 1 0 0 1 1 1 0 0 \\ 0 0 1 0 1 0 0 0 \\ 0 0 0 1 0 0 0 0 \\ 1 1 0 1 0 0 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 29_x $(2B_x, 2A_x)$, $(22_x, 5B_x, 09_x, 71_x)$.

Dual Cipher #91

Dual cipher by 62_x, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 03_x$ (69_x, 68_x), (67_x, $B0_x$, $0E_x$, $D8_x$).

Dual Cipher #92

Dual cipher by 63_x, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&0&1&0&0 \\ 0&0&0&0&1&1&0&0 \\ 0&0&1&0&1&0&0&1 \\ 0&1&0&1&1&1&0&1 \\ 0&0&1&0&0&0&0&0 \\ 0&1&0&0&1&1&0&1 \\ 0&1&1&0&1&0&1&0 \\ 0&0&1&0&1&0&0&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&0&0&1&0&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&1&0&1&0&0 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&1&0&0&1 \\ 0&1&1&0&0&1&1&0 \\ 0&0&1&0&0&0&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&1&0&0&1&0&1&1 \\ 0&0&0&0&0&0&0&1 \\ 0&0&1&0&1&1&0&0 \\ 0&0&0&0&0&1&1&0 \\ 0&0&0&1&1&1&1&1 \\ 0&0&0&0&1&1&0&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&0&0&1&0&0 \\ 0&0&1&1&0&1&0&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&0&1&0 \\ 0&1&0&1&0&1&0&0 \\ 0&1&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&0&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&1&1&0&1&1&1 \\ 1&0&0&0&0&0&0&0 \\ 0&1&0&0&1&0&0&1 \\ 1&0&1&0&0&0&0&0 \\ 1&1&1&0&0&0&1&1 \\ 0&0&1&1&0&0&0&1 \\ 1&1&0&0&0&0&1&0 \\ 0&1&0&1&1&0&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 02_x (68_x, 69_x), (61_x, DD_x, 09_x, $B4_x$).

Dual Cipher #93

Dual cipher by 64_x, primitive polynomial $18D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 1 1 0 0 1 \\ 0 1 0 1 1 1 0 0 \\ 0 1 0 1 0 0 0 0 \\ 0 0 0 1 0 1 1 1 \\ 0 1 0 1 0 1 1 0 \\ 0 1 1 0 1 1 0 1 \\ 0 1 0 0 0 1 1 0 \\ 0 0 0 0 1 1 1 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 1 1 0 1 1 \\ 0 0 1 0 1 0 1 0 \\ 0 1 1 1 1 1 0 0 \\ 0 0 0 0 1 0 1 0 \\ 0 0 1 0 1 0 0 1 \\ 0 1 0 0 1 0 0 1 \\ 0 1 1 0 0 0 0 1 \\ 0 0 1 1 0 0 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 1 0 \\ 0 0 0 0 0 1 1 0 \\ 0 1 0 0 1 0 0 1 \\ 0 0 0 0 1 0 1 1 \\ 0 0 1 0 0 0 1 0 \\ 0 0 0 0 0 1 0 1 \\ 0 0 0 1 0 0 0 1 \\ 0 0 0 0 1 1 0 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 1 0 1 0 0 \\ 0 0 1 0 0 1 0 1 \\ 0 0 0 1 1 1 0 1 \\ 0 1 0 1 0 0 1 1 \\ 0 1 0 1 0 1 0 0 \\ 0 1 0 1 0 1 0 1 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 1 0 0 0 0 1 \\ 1 0 1 0 1 1 0 0 \\ 0 1 0 1 1 1 1 0 \\ 1 0 1 0 0 1 1 1 \\ 0 0 0 1 0 1 0 1 \\ 1 1 1 1 1 1 1 0 \\ 1 1 0 0 0 0 0 0 \\ 1 0 0 0 0 1 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 54_x$ $(77_x, 76_x)$, $(69_x, 3E_x, 1E_x, 48_x)$.

Dual Cipher #94

Dual cipher by 65_x, primitive polynomial $1F5_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 41_x (70_x, 71_x), (68_x, $2B_x$, 18_x, $5A_x$).

Dual Cipher #95

Dual cipher by 66_x, irreducible polynomial $1D7_x$, minimal generator 07_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 9E_x$ (93_x, 92_x), ($A1_x$, AF_x, 32_x, $3D_x$).

Dual Cipher #96

Dual cipher by 67_x, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow E7_x$ (EC_x, ED_x), (CD_x, $C4_x$, 21_x, 29_x).

Dual Cipher #97

Dual cipher by 68_x, primitive polynomial $18D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 24_x$ $(33_x, 32_x)$, $(26_x, 3E_x, 15_x, 0C_x)$.

Dual Cipher #98

Dual cipher by 69_x, primitive polynomial $1F5_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&1&0&1&0 \\ 0&0&1&0&1&1&0&1 \\ 0&0&1&1&1&0&1&0 \\ 0&0&1&0&1&0&0&1 \\ 0&0&1&1&1&1&0&1 \\ 0&1&1&0&0&1&1&0 \\ 0&0&0&0&0&1&1&0 \\ 0&0&0&0&1&1&1&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&0&1&1&1&1&1&1 \\ 0&0&1&1&1&0&0&1 \\ 0&1&0&0&1&0&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&1&0&0&1&0 \\ 0&0&1&0&1&0&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&1&1&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&0&1&0&1&1&1&0 \\ 0&0&0&0&1&1&1&0 \\ 0&0&0&1&1&0&1&0 \\ 0&0&0&0&1&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&0&0&1&0&1&1&0 \\ 0&1&0&0&1&1&0&1 \\ 1&1&1&1&0&1&1&0 \\ 0&1&0&1&0&0&0&0 \\ 1&1&1&1&1&0&0&0 \\ 0&0&0&0&0&1&0&0 \\ 0&1&1&0&1&1&0&1 \\ 1&1&1&1&0&0&0&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 36_x$ $(20_x, 21_x)$, $(35_x, 2B_x, 15_x, 0A_x)$.

Dual Cipher #99

Dual cipher by $6A_x$, irreducible polynomial $1F3_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 1 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ DF_x (80_x, 81_x), ($5D_x$, 68_x, DD_x, $E9_x$).

Dual Cipher #100

Dual cipher by $6B_x$, irreducible polynomial $18B_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&1&1&1&0&1&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&1&0&0&1&0&1&0 \\ 0&1&1&0&1&1&0&1 \\ 0&1&1&1&1&1&1&1 \\ 0&1&0&1&1&0&0&1 \\ 0&1&1&0&1&0&1&1 \\ 0&1&1&1&0&1&1&1 \end{pmatrix}$$

$$R^{-1} = \begin{pmatrix} 1&1&0&1&0&1&0&0 \\ 0&1&1&1&1&1&0&0 \\ 0&0&0&1&1&1&1&0 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&1&1&1 \\ 0&1&0&1&0&1&0&1 \\ 0&0&1&1&1&1&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&0&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&1&1&0&1 \end{pmatrix}$$

$$Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&1&0&1&1&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&1&0&0&1&1&0 \\ 1&1&1&0&1&1&0&0 \\ 0&0&1&1&1&1&0&0 \\ 1&0&1&0&0&0&0&0 \\ 0&0&1&0&1&1&1&1 \\ 1&1&0&1&1&0&0&1 \\ 1&0&0&0&1&0&0&1 \\ 1&1&0&1&1&1&0&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $B3_x$ (FF_x, FE_x), ($4F_x$, 69_x, $B0_x$, 97_x).

Dual Cipher #101

Dual cipher by $6C_x$, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 0 0 1 \\ 0 0 1 1 1 0 1 0 \\ 0 1 1 0 0 0 1 1 \\ 0 0 1 0 0 1 0 1 \\ 0 1 0 1 0 1 0 1 \\ 0 0 0 0 1 1 1 1 \\ 0 0 0 1 1 0 1 1 \\ 0 0 1 1 1 0 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 1 0 1 0 0 \\ 0 0 1 0 0 0 1 1 \\ 0 1 1 0 1 1 1 1 \\ 0 1 0 1 0 1 0 0 \\ 0 0 1 1 1 0 1 0 \\ 0 1 0 1 0 0 1 0 \\ 0 1 0 0 0 0 0 1 \\ 0 0 1 0 1 1 0 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 1 \\ 0 0 0 0 1 0 1 1 \\ 0 1 0 0 1 1 0 1 \\ 0 0 0 0 1 1 1 0 \\ 0 0 1 0 1 1 0 1 \\ 0 0 0 0 0 0 0 1 \\ 0 0 0 1 0 1 1 0 \\ 0 0 0 0 1 1 0 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 0 0 1 \\ 0 0 1 0 0 0 0 1 \\ 0 0 0 0 1 0 0 1 \\ 0 1 0 0 0 0 1 1 \\ 0 1 0 1 0 0 0 1 \\ 0 1 0 1 0 1 0 0 \\ 0 0 0 1 0 1 0 1 \\ 0 0 0 0 0 1 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 1 1 1 1 1 \\ 1 0 0 1 0 0 0 1 \\ 0 1 1 1 1 1 1 1 \\ 1 0 1 1 0 1 0 0 \\ 0 0 0 0 1 0 0 0 \\ 1 0 1 0 0 1 0 0 \\ 0 1 0 1 0 1 0 1 \\ 1 0 0 0 0 0 1 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 4A_x$ $(15_x, 14_x)$, $(C6_x, 5D_x, D3_x, 49_x)$.

Dual Cipher #102

Dual cipher by $6D_x$, primitive polynomial $1E7_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 59_x $(15_x, 14_x)$, $(AC_x, 4F_x, B9_x, 5B_x)$.

Dual Cipher #103

Dual cipher by $6E_x$, primitive polynomial $1CF_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 0 0 1 0 \\ 0 1 0 0 1 1 1 0 \\ 0 1 0 0 0 1 0 0 \\ 0 0 0 1 0 0 1 0 \\ 0 1 0 0 0 0 1 1 \\ 0 0 1 1 1 1 1 1 \\ 0 0 0 1 0 1 0 0 \\ 0 1 0 0 1 1 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 1 0 0 1 0 \\ 0 1 1 1 0 0 1 1 \\ 0 1 0 1 1 1 0 0 \\ 0 1 0 1 0 0 0 1 \\ 0 0 1 0 0 0 0 1 \\ 0 1 0 1 0 0 1 1 \\ 0 1 0 0 0 0 0 1 \\ 0 0 1 1 1 0 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 1 0 \\ 0 0 0 0 1 1 0 1 \\ 0 1 0 0 1 0 0 0 \\ 0 0 0 0 1 0 1 1 \\ 0 0 1 0 0 0 1 1 \\ 0 0 0 0 0 1 0 1 \\ 0 0 0 1 1 0 1 1 \\ 0 0 0 0 1 1 1 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 1 0 1 \\ 0 1 1 0 0 1 0 0 \\ 0 1 0 1 1 1 0 0 \\ 0 0 0 1 0 0 1 0 \\ 0 1 0 0 0 1 0 0 \\ 0 0 0 1 0 0 0 1 \\ 0 1 0 0 0 0 0 1 \\ 0 0 0 1 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 1 1 0 1 1 0 0 \\ 0 0 1 1 0 1 1 0 \\ 1 1 1 0 0 1 0 1 \\ 1 1 0 0 1 0 0 0 \\ 1 0 0 0 1 1 1 1 \\ 1 0 0 1 0 1 1 1 \\ 1 1 1 1 1 0 1 0 \\ 0 0 0 0 1 0 0 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $4B_x$ (97_x, 96_x), (FE_x, 49_x, 69_x, DF_x).

Dual Cipher #104

Dual cipher by $6F_x$, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 58_x$ ($E9_x$, $E8_x$), (81_x, $5B_x$, 68_x, $B3_x$).

Dual Cipher #105

Dual cipher by 70_x, primitive polynomial $1C3_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,1\,0\,1\,1\,0\,0 \\ 0\,0\,1\,1\,1\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,1\,1\,0\,0\,1\,1\,0 \\ 0\,1\,0\,1\,1\,1\,0\,0 \\ 0\,1\,1\,1\,0\,0\,0\,0 \\ 0\,1\,0\,1\,1\,0\,1\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,0\,0\,0\,1\,1\,0 \\ 0\,0\,0\,1\,1\,0\,1\,1 \\ 0\,0\,1\,1\,0\,0\,1\,1 \\ 0\,0\,1\,0\,1\,0\,1\,0 \\ 0\,1\,1\,1\,1\,1\,0\,0 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,1\,1\,0\,1\,0\,0\,1 \\ 0\,0\,1\,0\,0\,1\,0\,1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,1\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,1\,0\,0\,0\,0\,1\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,0\,0\,1\,1\,0\,1\,1 \\ 0\,0\,0\,0\,1\,1\,0\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,1\,0\,0\,0\,0 \\ 0\,0\,1\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,1\,0\,1\,0\,0\,1\,0 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1\,1\,0\,1\,0\,0\,1\,0 \\ 1\,1\,1\,0\,1\,0\,0\,0 \\ 0\,1\,1\,1\,0\,0\,1\,0 \\ 1\,0\,0\,1\,1\,1\,0\,0 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 1\,1\,1\,1\,0\,1\,1\,0 \\ 1\,1\,0\,1\,1\,0\,1\,1 \\ 1\,1\,0\,1\,0\,1\,1\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 58_x ($F0_x$, $F1_x$), (13_x, $B0_x$, $E3_x$, 41_x).

Dual Cipher #106

Dual cipher by 71_x, primitive polynomial $1A9_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $4B_x$ $(88_x, 89_x)$, $(13_x, DD_x, 9B_x, 54_x)$.

Dual Cipher #107

Dual cipher by 72_x, irreducible polynomial $1F3_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 29_x ($7D_x$, $7C_x$), (44_x, 19_x, 39_x, 65_x).

