# Matrix inverse for separated real and imaginary

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**Summary**

For a complex matrix $A + iB$, where $A$ and $B$ are real matrices, we can calculate the inverse matrix $C + iD$ as:

$C = (A + BA^{-1}B)^{-1}$

$D = -A^{-1}BC$

**Derivation**

Given complex matrix $X$ and its inverse Y as:

$X = A + iB$

$Y = C + iD$

$Y = X^{-1}$

Substituting in the inverse definition:

$XY = I$

$(A + iB)(C + iD) = I$

$(AC - BD) + i * (AD + BC) = I$

Separating real and imaginary parts, we get two equations

$AC - BD = I$

$AD + BC = O$

Using the second equation

$AD = -BC$

$D = -A^{-1}BC$

Substituting in the first equation

$AC - B(-A^{-1}BC) = I$

$AC + BA^{-1}BC = I$

$(A + BA^{-1}B)C = I$

$C = (A + BA^{-1}B)^{-1}$

Once we have $C$, we can calculate D.