In[]:=
```
f = {3, 5}; d = {-2, 1};
wd = Dot[f, d]
```

Out[]=
```
-1
```

In[]:=
```
Print["work done = ", wd]
```

```
work done = -1
```

In[]:=
```
theta = ArcCos[wd / (Norm[f] * Norm[d])] // N
Print["Anlge =", theta * 180 / Pi]
```

Out[]=
```
1.64757
```

```
Anlge =94.3987
```

In[]:=
```
m = {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}}
n = {{0, -1, 0}, {0, 0, -1}, {1, 0, 0}}
```

Out[]=
```
{{1, 0, 0}, {0, 1, 0}, {0, 0, 1}}
```

Out[]=
```
{{0, -1, 0}, {0, 0, -1}, {1, 0, 0}}
```

In[]:=
```
2 m - 3 n // MatrixForm
```

Out[]//MatrixForm=

$$\begin{pmatrix} 2 & 3 & 0 \\ 0 & 2 & 3 \\ -3 & 0 & 2 \end{pmatrix}$$

In[]:=
```
mm = m.n
```

Out[]=
```
{{0, -1, 0}, {0, 0, -1}, {1, 0, 0}}
```

In[]:=
```
mm // MatrixForm
```

Out[]//MatrixForm=

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

```
(*Clearing*)
```

In[]:=
```
f =.;
```

In[]:=
```
f[i_, j_] := 1 / (i + j + 1);
Array[f, {2, 2}] // MatrixForm
matrix = Table[f[i, j], {i, 1, 2}, {j, 1, 2}]
matrix // N
m1 = