

Matrix Inverse % . 2 _ 2 Matrix Divide

<p>If y is a non-singular matrix, then $\% . y$ is the inverse of y. For example:</p> <pre style="margin-left: 20px;">mp=: +/ . * Matrix product (% . ;] ; % . mp]) i. 2 2</pre> <pre style="margin-left: 20px;">+-----+-----+ _1.5 0.5 0 1 1 0 1 0 2 3 0 1 +-----+-----+</pre> <p>More generally, $\% . y$ is defined in terms of the dyadic case, with the left argument $= i. \{ : \\$ y$ (an identity matrix) or, equally, by the relation $(\% . y) mp x \leftrightarrow x \% . y$.</p> <p>The shape of $\% . y$ is $. \\$ y$.</p> <p>The vector and scalar cases are defined by using the matrix $, . y$, but the shape of the result is $\\$ y$.</p> <p>For a non-zero vector y, the result of $\% . y$ is a vector collinear with y whose length is the reciprocal of that of y; it is called the reflection of y in the unit circle (or sphere). Thus:</p> <pre style="margin-left: 20px;">(% . ,:] % % .) 2 3 4 0.0689655 0.103448 0.137931 29 29 29</pre>	<p>If y is non-singular, then $x \% . y$ is $(\% . y) mp x$. More generally, if the columns of y are linearly independent and if $\#x$ and $\#y$ agree, then $x \% . y$ minimizes the difference:</p> $d = \ x - y mp x \% . y \ ^2$ <p>in the sense that the magnitudes $\ d\$ are minimized. Scalar and vector cases of y are treated as the one-column matrix $, . y$.</p> <p>Geometrically, $y mp x \% . y$ is the projection of the vector x on the column space of y, the point nearest to x in the space spanned by the columns of y.</p> <p>Common uses of $\% .$ are in the solution of linear equations and in the approximation of functions by polynomials, as in $c = (f x) \% . x ^ / i. 4$.</p> <p>We will illustrate the use of $\% .$ in function fitting by the sine function, showing, in particular, the maximum over the magnitudes of the differences from the function being approximated:</p>
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sin=: 1&o. [. x=: 5 %~ i. 6          Function to be approximated
c=: (sin x) % . x ^ / i. 4          Use of matrix divide
, .&. > @ ( ] ; c "_ ; sin ; c&p. ; > . / @ : | @ ( sin - c&p. ) ) x
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0	_5.30503e_5	0	_5.30503e_5	0.000167992
0.2	1.00384	0.198669	0.198826	
0.4	_0.018453	0.389418	0.389321	
0.6	_0.143922	0.564642	0.564523	
0.8		0.717356	0.717524	
1		0.841471	0.841416	