Dual Cipher #108

Dual cipher by 73_x, irreducible polynomial $18B_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 3D_x$ $(7C_x, 7D_x)$, $(50_x, 1F_x, 2C_x, 62_x)$.

Dual Cipher #109

Dual cipher by 74_x, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $F9_x$ $(E9_x, E8_x)$, $(B4_x, 96_x, 5D_x, 7E_x)$.

Dual Cipher #110

Dual cipher by 75_x, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 86_x$ $(97_x, 96_x)$, $(D8_x, E8_x, 4F_x, 7E_x)$.

Dual Cipher #111

Dual cipher by 76_x, primitive polynomial $1A9_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ AF_x $(C1_x, C0_x)$, $(09_x, 1A_x, C8_x, DA_x)$.

Dual Cipher #112

Dual cipher by 77_x, primitive polynomial $1C3_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 1 0 0 0 1 1 0 \\
0 1 0 0 1 1 0 0 \\
0 0 0 1 1 0 1 1 \\
0 1 1 0 1 0 1 1 \\
0 0 1 0 1 0 0 0 \\
0 1 1 1 1 0 1 0 \\
0 0 0 0 1 0 1 1 \\
0 1 1 1 0 1 1 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 1 1 1 0 1 0 0 \\
0 1 0 0 0 1 0 1 \\
0 1 0 1 0 1 1 1 \\
0 0 1 0 0 0 1 0 \\
0 1 0 1 1 1 1 1 \\
0 1 0 1 1 0 1 0 \\
0 1 1 0 1 0 1 1 \\
0 0 1 1 0 1 1 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 0 0 0 1 0 1 1 \\
0 0 0 0 1 1 0 1 \\
0 1 0 0 0 0 1 1 \\
0 0 0 0 0 1 1 0 \\
0 0 1 0 0 0 0 1 \\
0 0 0 0 0 0 1 1 \\
0 0 0 1 1 0 1 1 \\
0 0 0 0 1 1 0 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 1 0 1 0 0 0 0 \\
0 0 1 0 0 1 0 0 \\
0 1 0 0 1 0 0 1 \\
0 1 0 1 0 0 1 0 \\
0 1 0 1 0 1 0 0 \\
0 1 0 1 0 1 0 1 \\
0 1 0 0 0 1 0 1 \\
0 1 0 0 0 0 0 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 0 1 1 0 1 0 0 \\
0 0 0 1 1 0 0 0 \\
0 0 0 0 1 0 0 0 \\
1 1 1 1 0 1 1 1 \\
0 0 1 0 0 0 0 0 \\
0 1 1 1 1 1 1 1 \\
1 1 1 1 1 0 1 0 \\
1 1 0 1 0 0 0 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow C4_x$ (AB_x, AA_x), ($0E_x$, $1D_x$, $A5_x$, $B7_x$).

Dual Cipher #113

Dual cipher by 78_x, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&1&0&1&1 \\ 0&1&0&1&1&0&1&0 \\ 0&1&1&0&1&1&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&1&1&0&0&0&0&1 \\ 0&0&1&1&1&0&0&1 \\ 0&0&1&0&0&1&1&1 \\ 0&1&0&1&1&1&1&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&1&1&0&1&1 \\ 0&0&0&0&0&1&1&1 \\ 0&0&1&1&0&0&0&1 \\ 0&1&1&0&0&0&1&0 \\ 0&1&1&0&1&0&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&1&0&0&1&1&0&0 \\ 0&0&1&1&1&1&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&0&1&0&0 \\ 0&1&0&0&0&1&0&0 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&1&1&1&1 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&1&1&0&1&0 \\ 0&0&0&0&1&0&0&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&0&0&1 \\ 0&1&1&0&0&0&0&0 \\ 0&1&0&1&1&0&0&0 \\ 0&0&0&1&0&1&1&1 \\ 0&0&0&0&0&1&0&0 \\ 0&1&0&0&0&0&0&0 \\ 0&0&0&1&0&0&0&1 \\ 0&0&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&1&0&1&0&0&0 \\ 1&1&0&0&1&1&1&1 \\ 1&0&0&1&0&0&1&0 \\ 1&1&1&1&1&1&1&0 \\ 0&1&0&0&1&0&0&0 \\ 1&0&1&1&0&0&0&0 \\ 1&0&1&0&1&1&0&0 \\ 1&0&1&1&0&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 98_x $(96_x, 97_x)$, $(3D_x, DF_x, AB_x, 48_x)$.

Dual Cipher #114

Dual cipher by 79_x, primitive polynomial 187_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $E1_x$ ($E8_x$, $E9_x$), (29_x, $B3_x$, $C1_x$, $5A_x$).

Dual Cipher #115

Dual cipher by $7A_x$, primitive polynomial $1C3_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 75_x $(24_x, 25_x)$, $(A3_x, 1D_x, 87_x, 38_x)$.

Dual Cipher #116

Dual cipher by $7B_x$, primitive polynomial $1A9_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 73_x$ $(36_x, 37_x)$, $(CE_x, 1A_x, F8_x, 2D_x)$.

Dual Cipher #117

Dual cipher by $7C_x$, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&1&1&0&0 \\ 0&0&0&1&0&0&0&1 \\ 0&1&1&1&1&0&1&1 \\ 0&1&1&1&1&1&0&0 \\ 0&0&1&1&0&0&0&0 \\ 0&1&0&0&0&1&1&0 \\ 0&1&0&1&0&0&1&1 \\ 0&0&0&1&1&0&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&0&1&1&1 \\ 0&0&0&1&1&1&1&1 \\ 0&1&1&0&0&0&1&1 \\ 0&1&1&0&1&0&1&1 \\ 0&1&0&0&0&0&0&1 \\ 0&1&0&0&0&1&1&0 \\ 0&1&0&1&1&1&0&1 \\ 0&0&1&0&1&0&1&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&0&1&1&0&1 \\ 0&0&1&0&1&0&0&0 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&0&1&1&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&0&0&0&0&1 \\ 0&0&1&1&0&0&0&0 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&1&0&0&1&0 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&0&0&0&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&0&1&1&0&1&1&1 \\ 1&0&1&0&0&0&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&1&0&1&1&1&1&1 \\ 0&0&1&1&0&1&1&0 \\ 1&1&1&0&1&0&1&0 \\ 0&1&0&1&1&0&1&1 \\ 0&1&1&1&0&0&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 20_x ($6C_x$, $6D_x$), ($B3_x$, $C3_x$, DF_x, AE_x).

Dual Cipher #118

Dual cipher by $7D_x$, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 33_x$ $(6C_x, 6D_x)$, $(DF_x, A8_x, B3_x, C5_x)$.

Dual Cipher #119

Dual cipher by $7E_x$, primitive polynomial $1CF_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $6A_x$ $(5C_x, 5D_x)$, $(BF_x, A5_x, E3_x, F8_x)$.

Dual Cipher #120

Dual cipher by $7F_x$, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → $6A_x$ $(4E_x, 4F_x)$, $(D5_x, C8_x, 9B_x, 87_x)$.

Dual Cipher #121

Dual cipher by 80_x, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow EC_x$ (CC_x, CD_x), ($3C_x$, $5D_x$, $F0_x$, 90_x).

Dual Cipher #122

Dual cipher by 81_x, primitive polynomial $1E7_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 93_x ($A0_x$, $A1_x$), (28_x, $4F_x$, 88_x, EE_x).

Dual Cipher #123

Dual cipher by 82_x, irreducible polynomial $18B_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&0&1&1&1&0 \\ 0&0&1&0&0&1&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&1&0&1&0&0&0 \\ 0&0&1&0&1&1&1&0 \\ 0&0&1&1&0&1&1&0 \\ 0&0&1&0&1&1&0&0 \\ 0&1&1&0&1&1&1&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&1&0&0&0 \\ 0&1&1&0&0&0&0&0 \\ 0&0&1&1&1&0&1&1 \\ 0&0&1&0&0&1&1&1 \\ 0&0&1&0&1&0&1&1 \\ 0&0&0&1&0&0&1&0 \\ 0&0&0&0&1&0&1&0 \\ 0&1&1&0&1&0&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&0&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&1&1&0&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&1&0&1&1&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&0&1&0&1&1&1 \\ 1&0&0&0&1&0&0&0 \\ 0&0&0&1&0&0&0&1 \\ 0&1&1&0&1&1&1&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&1&1&1 \\ 0&0&1&0&1&0&1&0 \\ 1&1&1&0&0&0&0&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow C3_x$ $(84_x, 85_x)$, $(A5_x, DE_x, 21_x, 5B_x)$.

Dual Cipher #124

Dual cipher by 83_x, irreducible polynomial $1F3_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $A8_x$ (FA_x, FB_x), ($C8_x$, $B2_x$, 32_x, 49_x).

Dual Cipher #125

Dual cipher by 84_x, primitive polynomial $1CF_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 2D_x$ (72_x, 73_x), ($B7_x$, 75_x, $C5_x$, 06_x).

Dual Cipher #126

Dual cipher by 85_x, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 38_x (74_x, 75_x), (DA_x, 73_x, AE_x, 06_x).

Dual Cipher #127

Dual cipher by 86_x, primitive polynomial $1F5_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&0&0&0&0 \\ 0&1&0&1&1&0&0&0 \\ 0&1&0&1&1&0&1&1 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&0&1&0&1&0 \\ 0&1&1&0&1&0&0&0 \\ 0&0&0&0&0&1&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&0&0&0&0 \\ 0&1&1&1&1&0&1&1 \\ 0&1&1&0&1&1&1&1 \\ 0&0&1&0&1&0&1&1 \\ 0&0&0&1&0&0&0&0 \\ 0&0&0&0&0&0&1&0 \\ 0&0&0&1&1&0&0&0 \\ 0&1&1&1&1&0&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&1&1&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&0&1&0&1&1&1&0 \\ 0&0&0&0&1&1&1&0 \\ 0&0&0&1&1&0&1&0 \\ 0&0&0&0&1&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&1&1&0&0&1&0 \\ 1&1&1&1&0&0&0&1 \\ 1&1&1&0&0&1&1&0 \\ 1&0&1&0&1&1&1&1 \\ 1&1&1&0&0&0&0&1 \\ 1&1&0&0&0&0&1&0 \\ 0&0&1&0&1&1&0&1 \\ 1&1&1&0&1&1&0&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 73_x ($A6_x$, $A7_x$), ($A1_x$, 27_x, 07_x, 80_x).

Dual Cipher #128

Dual cipher by 87_x, primitive polynomial $18D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 75_x$ (CA_x, CB_x), (CD_x, 34_x, 07_x, FF_x).

Dual Cipher #129

Dual cipher by 88_x, primitive polynomial $1CF_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 65_x ($A2_x$, $A3_x$), ($8B_x$, 75_x, 29_x, $D6_x$).

Dual Cipher #130

Dual cipher by 89_x, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 62_x$ (CF_x, CE_x), ($F2_x$, 73_x, $3D_x$, BD_x).

Dual Cipher #131

Dual cipher by $8A_x$, primitive polynomial $1CF_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&0&1&1&0&0&0&0 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&0 \\ 0&0&1&0&1&1&0&0 \\ 0&0&1&1&1&1&0&1 \\ 0&1&1&1&0&0&1&0 \\ 0&1&0&1&1&0&1&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&1&0&0&0&0 \\ 0&1&1&1&1&1&1&0 \\ 0&0&1&0&1&1&1&0 \\ 0&1&1&0&1&1&1&0 \\ 0&0&1&0&1&1&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&1&1&1&0&0 \\ 0&1&1&0&0&0&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&1&0 \\ 0&0&0&0&1&1&0&1 \\ 0&1&0&0&1&0&0&0 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&0&0&1&1 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&1&0&1&1 \\ 0&0&0&0&1&1&1&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&1&0&1 \\ 0&1&1&0&0&1&0&0 \\ 0&1&0&1&1&1&0&0 \\ 0&0&0&1&0&0&1&0 \\ 0&1&0&0&0&1&0&0 \\ 0&0&0&1&0&0&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&1&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&0&1&1&1&1&1 \\ 0&1&0&1&0&0&1&0 \\ 1&1&1&1&0&1&1&1 \\ 0&1&1&1&0&1&1&1 \\ 0&0&0&0&0&1&0&1 \\ 1&1&0&1&1&1&1&1 \\ 1&0&1&1&0&0&1&1 \\ 1&0&1&0&1&1&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 38_x$ (CD_x, CC_x), $(27_x, 98_x, EA_x, 54_x)$.

Dual Cipher #132

Dual cipher by $8B_x$, irreducible polynomial $1A3_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \end{pmatrix}$$

$$R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 2D_x$ ($A1_x$, $A0_x$), (34_x, $E1_x$, 95_x, 41_x).

Dual Cipher #133

Dual cipher by $8C_x$, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&0&1&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&1&1&1&1&1&1&0 \\ 0&0&1&0&1&1&1&1 \\ 0&1&0&0&1&1&1&0 \\ 0&1&1&1&0&1&0&0 \\ 0&0&1&0&0&0&1&1 \\ 0&1&0&0&0&1&1&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&1&1&0&1&1 \\ 0&0&1&1&0&1&1&1 \\ 0&1&0&1&1&0&0&1 \\ 0&1&1&1&0&0&0&1 \\ 0&0&0&0&1&0&0&1 \\ 0&0&0&1&1&0&1&1 \\ 0&0&1&0&1&1&0&1 \\ 0&1&1&1&0&1&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&0&1&1&0&1 \\ 0&0&1&0&1&0&0&0 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&0&1&1&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&0&0&0&0&1 \\ 0&0&1&1&0&0&0&0 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&1&0&0&1&0 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&0&0&0&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&0&1&1&1&1&1 \\ 0&0&1&0&0&0&1&0 \\ 0&0&1&0&0&1&1&1 \\ 0&0&0&0&0&0&0&1 \\ 0&1&1&1&1&0&1&1 \\ 1&0&1&1&1&1&0&1 \\ 1&0&0&0&0&0&0&1 \\ 1&1&1&1&0&1&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $D4_x$ $(B4_x, B5_x)$, $(91_x, 49_x, 25_x, FC_x)$.

Dual Cipher #134

Dual cipher by $8D_x$, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ BE_x ($D8_x$, $D9_x$), (EF_x, $5B_x$, 37_x, 82_x).

Dual Cipher #135

Dual cipher by $8E_x$, primitive polynomial $1F5_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&1&0&1&0&1 \\ 0&1&1&0&0&0&1&1 \\ 0&1&1&0&0&0&1&0 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&0&1&0&1&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&1&1&0&1&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&1&0&0&0 \\ 0&1&1&1&0&0&0&0 \\ 0&1&1&1&1&0&0&1 \\ 0&1&1&1&0&0&1&0 \\ 0&0&0&0&0&1&1&1 \\ 0&0&0&1&1&0&1&0 \\ 0&0&1&0&1&0&0&1 \\ 0&1&1&0&0&0&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&1&1&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&0&1&0&1&1&1&0 \\ 0&0&0&0&1&1&1&0 \\ 0&0&0&1&1&0&1&0 \\ 0&0&0&0&1&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&0&0&0&1&1&1&1 \\ 0&1&1&1&1&0&1&0 \\ 0&1&0&1&1&1&0&0 \\ 1&0&0&0&1&1&0&1 \\ 1&1&0&1&0&0&1&1 \\ 0&1&1&1&1&1&0&0 \\ 0&0&1&1&1&0&0&0 \\ 1&0&1&1&0&0&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 78_x$ (CE_x, CF_x), $(1E_x, 76_x, D0_x, B9_x)$.

Dual Cipher #136

Dual cipher by $8F_x$, primitive polynomial $18D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 78_x$ ($A3_x$, $A2_x$), (18_x, 71_x, BB_x, $D3_x$).

Dual Cipher #137

Dual cipher by 90_x, primitive polynomial $1E7_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 77_x ($C7_x$, $C6_x$), (12_x, FA_x, $D5_x$, $3C_x$).

Dual Cipher #138

Dual cipher by 91_x, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&1&0&1&1&1&0 \\ 0&0&1&1&1&0&0&0 \\ 0&1&0&1&1&1&0&1 \\ 0&1&1&1&0&1&0&0 \\ 0&0&1&1&0&1&0&0 \\ 0&1&1&1&0&1&1&0 \\ 0&0&0&0&0&1&0&0 \\ 0&1&0&1&0&0&1&0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1&1&0&0&0&0&1&1 \\ 0&0&0&1&1&0&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&0&0&0&1&1&0&1 \\ 0&1&0&0&1&0&1&0 \\ 0&0&0&0&0&0&1&0 \\ 0&0&0&1&0&1&0&0 \\ 0&1&1&1&1&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&0&1&1&1&0 \\ 0&0&1&0&1&1&0&1 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&1&0&1&1&0 \\ 0&0&0&0&1&1&0&1 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&0&0&1 \\ 0&0&1&0&0&0&0&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&1&0&1&0&1&0&0 \\ 0&0&0&1&0&1&0&1 \\ 0&0&0&0&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&1&1&0&0&0&0 \\ 1&0&0&0&0&0&1&0 \\ 1&1&1&1&0&0&0&1 \\ 1&1&1&1&0&0&1&1 \\ 0&1&0&0&0&0&1&1 \\ 1&0&1&0&0&1&0&1 \\ 0&1&0&1&1&0&1&0 \\ 0&1&0&0&1&0&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 70_x$ (AD_x, AC_x), $(12_x, 84_x, BF_x, 28_x)$.

Dual Cipher #139

Dual cipher by 92_x, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&1&0&1&1&1&0 \\ 0&0&0&0&1&1&0&0 \\ 0&1&0&0&0&1&0&1 \\ 0&1&1&0&0&1&1&1 \\ 0&1&0&0&1&1&0&0 \\ 0&0&1&1&1&1&1&1 \\ 0&1&1&0&0&0&1&1 \\ 0&1&1&0&0&0&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&1&1&1&0&0&0 \\ 0&1&0&0&1&0&0&0 \\ 0&0&1&1&0&0&1&1 \\ 0&0&0&0&1&1&1&0 \\ 0&1&0&1&0&0&1&0 \\ 0&0&0&1&0&0&1&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&1&1&1&0&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&1&0&1&0 \\ 0&1&0&0&0&0&1&1 \\ 0&0&0&0&0&1&0&1 \\ 0&0&1&0&0&0&0&1 \\ 0&0&0&0&1&1&0&0 \\ 0&0&0&1&0&1&0&0 \\ 0&0&0&0&1&0&0&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&0&0&1&0&1 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&1&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&1&1&0&1&0&0 \\ 1&0&1&0&1&0&1&0 \\ 1&0&0&1&1&0&0&1 \\ 0&1&0&1&1&1&0&1 \\ 0&0&1&1&0&0&0&1 \\ 1&1&1&0&1&1&1&0 \\ 0&1&1&0&1&0&0&0 \\ 0&0&0&1&0&1&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 8A_x$ (DD_x, DC_x), (FC_x, $C8_x$, 21_x, 14_x).

Dual Cipher #140

Dual cipher by 93_x, primitive polynomial $1CF_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $F3_x$ ($B0_x$, $B1_x$), (82_x, $A5_x$, 32_x, 14_x).

Dual Cipher #141

Dual cipher by 94_x, irreducible polynomial $19F_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 08_x$ ($3B_x$, $3A_x$), ($9B_x$, $A7_x$, $A0_x$, $9D_x$).

Dual Cipher #142

Dual cipher by 95_x, primitive polynomial $1E7_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 0F_x$ ($2F_x$, $2E_x$), ($E3_x$, CB_x, CC_x, $E5_x$).

Dual Cipher #143

Dual cipher by 96_x, primitive polynomial $1E7_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \to 55_x$ $(07_x, 06_x)$, $(6D_x, 7F_x, 6A_x, 79_x)$.

Dual Cipher #144

Dual cipher by 97_x, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,1\,1\,0\,0\,1 \\ 0\,1\,0\,1\,1\,0\,1\,1 \\ 0\,1\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,1\,0\,0\,1 \\ 0\,0\,1\,0\,0\,1\,1\,1 \\ 0\,0\,0\,1\,0\,0\,0\,0 \\ 0\,0\,0\,1\,0\,0\,1\,0 \\ 0\,0\,0\,0\,1\,1\,1\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,1\,0\,0\,1\,1\,1\,1 \\ 0\,1\,0\,1\,0\,1\,1\,0 \\ 0\,1\,1\,1\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,1\,1\,1\,1\,0\,0\,0 \\ 0\,0\,0\,1\,0\,0\,1\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,1\,1\,0\,1\,1\,0\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,1\,0\,1\,1 \\ 0\,1\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,1\,0 \\ 0\,0\,0\,0\,1\,1\,0\,1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,1\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,1\,1 \\ 0\,1\,0\,1\,0\,0\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,0\,0\,1\,0\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,0\,1\,0\,1\,0\,0\,1 \\ 1\,1\,1\,0\,1\,0\,0\,1 \\ 1\,0\,1\,1\,1\,0\,1\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 1\,1\,0\,1\,0\,1\,1\,1 \\ 1\,0\,0\,0\,0\,0\,0\,0 \\ 1\,0\,0\,1\,1\,0\,0\,0 \\ 1\,1\,0\,0\,0\,0\,0\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 40_x $(07_x, 06_x)$, $(6D_x, 7F_x, 6A_x, 79_x)$.

Dual Cipher #145

Dual cipher by 98_x, primitive polynomial $1C3_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,0\,1\,0\,0\,0\,1\,0 \\ 0\,0\,0\,1\,1\,1\,0\,0 \\ 0\,1\,0\,1\,1\,0\,0\,0 \\ 0\,1\,1\,0\,0\,0\,0\,0 \\ 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,0\,0\,0\,1\,1\,1\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,1\,1\,0\,1\,1\,1 \\ 0\,0\,0\,0\,0\,0\,1\,0 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,1\,0\,0\,0\,0\,0\,1 \\ 0\,1\,0\,0\,1\,0\,1\,1 \\ 0\,0\,0\,1\,1\,0\,1\,0 \\ 0\,0\,1\,0\,0\,1\,1\,0 \\ 0\,1\,1\,1\,0\,1\,1\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,1\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,1\,0\,0\,0\,0\,1\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,0\,0\,1\,1\,0\,1\,1 \\ 0\,0\,0\,0\,1\,1\,0\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,1\,0\,0\,0\,0 \\ 0\,0\,1\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,1\,0\,1\,0\,0\,1\,0 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,1\,1\,1\,0\,0\,1\,0 \\ 0\,1\,0\,1\,1\,0\,0\,1 \\ 1\,1\,0\,1\,0\,0\,1\,1 \\ 0\,0\,1\,0\,1\,0\,0\,1 \\ 1\,1\,0\,0\,0\,0\,1\,0 \\ 0\,0\,0\,1\,1\,1\,0\,0 \\ 1\,1\,1\,1\,1\,1\,1\,1 \\ 1\,1\,0\,1\,1\,1\,0\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $7D_x$ (70_x, 71_x), ($6A_x$, $3E_x$, $1A_x$, $4F_x$).

Dual Cipher #146

Dual cipher by 99_x, primitive polynomial $1A9_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $7C_x$ (77_x, 76_x), ($6A_x$, $2B_x$, $1D_x$, $5D_x$).

Dual Cipher #147

Dual cipher by $9A_x$, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $C5_x$ (25_x, 24_x), (96_x, $7F_x$, $B3_x$, $5B_x$).

Dual Cipher #148

Dual cipher by $9B_x$, primitive polynomial $1E7_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ AE_x (37_x, 36_x), ($E8_x$, $7F_x$, DF_x, 49_x).

Dual Cipher #149

Dual cipher by $9C_x$, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a
matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x,$
$09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as
follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 81_x$ $(E9_x, E8_x)$, $(D3_x, AC_x, 3A_x, 44_x)$.

Dual Cipher #150

Dual cipher by $9D_x$, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ FE_x $(97_x, 96_x)$, $(B9_x, C6_x, 2E_x, 50_x)$.

Dual Cipher #151

Dual cipher by $9E_x$, irreducible polynomial $18B_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 1 0 0 \\ 0 0 0 1 1 0 0 1 \\ 0 1 1 0 1 0 0 1 \\ 0 1 0 1 1 1 0 1 \\ 0 1 0 1 1 0 0 1 \\ 0 1 0 0 1 0 1 0 \\ 0 0 0 0 1 1 0 1 \\ 0 1 1 1 1 1 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 0 1 0 0 1 \\ 0 1 0 0 1 0 0 0 \\ 0 1 1 1 0 0 1 0 \\ 0 1 0 1 1 0 1 0 \\ 0 1 1 1 1 0 0 1 \\ 0 0 0 1 1 0 0 0 \\ 0 0 1 1 0 1 0 1 \\ 0 1 1 0 0 0 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 1 1 \\ 0 0 0 0 1 0 0 1 \\ 0 1 0 0 0 0 0 1 \\ 0 0 0 0 1 0 1 1 \\ 0 0 1 0 0 1 1 0 \\ 0 0 0 0 0 1 0 1 \\ 0 0 0 1 0 0 1 1 \\ 0 0 0 0 1 1 0 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 1 0 0 0 1 \\ 0 1 1 0 0 1 0 1 \\ 0 0 0 1 1 0 0 1 \\ 0 0 0 1 0 1 1 1 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 0 0 0 0 1 \\ 0 1 0 1 0 0 0 0 \\ 0 1 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 0 0 0 0 0 0 0 \\ 0 1 1 1 0 1 1 1 \\ 1 0 1 1 0 1 1 1 \\ 1 1 0 1 1 0 0 1 \\ 1 1 0 1 1 0 0 0 \\ 0 1 1 0 0 0 1 1 \\ 1 1 0 1 1 1 0 0 \\ 0 1 1 1 0 0 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 55_x$ (BD_x, BC_x), $(26_x, 1F_x, 9B_x, A3_x)$.

Dual Cipher #152

Dual cipher by $9F_x$, irreducible polynomial $1F3_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 40_x ($D6_x$, $D7_x$), (35_x, 19_x, $E3_x$, CE_x).

Dual Cipher #153

Dual cipher by $A0_x$, primitive polynomial 171_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 1 & 1 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 54_x$ ($5D_x$, $5C_x$), ($F7_x$, BC_x, AA_x, $E0_x$).

Dual Cipher #154

Dual cipher by $A1_x$, irreducible polynomial 177_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 41_x$ $(4F_x, 4E_x)$, $(8F_x, D7_x, C0_x, 99_x)$.

Dual Cipher #155

Dual cipher by $A2_x$, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 28_x (FC_x, FD_x), (CD_x, 79_x, 31_x, 84_x).

Dual Cipher #156

Dual cipher by $A3_x$, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
1 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 3C_x$ (82_x, 83_x), ($A1_x$, 79_x, 23_x, FA_x).

Dual Cipher #157

Dual cipher by $A4_x$, primitive polynomial 163_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&1&1&1&0&1 \\ 0&1&1&0&1&0&0&0 \\ 0&1&1&0&0&1&0&0 \\ 0&1&1&1&1&0&1&1 \\ 0&1&0&0&1&0&1&0 \\ 0&0&1&0&1&1&0&0 \\ 0&1&0&1&0&0&1&0 \\ 0&0&0&0&1&1&0&1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1&0&0&1&1&1&0&0 \\ 0&0&1&1&0&0&1&1 \\ 0&1&1&0&0&1&0&0 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&1&0&1&1&1 \\ 0&1&1&1&0&1&1&1 \\ 0&0&1&0&1&1&0&0 \\ 0&1&1&0&0&0&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&1&1&0&0 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&0&1&1&0 \\ 0&0&1&0&0&0&1&0 \\ 0&0&0&0&1&1&0&1 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&0&0&1&0&0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&0&0&1&1&0 \\ 0&1&0&0&0&0&0&1 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&1&0&0&0&1 \\ 0&1&0&0&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&0&1&1&1&0&1 \\ 1&1&0&1&0&0&1&0 \\ 0&0&1&1&1&0&0&1 \\ 0&1&1&0&0&0&0&0 \\ 0&1&1&0&0&0&0&1 \\ 0&1&1&0&1&1&0&1 \\ 0&0&0&1&0&1&1&1 \\ 1&1&0&1&1&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $A2_x$ ($5E_x$, $5F_x$), (16_x, 66_x, 48_x, 39_x).

Dual Cipher #158

Dual cipher by $A5_x$, primitive polynomial 165_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow CF_x$ ($4D_x$, $4C_x$), (17_x, 60_x, $5A_x$, $2C_x$).

Dual Cipher #159

Dual cipher by $A6_x$, primitive polynomial $15F_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $A1_x$ (81_x, 80_x), ($C3_x$, CD_x, 42_x, $4D_x$).

Dual Cipher #160

Dual cipher by $A7_x$, primitive polynomial $14D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow CD_x$ (FE_x, FF_x), $(A8_x, A1_x, 56_x, 5E_x)$.

Dual Cipher #161

Dual cipher by $A8_x$, irreducible polynomial $13F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $1A_x$ ($F3_x$, $F2_x$), (90_x, AE_x, 63_x, $5C_x$).

Dual Cipher #162

Dual cipher by $A9_x$, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&1&0&1&1&1 \\ 0&1&0&0&0&0&1&1 \\ 0&0&0&1&0&1&0&0 \\ 0&1&0&0&1&1&1&1 \\ 0&0&0&0&0&0&1&0 \\ 0&0&1&1&0&0&0&1 \\ 0&0&0&1&1&1&1&0 \\ 0&1&1&0&0&1&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&1&0&1&1&0 \\ 0&0&1&0&0&1&0&1 \\ 0&0&1&1&0&0&1&1 \\ 0&1&0&1&1&0&1&0 \\ 0&0&1&0&1&0&1&0 \\ 0&1&1&1&1&0&1&0 \\ 0&0&0&0&1&0&0&0 \\ 0&1&1&0&1&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&1&0&1&0 \\ 0&1&0&0&0&1&1&1 \\ 0&0&0&0&1&1&0&0 \\ 0&0&1&0&0&0&0&0 \\ 0&0&0&0&1&1&1&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&0&1&1&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&1&0&0 \\ 0&0&1&0&0&0&0&1 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&1&0&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&0&1&0&0&1&1 \\ 1&0&0&1&0&0&1&0 \\ 1&1&0&0&1&0&1&1 \\ 0&0&0&1&1&1&1&0 \\ 0&0&1&1&0&0&0&1 \\ 0&0&1&1&1&1&0&1 \\ 0&1&1&0&1&0&1&0 \\ 0&0&1&1&1&0&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $1D_x$ ($8A_x$, $8B_x$), (EE_x, $C5_x$, 64_x, $4E_x$).

Dual Cipher #163

Dual cipher by AA_x, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,1\,1\,0\,0\,0 \\ 0\,1\,1\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,1\,1 \\ 0\,0\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,1\,1\,0\,1\,1 \\ 0\,1\,1\,1\,1\,0\,1\,0 \\ 0\,1\,0\,1\,1\,0\,1\,0 \\ 0\,0\,0\,1\,1\,1\,0\,0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,0\,1\,1\,0\,1\,1 \\ 0\,1\,1\,1\,0\,0\,1\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,1\,0\,1\,1\,0\,1\,0 \\ 0\,0\,1\,1\,0\,1\,0\,0 \\ 0\,1\,1\,0\,1\,1\,1\,1 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,1\,1\,1\,1\,0\,0\,1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,1\,0\,0\,1\,1\,0\,0 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,0\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,1\,0\,1 \\ 0\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1\,0\,0\,0\,0\,0\,1\,0 \\ 1\,1\,0\,1\,0\,0\,0\,0 \\ 0\,0\,1\,0\,0\,1\,1\,1 \\ 1\,0\,0\,1\,1\,0\,1\,1 \\ 0\,0\,1\,1\,0\,0\,1\,0 \\ 0\,0\,1\,1\,1\,1\,0\,0 \\ 1\,0\,1\,1\,0\,1\,0\,0 \\ 0\,0\,1\,1\,1\,0\,0\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 9C_x$ (67_x, 66_x), (91_x, DD_x, $F6_x$, BB_x).

Dual Cipher #164

Dual cipher by AB_x, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&0&1&1&0&0&1 \\ 0&0&1&1&0&1&1&1 \\ 0&0&1&1&0&1&0&0 \\ 0&0&1&1&1&0&0&1 \\ 0&0&1&0&0&1&1&1 \\ 0&1&1&0&0&1&1&0 \\ 0&1&0&0&0&1&1&0 \\ 0&0&0&1&1&1&0&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&0&0&0&1&1 \\ 0&1&1&1&0&1&0&1 \\ 0&0&0&0&0&1&1&0 \\ 0&1&0&0&1&0&0&0 \\ 0&0&1&0&0&1&1&1 \\ 0&1&1&0&1&1&1&0 \\ 0&0&0&1&1&0&0&1 \\ 0&1&1&1&1&0&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&1&1 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&1&0&1&0 \\ 0&0&1&0&1&0&1&0 \\ 0&0&0&0&1&1&0&1 \\ 0&0&0&1&0&1&1&0 \\ 0&0&0&0&0&1&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&1&0&1 \\ 0&1&1&0&0&0&0&1 \\ 0&0&0&1&1&0&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&1&0&1&0&0 \\ 0&1&0&1&0&1&0&1 \\ 0&0&0&1&0&1&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&1&0&1&1&0&1 \\ 0&1&0&1&1&1&0&0 \\ 0&0&1&0&0&0&1&1 \\ 1&1&0&0&1&1&1&1 \\ 1&1&1&1&1&1&0&1 \\ 0&0&0&0&0&1&0&0 \\ 1&1&1&1&0&1&0&0 \\ 0&0&1&0&1&1&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $E4_x$ (61_x, 60_x), (EF_x, $B0_x$, $8E_x$, $D0_x$).

Dual Cipher #165

Dual cipher by AC_x, primitive polynomial $15F_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ AC_x ($8F_x$, $8E_x$), (07_x, 53_x, 88_x, DD_x).

Dual Cipher #166

Dual cipher by AD_x, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&1&1&0&1&1&1&1 \\ 0&1&1&0&1&0&0&1 \\ 0&0&0&0&1&0&0&0 \\ 0&1&1&1&1&1&0&1 \\ 0&1&1&1&0&0&1&0 \\ 0&1&0&1&0&0&0&1 \\ 0&1&1&1&0&1&1&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&1&1&1&1&0 \\ 0&0&1&0&1&1&1&1 \\ 0&1&1&0&0&0&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&0&0&0 \\ 0&1&1&1&1&0&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&1&1&1&1&1&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&0&0&0&1 \\ 0&1&0&0&1&0&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&0&0&1&1&1&0&0 \\ 0&0&0&0&0&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&1 \\ 0&1&0&1&0&0&1&1 \\ 0&0&0&1&0&1&0&0 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&0&0&0&1 \\ 0&1&0&0&0&0&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&1&0&0&0&0&0 \\ 1&0&0&0&0&0&1&0 \\ 1&0&1&1&0&1&0&0 \\ 1&1&1&1&0&0&1&1 \\ 0&1&0&1&1&1&1&1 \\ 1&1&0&0&0&1&1&1 \\ 0&0&0&0&1&1&1&1 \\ 1&1&1&0&1&1&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $C6_x$ $(F7_x, F6_x)$, $(07_x, 46_x, F0_x, B0_x)$.

Dual Cipher #167

Dual cipher by AE_x, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,1 \\ 0\,0\,1\,0\,1\,0\,1\,0 \\ 0\,0\,0\,1\,1\,1\,0\,0 \\ 0\,1\,1\,1\,0\,1\,0\,0 \\ 0\,0\,0\,0\,0\,0\,1\,0 \\ 0\,0\,1\,1\,1\,1\,1\,1 \\ 0\,1\,1\,1\,0\,0\,0\,1 \\ 0\,0\,1\,1\,0\,1\,0\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,0\,1\,0\,1\,1\,1 \\ 0\,1\,1\,1\,1\,0\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,1\,1\,0 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,1\,1\,1\,1\,0\,1\,1 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 0\,1\,1\,0\,1\,0\,0\,1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,0\,0 \\ 0\,0\,0\,0\,1\,1\,1\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,1\,0\,1\,1 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,0\,0\,1\,1\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,0\,0\,0\,0\,1\,0\,1 \\ 0\,1\,1\,0\,0\,1\,0\,0 \\ 0\,0\,0\,1\,1\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,1\,1 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,0\,0\,0 \\ 0\,1\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,1\,0\,1\,0\,1\,1\,1 \\ 0\,1\,1\,1\,1\,0\,0\,1 \\ 1\,0\,1\,1\,0\,1\,1\,0 \\ 0\,1\,1\,0\,1\,1\,0\,1 \\ 1\,0\,0\,1\,1\,1\,1\,0 \\ 1\,1\,1\,0\,1\,0\,1\,0 \\ 0\,0\,0\,0\,0\,0\,1\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $D7_x$ (48_x, 49_x), ($A5_x$, 07_x, ED_x, $4E_x$).

Dual Cipher #168

Dual cipher by AF_x, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ BC_x ($5A_x$, $5B_x$), ($C8_x$, 07_x, 92_x, $5C_x$).

Dual Cipher #169

Dual cipher by $B2_x$, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 33_x$ $(87_x, 86_x)$, $(DA_x, 3A_x, 5D_x, BC_x)$.

Dual Cipher #170

Dual cipher by $B3_x$, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

$$R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 20_x$ $(F8_x, F9_x)$, $(B7_x, 2E_x, 4F_x, D7_x)$.

Dual Cipher #171

Dual cipher by $B4_x$, primitive polynomial 171_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow C1_x$ $(3C_x, 3D_x)$, $(E4_x, 4C_x, D8_x, 71_x)$.

Dual Cipher #172

Dual cipher by $B5_x$, irreducible polynomial 177_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ AB_x (28_x, 29_x), ($9C_x$, $5F_x$, $B4_x$, 76_x).

Dual Cipher #173

Dual cipher by $B6_x$, irreducible polynomial $13F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 0 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $C5_x$ ($E2_x$, $E3_x$), (97_x, 86_x, 75_x, 65_x).

Dual Cipher #174

Dual cipher by $B7_x$, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ AE_x $(9A_x, 9B_x)$, $(E9_x, F9_x, 73_x, 62_x)$.

Dual Cipher #175

Dual cipher by $B8_x$, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&1&1&1&0&1&1&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&1&0&1&0&0&1 \\ 0&1&1&0&1&1&0&0 \\ 0&1&0&1&0&1&0&0 \\ 0&0&0&0&0&1&1&1 \\ 0&1&0&1&0&0&0&1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1&0&1&0&1&0&1&0 \\ 0&0&0&1&1&1&0&1 \\ 0&0&1&1&1&0&0&0 \\ 0&1&1&0&0&1&1&1 \\ 0&1&0&1&0&0&1&1 \\ 0&1&1&1&1&1&1&0 \\ 0&0&0&0&0&1&1&1 \\ 0&1&1&1&1&0&1&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&0&0&0&1 \\ 0&1&0&0&1&0&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&0&0&1&1&1&0&0 \\ 0&0&0&0&0&0&1&0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&1&1&1&0&1&0&0 \\ 0&0&0&0&1&1&0&1 \\ 0&1&0&1&0&0&1&1 \\ 0&0&0&1&0&1&0&0 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&0&0&0&1 \\ 0&1&0&0&0&0&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&0&1&1&0&1&0 \\ 1&1&1&1&1&0&0&1 \\ 0&0&0&1&1&1&1&1 \\ 0&1&1&1&1&1&1&0 \\ 1&0&0&1&0&0&1&0 \\ 0&1&0&0&1&0&0&1 \\ 0&0&1&0&1&1&0&0 \\ 0&0&0&1&0&0&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 83_x $(B6_x, B7_x)$, $(15_x, BD_x, A3_x, 0A_x)$.

Dual Cipher #176

Dual cipher by $B9_x$, primitive polynomial $15F_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow FD_x$ (DB_x, DA_x), $(15_x, D6_x, CE_x, 0C_x)$.

Dual Cipher #177

Dual cipher by BA_x, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 7A_x$ ($A1_x$, $A0_x$), (FB_x, 12_x, $5A_x$, $B2_x$).

Dual Cipher #178

Dual cipher by BB_x, irreducible polynomial $13F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 7B_x$ (CD_x, CC_x), $(85_x, 12_x, 48_x, DE_x)$.

Dual Cipher #179

Dual cipher by BE_x, primitive polynomial $15F_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 2F_x$ $(18_x, 19_x)$, $(4E_x, 49_x, 56_x, 50_x)$.

Dual Cipher #180

Dual cipher by BF_x, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 3B_x$ $(1E_x, 1F_x)$, $(5C_x, 5B_x, 42_x, 44_x)$.

Dual Cipher #181

Dual cipher by $C0_x$, primitive polynomial $1A9_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&1&0&1&0&0 \\ 0&1&1&1&1&1&0&1 \\ 0&1&1&0&1&0&1&1 \\ 0&1&0&1&0&0&1&1 \\ 0&1&1&0&1&1&1&1 \\ 0&1&1&1&1&1&0&0 \\ 0&1&1&0&0&0&0&0 \\ 0&0&0&1&0&0&0&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&1&1&0&1&1&1 \\ 0&0&0&1&1&1&0&0 \\ 0&0&0&1&1&1&1&0 \\ 0&0&0&0&0&0&0&1 \\ 0&0&1&0&1&1&1&1 \\ 0&0&1&0&1&0&0&0 \\ 0&1&0&0&1&0&0&1 \\ 0&1&0&0&0&1&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&1&1&1 \\ 0&0&0&0&1&1&0&0 \\ 0&0&1&0&0&1&1&0 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&1&0&1&1&0 \\ 0&0&0&0&1&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&1&0&1&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&0&1&0&0 \\ 0&0&0&1&0&1&0&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&1&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&1&1&0&0&0&1 \\ 0&1&0&1&0&0&1&0 \\ 1&1&1&1&0&1&1&1 \\ 0&0&1&0&0&1&0&0 \\ 1&1&1&1&0&0&1&1 \\ 0&1&0&1&1&0&0&1 \\ 0&0&1&1&0&1&1&0 \\ 1&1&1&1&0&0&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 50_x$ $(7E_x, 7F_x)$, $(D4_x, DD_x, AA_x, A2_x)$.

Dual Cipher #182

Dual cipher by $C1_x$, primitive polynomial $1C3_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 44_x ($7E_x$, $7F_x$), (BE_x, $B0_x$, $C0_x$, CF_x).

Dual Cipher #183

Dual cipher by $C2_x$, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 79_x$ ($C9_x$, $C8_x$), ($3A_x$, $9B_x$, $F3_x$, 53_x).

Dual Cipher #184

Dual cipher by $C3_x$, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 79_x $(A4_x, A5_x)$, $(2E_x, E3_x, 8A_x, 46_x)$.

Dual Cipher #185

Dual cipher by $C4_x$, primitive polynomial $1E7_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 41_x ($9B_x$, $9A_x$), (67_x, CB_x, FC_x, 51_x).

Dual Cipher #186

Dual cipher by $C5_x$, irreducible polynomial $19F_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 54_x ($E3_x$, $E2_x$), (61_x, $A7_x$, 82_x, 45_x).

Dual Cipher #187

Dual cipher by $C6_x$, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,1\,1\,1\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,0\,1\,1\,0\,1\,1\,0 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,1\,1\,0\,0\,1\,0\,0 \\ 0\,1\,0\,1\,1\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,1\,0\,1\,1\,1\,0 \\ 0\,1\,0\,0\,0\,1\,1\,1 \\ 0\,1\,1\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,0\,0\,0\,1\,0\,0\,1 \\ 0\,0\,1\,0\,1\,0\,1\,1 \\ 0\,1\,0\,1\,1\,0\,0\,1 \\ 0\,1\,0\,0\,0\,1\,1\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,1\,0 \\ 0\,0\,0\,0\,0\,0\,1\,0 \\ 0\,0\,1\,0\,1\,1\,1\,0 \\ 0\,0\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,1\,0\,0\,1\,1 \\ 0\,0\,0\,0\,1\,0\,0\,1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,0\,0\,1 \\ 0\,1\,1\,1\,0\,0\,0\,0 \\ 0\,1\,0\,1\,1\,1\,0\,0 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \\ 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,0\,0\,1\,0\,0\,0\,0 \\ 0\,0\,0\,0\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,0\,1\,1\,1\,0\,1\,0 \\ 1\,1\,0\,1\,0\,1\,1\,0 \\ 0\,0\,1\,0\,0\,0\,0\,0 \\ 0\,1\,0\,0\,1\,1\,0\,1 \\ 0\,1\,1\,0\,1\,0\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,0 \\ 1\,0\,1\,0\,0\,1\,0\,1 \\ 1\,1\,1\,0\,1\,0\,1\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow D3_x$ ($F4_x$, $F5_x$), (BB_x, 64_x, $4F_x$, 91_x).

Dual Cipher #188

Dual cipher by $C7_x$, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $B9_x$ $(8D_x, 8C_x)$, $(D0_x, 63_x, 5D_x, EF_x)$.

Dual Cipher #189

Dual cipher by $C8_x$, primitive polynomial $1A9_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 90_x $(46_x, 47_x)$, $(AC_x, 2B_x, EA_x, 6C_x)$.

Dual Cipher #190

Dual cipher by $C9_x$, primitive polynomial $1C3_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ EE_x (53_x, 52_x), ($C6_x$, $3E_x$, 95_x, $6C_x$).

Dual Cipher #191

Dual cipher by CA_x, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \\ 0 1 1 1 1 0 1 1 \\ 0 0 0 0 1 1 0 0 \\ 0 0 1 1 0 1 0 1 \\ 0 1 1 0 1 1 1 0 \\ 0 0 0 1 1 1 0 1 \\ 0 1 1 1 0 1 0 0 \end{pmatrix}$$
$$R^{-1} = \begin{pmatrix} 1 0 1 1 1 1 1 1 \\ 0 1 0 1 0 0 1 0 \\ 0 0 1 0 1 1 0 0 \\ 0 1 0 0 1 0 0 1 \\ 0 0 1 0 0 1 1 0 \\ 0 0 1 1 0 1 1 0 \\ 0 1 1 0 1 0 1 0 \\ 0 1 0 1 1 0 1 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 1 \\ 0 0 0 0 0 1 1 1 \\ 0 1 0 0 1 1 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 0 1 0 1 0 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 0 0 1 1 1 0 1 \\ 0 0 0 0 1 1 1 0 \end{pmatrix}$$
$$Q^{-1} = \begin{pmatrix} 1 1 0 0 0 0 0 1 \\ 0 0 1 1 0 0 0 0 \\ 0 1 0 0 1 1 0 1 \\ 0 0 0 1 0 0 1 0 \\ 0 1 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 1 0 1 0 1 \\ 0 0 0 0 0 1 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 1 1 1 0 1 1 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 1 0 0 0 0 \\ 1 0 0 0 1 0 0 1 \\ 0 1 1 0 1 1 0 0 \\ 1 0 0 0 1 1 0 0 \\ 0 0 1 1 0 0 1 0 \\ 1 1 1 0 1 1 1 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 7B_x$ ($A7_x$, $A6_x$), (70_x, 63_x, $D7_x$, $C5_x$).

Dual Cipher #192

Dual cipher by CB_x, irreducible polynomial $1B1_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\
1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 7A_x$ (CB_x, CA_x), (77_x, 64_x, BC_x, AE_x).

Dual Cipher #193

Dual cipher by CC_x, irreducible polynomial $1B1_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 56_x (52_x, 53_x), (13_x, $A8_x$, 41_x, FB_x).

Dual Cipher #194

Dual cipher by CD_x, irreducible polynomial $1DD_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&1&1&1&0&0&1 \\ 0&1&1&0&1&1&1&1 \\ 0&1&1&1&1&0&1&1 \\ 0&0&0&0&0&1&1&1 \\ 0&0&1&1&0&0&0&0 \\ 0&0&0&0&1&0&0&0 \\ 0&1&0&1&0&1&1&0 \\ 0&0&1&0&1&0&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&0&1&1&1&0&1 \\ 0&0&0&1&1&1&1&1 \\ 0&1&0&0&1&0&1&1 \\ 0&1&0&0&0&0&1&1 \\ 0&0&0&0&0&1&0&0 \\ 0&0&1&0&0&0&1&1 \\ 0&1&1&1&1&1&0&1 \\ 0&1&0&0&1&1&1&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&0&1&1&1 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&0&1&1&0&1 \\ 0&0&1&0&1&0&0&0 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&1&1&1&0&1 \\ 0&0&0&0&1&1&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&0&0&0&0&1 \\ 0&0&1&1&0&0&0&0 \\ 0&1&0&0&1&1&0&1 \\ 0&0&0&1&0&0&1&0 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&0&0&0&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&1&1&1&1&0&0 \\ 1&0&0&1&0&0&1&1 \\ 0&0&1&0&0&1&1&1 \\ 0&0&1&1&0&1&0&1 \\ 0&0&1&1&1&1&1&0 \\ 1&1&0&0&1&1&1&0 \\ 0&0&1&1&0&1&0&0 \\ 0&0&1&0&0&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 42_x (47_x, 46_x), (13_x, $C3_x$, 54_x, 85_x).

Dual Cipher #195

Dual cipher by CE_x, primitive polynomial $1F5_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 0 0 1 0 \\ 0 1 1 0 1 1 0 1 \\ 0 0 1 1 1 0 0 0 \\ 0 0 1 0 0 1 0 1 \\ 0 1 0 1 0 1 1 1 \\ 0 1 0 1 1 0 0 0 \\ 0 0 1 0 0 0 1 0 \\ 0 0 1 1 1 0 1 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 1 0 0 1 1 0 \\ 0 1 0 0 1 1 1 0 \\ 0 1 1 0 1 0 1 0 \\ 0 1 0 1 0 1 0 0 \\ 0 0 0 1 1 1 1 0 \\ 0 0 1 1 0 0 1 1 \\ 0 1 1 0 1 0 0 0 \\ 0 1 0 0 1 0 0 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 0 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 0 0 1 1 1 \\ 0 0 1 0 1 1 1 0 \\ 0 0 0 0 1 1 1 0 \\ 0 0 0 1 1 0 1 0 \\ 0 0 0 0 1 0 1 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 1 0 0 0 1 \\ 0 1 1 1 0 1 0 0 \\ 0 0 0 0 1 1 0 0 \\ 0 0 0 0 0 0 1 1 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 0 \\ 0 1 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 1 0 1 0 1 1 \\ 1 0 0 1 0 1 0 0 \\ 1 1 1 1 0 1 0 0 \\ 1 0 1 0 0 1 1 0 \\ 0 0 0 1 1 0 1 1 \\ 1 0 1 0 1 1 0 1 \\ 1 1 0 1 1 0 0 0 \\ 1 1 0 1 0 1 1 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $F9_x$ $(33_x, 32_x)$, $(86_x, 7B_x, B5_x, 49_x)$.

Dual Cipher #196

Dual cipher by CF_x, primitive polynomial $18D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 1 & 1 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 86_x (20_x, 21_x), ($F9_x$, $7A_x$, $D9_x$, $5B_x$).

Dual Cipher #197

Dual cipher by $D0_x$, primitive polynomial 187_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&1&0&1&1&1 \\ 0&0&1&1&0&1&1&0 \\ 0&1&1&1&0&1&1&1 \\ 0&0&0&1&1&1&1&0 \\ 0&1&1&0&0&1&0&0 \\ 0&0&0&0&1&0&1&0 \\ 0&0&0&0&1&0&0&1 \\ 0&0&1&1&1&1&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&0&1&0&1 \\ 0&0&1&0&0&1&0&1 \\ 0&0&0&1&0&1&1&1 \\ 0&0&1&0&1&1&1&0 \\ 0&1&0&0&0&1&1&1 \\ 0&0&1&1&1&0&1&0 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&1&1&1&0 \\ 0&0&0&0&0&0&1&1 \\ 0&0&1&0&0&1&1&1 \\ 0&0&0&0&0&0&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&1&1&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&0&0&1 \\ 0&0&1&0&0&0&0&1 \\ 0&1&0&0&1&0&0&1 \\ 0&0&0&1&0&0&1&0 \\ 0&1&0&0&0&1&0&0 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&1&0&0 \\ 0&0&0&0&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&1&0&0&0&0&0 \\ 0&0&0&0&1&0&1&1 \\ 1&1&0&0&0&0&1&0 \\ 0&1&1&0&0&1&0&0 \\ 0&1&0&0&1&1&0&0 \\ 1&1&0&1&1&0&0&1 \\ 1&0&0&0&1&0&1&1 \\ 1&0&0&0&0&1&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $A5_x$ $(14_x, 15_x)$, $(9A_x, 19_x, 8E_x, 0C_x)$.

Dual Cipher #198

Dual cipher by $D1_x$, irreducible polynomial $1F9_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
1 & 1 & 1 & 1 & 1 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → $C8_x$ $(14_x, 15_x)$, $(E2_x, 1F_x, F6_x, 0A_x)$.

Dual Cipher #199

Dual cipher by $D2_x$, irreducible polynomial $1BD_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 94_x$ ($1D_x$, $1C_x$), (41_x, $B0_x$, $5C_x$, AC_x).

Dual Cipher #200

Dual cipher by $D3_x$, irreducible polynomial $1D7_x$, minimal generator 07_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&1&1&1&1&1 \\ 0&1&1&1&0&1&1&1 \\ 0&0&0&1&1&0&0&1 \\ 0&1&0&1&1&0&0&0 \\ 0&1&1&0&1&0&1&1 \\ 0&0&0&0&0&0&1&1 \\ 0&0&0&1&0&1&0&0 \\ 0&0&1&0&1&1&0&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&0&1&1&1&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&1&0&0&0&1&1 \\ 0&0&1&1&1&1&1&1 \\ 0&1&0&0&1&0&1&0 \\ 0&0&1&1&1&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&1&0&1&0&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&1&1&1&1 \\ 0&1&0&0&1&0&1&1 \\ 0&0&0&0&0&0&0&1 \\ 0&0&1&0&1&1&0&0 \\ 0&0&0&0&0&1&1&0 \\ 0&0&0&1&1&1&1&1 \\ 0&0&0&0&1&1&0&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&0&0&1&0&0 \\ 0&0&1&1&0&1&0&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&0&0&0&1&0 \\ 0&1&0&1&0&1&0&0 \\ 0&1&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&0&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&1&0&1&0&1&1&0 \\ 1&0&1&0&0&1&0&1 \\ 0&1&0&1&0&0&1&1 \\ 1&0&1&0&1&1&0&0 \\ 1&0&1&1&0&1&0&0 \\ 0&1&1&1&0&1&1&0 \\ 1&1&0&0&1&1&0&1 \\ 0&0&1&1&0&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ EB_x ($1A_x$, $1B_x$), (54_x, DD_x, $4E_x$, $C6_x$).

Dual Cipher #201

Dual cipher by $D4_x$, irreducible polynomial $1F3_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\
1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 08_x ($6E_x$, $6F_x$), ($7A_x$, $C2_x$, 14_x, AD_x).

Dual Cipher #202

Dual cipher by $D5_x$, irreducible polynomial $18B_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $0F_x$ ($6F_x$, $6E_x$), ($7B_x$, $A9_x$, 14_x, $C7_x$).

Dual Cipher #203

Dual cipher by $D6_x$, primitive polynomial $1F5_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 0 0 0 1 1 1 0 \\ 0 1 0 1 1 1 0 1 \\ 0 0 0 1 0 0 0 0 \\ 0 1 0 0 0 1 1 0 \\ 0 0 1 1 1 1 1 1 \\ 0 1 1 0 1 1 0 1 \\ 0 0 1 1 0 0 0 1 \\ 0 1 0 0 0 1 0 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 0 0 1 0 1 0 \\ 0 1 1 1 1 0 1 1 \\ 0 1 1 0 0 1 0 0 \\ 0 0 1 0 0 0 0 0 \\ 0 1 1 0 0 0 0 1 \\ 0 0 1 1 1 1 0 0 \\ 0 1 0 1 0 1 1 1 \\ 0 1 0 0 0 1 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 0 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 0 0 1 1 1 \\ 0 0 1 0 1 1 1 0 \\ 0 0 0 0 1 1 1 0 \\ 0 0 0 1 1 0 1 0 \\ 0 0 0 0 1 0 1 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 1 0 0 0 1 \\ 0 1 1 1 0 1 0 0 \\ 0 0 0 0 1 1 0 0 \\ 0 0 0 0 0 0 1 1 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 0 \\ 0 1 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 1 1 1 1 1 0 \\ 1 1 1 1 0 1 0 1 \\ 1 1 1 1 0 0 1 1 \\ 1 1 1 1 0 0 0 0 \\ 1 1 1 0 0 0 1 1 \\ 1 0 0 0 0 0 1 0 \\ 0 0 0 1 1 0 1 1 \\ 1 1 0 1 0 0 1 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 09_x (AA_x, AB_x), (FD_x, 27_x, 57_x, $8C_x$).

Dual Cipher #204

Dual cipher by $D7_x$, primitive polynomial $18D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 0E_x$ ($C0_x$, $C1_x$), (83_x, 34_x, 43_x, $F5_x$).

Dual Cipher #205

Dual cipher by $D8_x$, irreducible polynomial $1F3_x$, minimal generator 06_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 1 0 0 1 0 0 \\ 0 0 0 1 0 1 0 0 \\ 0 1 1 1 0 1 0 1 \\ 0 0 1 1 0 0 1 0 \\ 0 1 1 1 0 1 1 0 \\ 0 1 1 1 1 1 1 1 \\ 0 0 1 0 0 0 0 0 \\ 0 1 0 1 0 0 0 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 0 1 1 0 1 0 \\ 0 0 1 1 1 0 1 1 \\ 0 0 0 0 0 0 1 0 \\ 0 1 1 0 0 0 1 1 \\ 0 1 0 1 0 1 0 1 \\ 0 0 1 0 0 0 1 1 \\ 0 1 1 1 0 0 0 1 \\ 0 1 0 1 1 0 0 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 0 1 \\ 0 0 0 0 1 1 0 0 \\ 0 1 0 0 0 0 0 1 \\ 0 0 0 0 0 1 1 0 \\ 0 0 1 0 1 0 0 1 \\ 0 0 0 0 1 1 1 1 \\ 0 0 0 1 1 0 0 0 \\ 0 0 0 0 1 0 1 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 1 0 1 0 0 \\ 0 1 1 1 0 0 0 1 \\ 0 0 0 1 1 1 0 0 \\ 0 1 0 0 0 1 1 1 \\ 0 1 0 0 0 1 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 0 1 0 0 1 \\ 1 0 1 1 0 1 0 1 \\ 1 0 1 0 1 0 0 1 \\ 0 1 1 1 0 1 0 0 \\ 1 1 1 1 0 0 1 0 \\ 0 1 0 1 1 0 1 0 \\ 1 0 0 0 1 0 1 1 \\ 0 0 0 0 1 1 1 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ BB_x ($B5_x$, $B4_x$), ($0A_x$, $C2_x$, BF_x, 76_x).

Dual Cipher #206

Dual cipher by $D9_x$, irreducible polynomial $18B_x$, minimal generator 06_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $D0_x$ ($D9_x$, $D8_x$), ($0C_x$, $A9_x$, $D5_x$, 71_x).

Dual Cipher #207

Dual cipher by DA_x, primitive polynomial $1CF_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $9C_x$ (20_x, 21_x), ($1A_x$, 98_x, $3A_x$, $B9_x$).

Dual Cipher #208

Dual cipher by DB_x, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,1\,1\,0\,0\,0\,1 \\ 0\,1\,1\,1\,1\,1\,0\,0 \\ 0\,0\,1\,1\,1\,0\,1\,1 \\ 0\,0\,1\,1\,1\,1\,1\,1 \\ 0\,1\,0\,0\,0\,0\,1\,0 \\ 0\,1\,0\,1\,0\,1\,1\,1 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,0\,1\,0\,0\,1\,0\,0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,1\,1\,1\,1\,0\,0\,1\,1 \\ 0\,1\,1\,1\,1\,1\,1\,0 \\ 0\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,1\,0\,0\,1\,0\,0 \\ 0\,1\,0\,1\,1\,0\,1\,1 \\ 0\,0\,1\,1\,0\,0\,0\,0 \\ 0\,1\,1\,1\,0\,1\,1\,0 \\ 0\,1\,0\,1\,1\,0\,0\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,1\,0\,0\,0\,0\,1\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,1\,1\,0\,0 \\ 0\,0\,0\,1\,0\,1\,0\,0 \\ 0\,0\,0\,0\,1\,0\,0\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,1\,1\,0\,1\,0\,0 \\ 0\,0\,0\,1\,1\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,1 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,0\,0\,1\,0\,1\,1\,0 \\ 0\,1\,0\,0\,0\,0\,1\,0 \\ 1\,1\,1\,1\,1\,0\,0\,0 \\ 1\,0\,1\,1\,1\,0\,0\,0 \\ 1\,1\,0\,1\,1\,0\,1\,1 \\ 0\,0\,1\,1\,1\,0\,1\,0 \\ 0\,1\,1\,1\,0\,0\,0\,0 \\ 1\,1\,0\,1\,0\,0\,1\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow E4_x$ $(33_x, 32_x)$, $(1D_x, E1_x, 2E_x, D3_x)$.

Dual Cipher #209

Dual cipher by DC_x, primitive polynomial $1C3_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&1&1&0&0&0 \\ 0&1&0&1&1&0&1&0 \\ 0&0&0&0&0&1&0&0 \\ 0&1&0&0&0&1&0&0 \\ 0&1&1&0&1&0&0&0 \\ 0&0&1&1&0&0&1&1 \\ 0&0&1&1&1&1&1&0 \\ 0&1&1&0&0&0&1&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&1&0&0&1&1 \\ 0&0&1&1&0&0&0&0 \\ 0&1&0&1&0&0&1&0 \\ 0&1&1&1&1&0&0&1 \\ 0&1&1&0&1&0&1&0 \\ 0&0&1&0&0&0&0&0 \\ 0&1&1&0&0&0&1&1 \\ 0&1&0&0&1&1&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&1&1 \\ 0&0&0&0&1&1&0&1 \\ 0&1&0&0&0&0&1&1 \\ 0&0&0&0&0&1&1&0 \\ 0&0&1&0&0&0&0&1 \\ 0&0&0&0&0&0&1&1 \\ 0&0&0&1&1&0&1&1 \\ 0&0&0&0&1&1&0&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&0&1&0&0&1&0&0 \\ 0&1&0&0&1&0&0&1 \\ 0&1&0&1&0&0&1&0 \\ 0&1&0&1&0&1&0&0 \\ 0&1&0&1&0&1&0&1 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&0&0&0&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 1&0&0&0&1&0&0&0 \\ 0&1&0&1&0&0&0&1 \\ 1&1&1&1&1&1&0&1 \\ 1&0&0&1&0&0&0&0 \\ 0&0&0&0&0&1&0&0 \\ 1&0&1&0&1&0&1&1 \\ 0&1&1&1&0&0&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 35_x$ $(9A_x, 9B_x)$, $(F8_x, 92_x, 62_x, 09_x)$.

Dual Cipher #210

Dual cipher by DD_x, primitive polynomial $1A9_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&0&1&0&1 \\ 0&1&0&0&1&1&1&1 \\ 0&0&0&1&1&1&0&0 \\ 0&0&1&0&0&1&1&0 \\ 0&0&0&0&0&1&1&1 \\ 0&1&0&1&0&0&0&1 \\ 0&1&0&1&1&1&0&0 \\ 0&1&1&0&0&0&1&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&0&1&1&0&0 \\ 0&0&1&0&0&0&1&0 \\ 0&1&0&0&0&1&1&1 \\ 0&1&1&1&1&0&0&1 \\ 0&1&1&0&1&0&1&0 \\ 0&0&1&1&0&0&1&1 \\ 0&1&1&0&0&1&0&0 \\ 0&1&0&1&1&1&1&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&0&0&1&1&1 \\ 0&0&0&0&1&1&0&0 \\ 0&0&1&0&0&1&1&0 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&1&0&1&1&0 \\ 0&0&0&0&1&0&1&0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&0&0&1&0&1&0&1 \\ 0&1&1&0&0&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&0&1&0&0 \\ 0&0&0&1&0&1&0&0 \\ 0&0&0&0&0&1&0&1 \\ 0&1&0&1&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&0&1&0&0&0&0 \\ 0&0&0&0&0&0&0&1 \\ 0&1&1&1&0&0&0&0 \\ 1&1&1&1&0&1&0&0 \\ 0&1&0&1&1&1&0&1 \\ 0&1&1&1&0&0&1&0 \\ 1&0&1&1&0&1&1&0 \\ 0&1&1&1&0&1&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 26_x $(E2_x, E3_x)$, $(87_x, ED_x, 65_x, 0E_x)$.

Dual Cipher #211

Dual cipher by DE_x, primitive polynomial $1CF_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 3F_x$ (46_x, 47_x), ($C2_x$, 49_x, 84_x, $0E_x$).

Dual Cipher #212

Dual cipher by DF_x, irreducible polynomial $1A3_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 1 1 0 0 0 0 \\ 0 1 0 1 0 0 0 1 \\ 0 0 0 0 1 1 1 0 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 1 1 0 1 0 \\ 0 0 1 1 1 1 0 1 \\ 0 1 0 1 1 1 0 1 \\ 0 0 1 1 0 1 1 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 1 1 1 1 1 0 \\ 0 1 1 1 0 1 0 1 \\ 0 1 1 1 0 0 1 1 \\ 0 1 1 1 1 0 0 0 \\ 0 1 1 0 0 1 1 1 \\ 0 0 1 0 0 1 0 1 \\ 0 1 1 0 0 0 1 0 \\ 0 1 0 0 1 1 0 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 1 0 \\ 0 0 0 0 1 0 1 0 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 0 0 1 0 1 \\ 0 0 1 0 0 0 0 1 \\ 0 0 0 0 1 1 0 0 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 1 0 0 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 0 0 1 0 1 \\ 0 1 1 1 0 1 0 0 \\ 0 0 0 1 1 1 0 1 \\ 0 0 0 0 0 1 1 1 \\ 0 0 0 0 0 0 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 0 0 0 0 1 \\ 0 0 0 1 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 0 0 0 1 0 0 0 \\ 0 1 0 1 1 0 0 1 \\ 1 1 1 1 0 0 0 0 \\ 1 1 1 0 0 1 0 0 \\ 1 0 0 0 0 0 0 0 \\ 1 1 0 1 0 1 0 0 \\ 1 0 0 0 0 0 1 0 \\ 0 0 0 1 1 0 0 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $2A_x$ $(53_x, 52_x)$, $(A9_x, 5B_x, FA_x, 09_x)$.

Dual Cipher #213

Dual cipher by $E2_x$, primitive polynomial $15F_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 7D_x$ ($9C_x$, $9D_x$), (54_x, 49_x, $C8_x$, $D4_x$).

Dual Cipher #214

Dual cipher by $E3_x$, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $7C_x$ ($E4_x$, $E5_x$), (41_x, $5B_x$, $A5_x$, BE_x).

Dual Cipher #215 ($Rijndael^8$)

Dual cipher by $E4_x$, irreducible polynomial $11B_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 66_x ($1B_x$, $1A_x$), ($A9_x$, EC_x, $B2_x$, $F6_x$).

Dual Cipher #216

Dual cipher by $E5_x$, primitive polynomial $11D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 60_x$ ($1C_x$, $1D_x$), ($C2_x$, 93_x, DE_x, $8E_x$).

Dual Cipher #217

Dual cipher by $E6_x$, primitive polynomial 163_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,0\,0\,0\,0\,1\,1 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,0\,1\,1\,1\,1\,0\,0 \\ 0\,1\,1\,1\,1\,1\,1\,0 \\ 0\,1\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,1\,1\,1\,0\,1\,1\,0 \\ 0\,1\,0\,0\,0\,1\,0\,0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,1\,0\,0\,1\,1\,1 \\ 0\,1\,0\,1\,1\,0\,1\,0 \\ 0\,1\,0\,0\,0\,1\,0\,0 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,0\,0\,1\,0 \\ 0\,1\,0\,1\,1\,0\,1\,1 \\ 0\,1\,1\,0\,1\,0\,1\,0 \\ 0\,1\,0\,0\,1\,1\,0\,1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,0\,1\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,0\,1\,0\,0\,0\,1\,0 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,1\,1\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,1\,0\,0\,0\,1 \\ 0\,1\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,1\,1\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,1\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,0\,1\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1\,1\,0\,0\,0\,0\,0\,0 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 1\,0\,1\,1\,1\,0\,1\,1 \\ 0\,1\,1\,1\,0\,0\,0\,0 \\ 0\,0\,1\,0\,0\,1\,1\,0 \\ 1\,0\,1\,1\,1\,1\,1\,1 \\ 1\,1\,1\,1\,0\,1\,1\,0 \\ 1\,1\,1\,1\,1\,0\,1\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 6E_x$ ($D8_x$, $D9_x$), (95_x, 13_x, $4D_x$, CA_x).

Dual Cipher #218

Dual cipher by $E7_x$, primitive polynomial 165_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 0 1 1 0 1 1 0 \\ 0 0 0 1 1 0 1 0 \\ 0 1 1 1 0 0 0 0 \\ 0 0 1 1 1 0 1 0 \\ 0 1 0 1 1 0 1 0 \\ 0 1 0 0 1 0 0 1 \\ 0 0 1 1 0 0 1 0 \\ 0 1 0 0 0 1 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 0 0 1 0 1 1 \\ 0 1 0 0 1 0 0 0 \\ 0 1 0 1 0 0 0 0 \\ 0 0 1 1 1 0 0 0 \\ 0 0 0 1 0 0 1 0 \\ 0 1 0 0 1 0 0 1 \\ 0 1 1 0 1 0 1 0 \\ 0 1 0 1 1 1 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 1 1 \\ 0 0 0 0 0 0 1 0 \\ 0 1 0 0 1 0 0 0 \\ 0 0 0 0 0 0 1 1 \\ 0 0 1 0 0 1 0 0 \\ 0 0 0 0 1 1 1 0 \\ 0 0 0 1 1 1 1 1 \\ 0 0 0 0 0 1 0 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 1 0 1 0 0 \\ 0 0 1 1 0 1 0 1 \\ 0 1 0 1 1 0 0 1 \\ 0 1 0 1 0 1 1 0 \\ 0 0 0 1 0 1 0 1 \\ 0 1 0 1 0 0 0 1 \\ 0 1 0 0 0 0 0 0 \\ 0 1 0 1 0 0 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 1 0 1 0 0 \\ 0 0 0 1 0 1 0 1 \\ 1 0 1 0 1 1 0 0 \\ 1 1 1 1 0 0 1 0 \\ 1 1 1 0 1 0 1 1 \\ 0 1 0 1 0 0 0 0 \\ 0 0 0 0 1 0 1 1 \\ 1 0 0 0 0 1 0 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow 6F_x$ $(B4_x, B5_x)$, $(EA_x, 13_x, 5E_x, A6_x)$.

Dual Cipher #219

Dual cipher by $E8_x$, irreducible polynomial 139_x, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow F1_x$ ($C2_x$, $C3_x$), ($5F_x$, 65_x, $9D_x$, $A6_x$).

Dual Cipher #220

Dual cipher by $E9_x$, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,0\,1\,1\,0\,0 \\ 0\,0\,1\,0\,1\,0\,0\,1 \\ 0\,0\,1\,1\,1\,1\,1\,1 \\ 0\,1\,0\,0\,0\,1\,1\,0 \\ 0\,0\,0\,0\,0\,1\,1\,0 \\ 0\,1\,0\,1\,1\,1\,0\,0 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,1\,1\,1\,0\,0\,0\,1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,1\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,1\,1\,0\,0\,0 \\ 0\,0\,1\,0\,0\,0\,1\,0 \\ 0\,1\,1\,0\,1\,0\,0\,0 \\ 0\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,0\,1\,1\,0\,1 \\ 0\,1\,0\,1\,0\,0\,1\,1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,1\,0\,0\,1\,1\,0\,0 \\ 0\,0\,0\,0\,1\,0\,1\,0 \\ 0\,0\,1\,0\,0\,1\,0\,1 \\ 0\,0\,0\,0\,1\,1\,0\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,1\,0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,1\,0\,1 \\ 0\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,1\,0\,0\,1 \\ 0\,0\,0\,1\,0\,1\,1\,1 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,0\,0\,1\,0\,1\,0\,1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,1\,0\,0\,1\,0\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,1 \\ 1\,1\,0\,1\,1\,1\,1\,1 \\ 1\,1\,0\,1\,1\,0\,0\,0 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 1\,1\,0\,0\,1\,0\,0\,1 \\ 0\,0\,1\,1\,0\,1\,0\,1 \\ 1\,0\,1\,0\,1\,0\,1\,0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 89_x ($A9_x$, $A8_x$), ($4C_x$, 62_x, $E5_x$, CA_x).

Dual Cipher #221

Dual cipher by EA_x, primitive polynomial 163_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 9D_x$ ($5A_x$, $5B_x$), (86_x, $E2_x$, DC_x, $B9_x$).

Dual Cipher #222

Dual cipher by EB_x, primitive polynomial 165_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,0\,1\,0\,0\,1\,1\,1 \\ 0\,0\,1\,0\,0\,0\,0\,1 \\ 0\,0\,0\,0\,1\,0\,1\,1 \\ 0\,1\,1\,0\,0\,0\,1\,0 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,0\,1\,1\,1\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,1\,1 \\ 0\,0\,0\,1\,1\,1\,0\,0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,1\,0\,1\,1\,1\,1\,0 \\ 0\,1\,0\,1\,1\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \\ 0\,1\,1\,1\,1\,0\,1\,0 \\ 0\,0\,1\,0\,1\,0\,0\,1 \\ 0\,1\,0\,1\,0\,0\,1\,0 \\ 0\,1\,0\,0\,1\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,0\,1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,1\,1 \\ 0\,0\,0\,0\,0\,0\,1\,0 \\ 0\,1\,0\,0\,1\,0\,0\,0 \\ 0\,0\,0\,0\,0\,0\,1\,1 \\ 0\,0\,1\,0\,0\,1\,0\,0 \\ 0\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,1\,0\,1\,0\,0 \\ 0\,0\,1\,1\,0\,1\,0\,1 \\ 0\,1\,0\,1\,1\,0\,0\,1 \\ 0\,1\,0\,1\,0\,1\,1\,0 \\ 0\,0\,0\,1\,0\,1\,0\,1 \\ 0\,1\,0\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,1\,0\,1\,0\,0\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,0\,1\,1\,1\,0\,1\,0 \\ 1\,0\,0\,0\,0\,0\,1\,1 \\ 1\,0\,0\,1\,0\,0\,0\,1 \\ 0\,0\,0\,1\,1\,1\,1\,1 \\ 0\,1\,1\,1\,0\,0\,0\,1 \\ 1\,0\,1\,1\,1\,0\,1\,0 \\ 1\,1\,0\,0\,0\,0\,0\,1 \\ 0\,0\,1\,1\,0\,0\,0\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $E5_x$ (48_x, 49_x), ($F9_x$, $9A_x$, $B1_x$, $D3_x$).

Dual Cipher #223

Dual cipher by EE_x, primitive polynomial $12D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $B6_x$ (60_x, 61_x), (64_x, $3A_x$, 04_x, $5B_x$).

Dual Cipher #224

Dual cipher by EF_x, irreducible polynomial 139_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0 \\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 1 \\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1 \\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 0 \\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1 \\ 0\ 1\ 1\ 0\ 1\ 1\ 0\ 1 \\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1 \\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\ 1\ 0\ 1\ 0\ 1\ 0\ 0 \\ 0\ 1\ 0\ 0\ 0\ 1\ 1\ 1 \\ 0\ 1\ 0\ 0\ 0\ 0\ 1\ 0 \\ 0\ 1\ 1\ 1\ 0\ 0\ 0\ 0 \\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0 \\ 0\ 1\ 0\ 1\ 0\ 0\ 1\ 0 \\ 0\ 1\ 0\ 0\ 1\ 1\ 0\ 1 \\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\ 0\ 0\ 0\ 1\ 0\ 1\ 1 \\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1 \\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 1 \\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 0 \\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0 \\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1 \\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0 \\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\ 0\ 0\ 0\ 0\ 1\ 0\ 1 \\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 1 \\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 0 \\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1 \\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 1 \\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0 \\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1 \\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1\ 1\ 1\ 1\ 0\ 1\ 1\ 0 \\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 0 \\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0 \\ 1\ 1\ 1\ 0\ 1\ 0\ 0\ 0 \\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1 \\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0 \\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1 \\ 1\ 0\ 1\ 1\ 1\ 0\ 1\ 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ DB_x (66_x, 67_x), (63_x, $2E_x$, 05_x, 49_x).

Dual Cipher #225

Dual cipher by $F0_x$, primitive polynomial $14D_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $9C_x$ ($0C_x$, $0D_x$), ($1A_x$, 46_x, 16_x, $4B_x$).

Dual Cipher #226

Dual cipher by $F1_x$, primitive polynomial $15F_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $E4_x$ ($0A_x$, $0B_x$), ($1D_x$, 53_x, 17_x, 58_x).

Dual Cipher #227

Dual cipher by $F2_x$, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&1&0&0&0&0 \\ 0&0&0&1&0&1&0&0 \\ 0&1&1&1&0&0&0&1 \\ 0&0&1&0&1&0&0&1 \\ 0&1&1&1&0&0&1&0 \\ 0&1&1&0&0&1&1&1 \\ 0&0&1&0&1&1&0&0 \\ 0&0&1&1&0&0&0&0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1&0&0&1&1&1&1&0 \\ 0&1&1&0&1&1&0&1 \\ 0&0&0&1&1&1&1&1 \\ 0&0&0&1&1&1&1&0 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&1&1&1&1&0 \\ 0&1&1&0&0&1&0&0 \\ 0&1&0&0&1&1&0&0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&0&0 \\ 0&0&0&0&1&1&1&1 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&1&1&0&1 \\ 0&0&0&0&1&0&1&0 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&0&0&1&1&0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&1&0&1 \\ 0&1&1&0&0&1&0&0 \\ 0&0&0&1&1&0&0&1 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0&0&0&1&0&1&0&1 \\ 1&1&0&0&1&1&1&1 \\ 1&1&0&1&0&1&0&0 \\ 0&1&0&1&1&1&1&0 \\ 1&0&0&0&0&1&1&1 \\ 0&1&1&0&0&0&1&1 \\ 0&0&0&0&0&1&0&0 \\ 0&1&1&1&1&0&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ 67_x (34_x, 35_x), ($A2_x$, $6A_x$, 96_x, $5F_x$).

Dual Cipher #228

Dual cipher by $F3_x$, irreducible polynomial $17B_x$, minimal generator 09_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&1&0&1&0&1&0&1 \\ 0&1&1&0&1&0&1&0 \\ 0&1&0&0&0&1&0&0 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&0&1&0&0&1 \\ 0&1&0&1&0&1&1&1 \\ 0&0&0&1&1&1&0&0 \\ 0&0&1&1&0&0&0&0 \end{pmatrix} \quad R^{-1} = \begin{pmatrix} 1&1&1&0&0&1&1&1 \\ 0&1&1&0&1&1&0&1 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&1&1&0&0&0 \\ 0&1&0&1&0&1&1&1 \\ 0&1&0&0&1&1&0&1 \\ 0&1&1&0&0&0&1&1 \\ 0&1&0&1&1&1&1&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&0&0 \\ 0&0&0&0&1&1&1&1 \\ 0&1&0&0&0&1&0&1 \\ 0&0&0&0&1&0&1&1 \\ 0&0&1&0&1&1&0&1 \\ 0&0&0&0&1&0&1&0 \\ 0&0&0&1&1&0&0&1 \\ 0&0&0&0&0&1&1&0 \end{pmatrix} \quad Q^{-1} = \begin{pmatrix} 1&0&0&0&0&1&0&1 \\ 0&1&1&0&0&1&0&0 \\ 0&0&0&1&1&0&0&1 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&0 \\ 0&1&0&1&0&0&0&1 \\ 0&0&0&1&0&1&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&1&0&0&1&1&0 \\ 1&1&1&1&0&0&0&0 \\ 1&0&0&0&1&1&0&1 \\ 0&0&1&1&0&1&1&0 \\ 1&1&1&0&0&0&1&0 \\ 0&0&0&1&1&1&1&1 \\ 0&1&1&1&1&1&1&0 \\ 0&1&1&1&1&0&1&1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 61_x $(27_x, 26_x)$, $(CF_x, 6A_x, E8_x, 4C_x)$.

Dual Cipher #229

Dual cipher by $F4_x$, primitive polynomial 163_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x) \rightarrow 31_x$ (BB_x, BA_x), $(80_x, 96_x, 3B_x, 2C_x)$.

Dual Cipher #230

Dual cipher by $F5_x$, primitive polynomial 165_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&1&0&1&1&1&1 \\ 0&0&1&1&1&1&0&0 \\ 0&0&1&1&1&1&1&0 \\ 0&0&0&1&0&0&0&0 \\ 0&1&0&0&1&1&0&0 \\ 0&0&0&1&1&0&1&0 \\ 0&1&1&0&0&1&0&0 \\ 0&1&1&0&1&0&1&1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&1&1&1&1&1&0&1 \\ 0&0&1&0&0&1&1&0 \\ 0&1&1&1&1&1&1&0 \\ 0&0&0&1&0&0&0&0 \\ 0&1&1&1&0&1&0&0 \\ 0&1&0&1&1&0&1&0 \\ 0&1&1&0&0&0&0&0 \\ 0&1&0&0&1&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&1&1&1 \\ 0&0&0&0&0&0&1&0 \\ 0&1&0&0&1&0&0&0 \\ 0&0&0&0&0&0&1&1 \\ 0&0&1&0&0&1&0&0 \\ 0&0&0&0&1&1&1&0 \\ 0&0&0&1&1&1&1&1 \\ 0&0&0&0&0&1&0&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&1&0&0 \\ 0&0&1&1&0&1&0&1 \\ 0&1&0&1&1&0&0&1 \\ 0&1&0&1&0&1&1&0 \\ 0&0&0&1&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \\ 0&1&0&0&0&0&0&0 \\ 0&1&0&1&0&0&0&0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&1&1&0&0&0&1&0 \\ 1&1&0&1&0&1&1&1 \\ 1&1&1&1&0&1&1&1 \\ 1&1&1&1&1&0&0&0 \\ 0&0&0&0&1&0&1&1 \\ 0&0&0&1&1&0&0&1 \\ 0&1&0&0&0&0&1&0 \\ 1&1&0&1&0&1&1&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 23_x $(D0_x, D1_x)$, $(FF_x, E8_x, 2F_x, 39_x)$.

Dual Cipher #231

Dual cipher by $F6_x$, primitive polynomial 171_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1\,1\,1\,1\,0\,1\,1\,0 \\ 0\,0\,0\,1\,1\,0\,1\,1 \\ 0\,0\,1\,0\,1\,1\,0\,1 \\ 0\,1\,1\,1\,0\,1\,1\,0 \\ 0\,1\,1\,0\,1\,1\,0\,0 \\ 0\,1\,0\,0\,0\,0\,1\,0 \\ 0\,0\,1\,1\,0\,0\,0\,1 \\ 0\,1\,0\,1\,0\,0\,1\,0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1\,0\,0\,1\,0\,0\,0\,0 \\ 0\,1\,1\,1\,0\,0\,0\,0 \\ 0\,1\,0\,1\,1\,1\,1\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \\ 0\,1\,1\,0\,1\,0\,0\,1 \\ 0\,1\,0\,0\,1\,1\,1\,0 \\ 0\,1\,1\,1\,0\,1\,0\,0 \\ 0\,1\,0\,1\,1\,0\,0\,0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1\,0\,0\,0\,1\,1\,0\,0 \\ 0\,0\,0\,0\,0\,0\,1\,0 \\ 0\,1\,0\,0\,0\,1\,1\,0 \\ 0\,0\,0\,0\,0\,0\,0\,1 \\ 0\,0\,1\,0\,1\,1\,1\,1 \\ 0\,0\,0\,0\,1\,1\,1\,0 \\ 0\,0\,0\,1\,1\,0\,0\,1 \\ 0\,0\,0\,0\,0\,1\,0\,1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1\,1\,0\,0\,0\,1\,0\,0 \\ 0\,1\,1\,1\,0\,0\,0\,1 \\ 0\,0\,0\,1\,1\,1\,0\,0 \\ 0\,1\,0\,0\,0\,1\,1\,1 \\ 0\,1\,0\,1\,0\,1\,0\,1 \\ 0\,0\,0\,1\,0\,0\,0\,1 \\ 0\,1\,0\,0\,0\,0\,0\,0 \\ 0\,0\,0\,1\,0\,0\,0\,0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 0\,1\,1\,0\,1\,1\,0\,0 \\ 0\,0\,1\,1\,0\,1\,1\,0 \\ 0\,1\,0\,0\,0\,0\,1\,1 \\ 1\,1\,1\,1\,0\,1\,1\,1 \\ 1\,1\,0\,0\,1\,1\,1\,1 \\ 1\,0\,0\,0\,1\,0\,1\,1 \\ 0\,1\,1\,1\,1\,1\,1\,1 \\ 0\,1\,1\,0\,1\,0\,0\,1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $0E_x$ ($B9_x$, $B8_x$), (73_x, 97_x, CA_x, $2F_x$).

Dual Cipher #232

Dual cipher by $F7_x$, irreducible polynomial 177_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ → 09_x $(D3_x, D2_x)$, $(75_x, E9_x, A6_x, 3B_x)$.

Dual Cipher #233

Dual cipher by $F8_x$, primitive polynomial $12B_x$, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1&0&0&0&0&0&0&0 \\ 0&1&1&0&1&0&1&1 \\ 0&1&0&1&0&1&0&0 \\ 0&1&1&0&1&1&0&0 \\ 0&1&1&1&0&0&1&0 \\ 0&0&0&1&0&0&1&0 \\ 0&0&0&0&0&0&1&1 \\ 0&1&1&1&1&0&0&0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1&0&0&0&0&0&0&0 \\ 0&0&1&1&0&0&0&1 \\ 0&0&1&1&1&1&0&1 \\ 0&1&0&0&0&0&1&1 \\ 0&1&0&0&1&1&1&0 \\ 0&1&0&1&0&0&1&0 \\ 0&1&0&0&0&1&1&1 \\ 0&1&0&0&0&1&0&1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1&0&0&0&1&0&0&1 \\ 0&0&0&0&1&0&1&0 \\ 0&1&0&0&0&1&1&1 \\ 0&0&0&0&1&1&0&0 \\ 0&0&1&0&0&0&0&0 \\ 0&0&0&0&1&1&1&1 \\ 0&0&0&1&0&0&1&1 \\ 0&0&0&0&0&1&1&1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1&1&0&1&0&1&0&0 \\ 0&0&1&0&0&0&0&1 \\ 0&0&0&0&1&0&0&0 \\ 0&0&0&1&0&1&1&0 \\ 0&0&0&0&0&1&0&1 \\ 0&0&0&1&0&1&0&1 \\ 0&1&0&0&0&1&0&1 \\ 0&1&0&1&0&0&0&1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1&0&0&1&1&1&1&0 \\ 1&0&0&1&0&1&1&0 \\ 0&0&1&1&1&0&0&0 \\ 1&0&1&1&1&1&0&1 \\ 1&1&0&0&0&0&0&0 \\ 1&0&1&0&1&1&1&1 \\ 0&1&1&1&1&0&0&0 \\ 0&1&1&0&0&1&0&0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $E1_x$ ($9E_x$, $9F_x$), ($2B_x$, $2F_x$, $B5_x$, $B0_x$).

Dual Cipher #234

Dual cipher by $F9_x$, irreducible polynomial $13F_x$, minimal generator 03_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 0 0 0 \\ 0 1 1 0 1 1 0 1 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 1 1 0 1 1 \\ 0 1 1 0 1 0 1 0 \\ 0 1 1 1 1 0 1 1 \\ 0 1 1 1 1 0 0 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 1 1 1 1 1 1 \\ 0 0 1 0 0 0 1 1 \\ 0 0 1 0 1 0 0 1 \\ 0 1 0 1 0 1 1 1 \\ 0 1 0 1 1 1 0 0 \\ 0 1 0 0 0 1 1 1 \\ 0 1 0 1 0 0 1 0 \\ 0 1 0 1 0 0 0 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 0 1 0 \\ 0 0 0 0 1 0 0 1 \\ 0 1 0 0 1 1 0 0 \\ 0 0 0 0 1 1 0 1 \\ 0 0 1 0 1 1 1 1 \\ 0 0 0 0 1 1 1 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 1 1 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 1 0 0 0 1 \\ 0 1 1 1 0 1 0 1 \\ 0 0 0 0 1 1 0 0 \\ 0 1 0 1 0 0 1 0 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 1 0 0 0 0 \\ 0 0 0 1 0 1 0 0 \\ 0 1 0 0 0 1 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 0 0 0 0 0 0 1 \\ 1 0 0 1 1 0 0 1 \\ 1 1 1 0 0 0 0 0 \\ 1 0 1 1 0 1 0 1 \\ 0 1 1 1 0 1 0 1 \\ 1 0 1 0 0 1 1 1 \\ 0 0 0 1 1 0 1 1 \\ 0 1 1 0 0 0 1 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 98_x$ ($E7_x$, $E6_x$), ($3E_x$, $3B_x$, $D9_x$, DD_x).

Dual Cipher #235 ($Rijndael^2$)

Dual cipher by FA_x, irreducible polynomial $11B_x$, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow C2_x$ (04_x, 05_x), (45_x, 51_x, 41_x, 54_x).

Dual Cipher #236

Dual cipher by FB_x, primitive polynomial $11D_x$, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\
1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
1 & 0 & 1 & 0 & 1 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\
1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 1 & 0 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $A9_x$ (05_x, 04_x), (51_x, 45_x, 54_x, 41_x).

Dual Cipher #237

Dual cipher by FC_x, irreducible polynomial 177_x, minimal generator 03_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 0 1 1 1 1 \\ 0 1 0 1 1 1 0 0 \\ 0 1 0 1 0 0 1 0 \\ 0 0 1 1 1 0 0 1 \\ 0 0 0 1 0 1 1 1 \\ 0 0 1 1 1 0 1 0 \\ 0 1 0 1 1 1 0 1 \\ 0 1 0 1 1 0 1 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 0 0 1 1 1 0 1 \\ 0 0 1 1 1 1 1 1 \\ 0 1 1 1 1 0 0 0 \\ 0 1 0 0 1 0 0 1 \\ 0 1 1 0 0 0 1 1 \\ 0 1 0 1 0 1 0 1 \\ 0 1 0 1 0 1 1 0 \\ 0 1 0 0 0 0 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 1 \\ 0 0 0 0 1 1 1 1 \\ 0 1 0 0 1 0 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 0 1 0 1 0 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 0 0 1 1 0 1 1 \\ 0 0 0 0 0 1 0 0 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 0 0 0 0 1 0 0 \\ 0 0 1 0 0 1 0 1 \\ 0 0 0 0 1 1 0 1 \\ 0 1 0 0 0 0 1 1 \\ 0 0 0 1 0 1 0 0 \\ 0 0 0 0 0 0 0 1 \\ 0 1 0 0 0 1 0 0 \\ 0 0 0 1 0 0 0 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 0 1 0 1 1 1 0 \\ 1 1 1 1 1 0 1 0 \\ 0 1 1 0 0 0 1 1 \\ 1 0 0 0 0 1 0 0 \\ 1 1 0 1 0 0 1 1 \\ 1 0 1 1 1 1 1 0 \\ 1 0 0 1 0 0 0 1 \\ 1 1 1 1 1 0 0 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow 20_x$ ($C7_x$, $C6_x$), (38_x, $D7_x$, FF_x, 11_x).

Dual Cipher #238

Dual cipher by FD_x, primitive polynomial 171_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 1 0 1 0 0 1 1 \\ 0 0 0 0 0 1 0 0 \\ 0 1 1 0 1 1 0 1 \\ 0 1 1 0 0 0 1 0 \\ 0 0 1 0 1 0 1 1 \\ 0 1 1 0 0 0 0 1 \\ 0 0 0 0 0 1 1 0 \\ 0 1 0 1 1 0 1 1 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 1 1 0 0 1 0 1 \\ 0 0 1 0 1 0 1 0 \\ 0 1 1 1 1 0 0 0 \\ 0 1 0 1 1 0 1 1 \\ 0 1 1 0 0 1 0 0 \\ 0 1 0 0 0 0 0 0 \\ 0 1 0 0 0 0 1 0 \\ 0 1 0 1 0 1 1 0 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 0 0 0 1 1 0 0 \\ 0 0 0 0 0 0 1 0 \\ 0 1 0 0 0 1 1 0 \\ 0 0 0 0 0 0 0 1 \\ 0 0 1 0 1 1 1 1 \\ 0 0 0 0 1 1 1 0 \\ 0 0 0 1 1 0 0 1 \\ 0 0 0 0 0 1 0 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 1 0 0 0 1 0 0 \\ 0 1 1 1 0 0 0 1 \\ 0 0 0 1 1 1 0 0 \\ 0 1 0 0 0 1 1 1 \\ 0 1 0 1 0 1 0 1 \\ 0 0 0 1 0 0 0 1 \\ 0 1 0 0 0 0 0 0 \\ 0 0 0 1 0 0 0 0 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 1 0 1 1 0 1 0 \\ 0 0 1 0 1 1 0 1 \\ 1 1 1 1 0 1 1 0 \\ 0 1 1 1 1 1 0 1 \\ 0 0 0 0 0 1 0 1 \\ 0 1 0 1 0 0 1 1 \\ 0 1 1 0 1 0 0 0 \\ 1 0 0 0 0 1 1 1 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ 33_x (AD_x, AC_x), $(2D_x, BC_x, 80_x, 10_x)$.

Dual Cipher #239

Dual cipher by FE_x, primitive polynomial 169_x, minimal generator 02_x.
Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$.
R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$
R = \begin{pmatrix}
1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 1 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 1 & 1 & 0
\end{pmatrix}
\qquad
R^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0
\end{pmatrix}
$$

$$
Q = \begin{pmatrix}
1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 1 & 1 & 1
\end{pmatrix}
\qquad
Q^{-1} = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

$$
A^R = \begin{pmatrix}
0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 1
\end{pmatrix}
$$

Rijndael involves the following constants: MixColumn (02_x, 03_x), inverse MixColumn ($0B_x$, $0D_x$, 09_x, $0E_x$), ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:
The constants 63_x (02_x, 03_x), ($0B_x$, $0D_x$, 09_x, $0E_x$) $\rightarrow$ $C2_x$ ($C9_x$, $C8_x$), (FD_x, 14_x, 34_x, DC_x).

Dual Cipher #240

Dual cipher by FF_x, primitive polynomial 169_x, minimal generator 02_x.

Let R be a matrix that takes a byte b in Rijndael, to it's dual byte b' in the dual cipher, i.e., $b' = R \cdot b$. R^{-1} is its inverse, i.e., $b = R^{-1} \cdot b'$. A^R is the linear matrix in the S Box in the dual cipher. Q is a matrix that performs the squaring operation in the dual cipher, i.e., $x^2 = Q \cdot x$.

$$R = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \qquad R^{-1} = \begin{pmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \qquad Q^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

$$A^R = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \end{pmatrix}$$

Rijndael involves the following constants: MixColumn $(02_x, 03_x)$, inverse MixColumn $(0B_x, 0D_x, 09_x, 0E_x)$, ByteSub (63_x) and round constants (which are 02_x^i). These constants are transformed as follows:

The constants 63_x $(02_x, 03_x)$, $(0B_x, 0D_x, 09_x, 0E_x)$ $\rightarrow$ $A9_x$ $(A4_x, A5_x)$, $(83_x, 14_x, 27_x, B1_x)$.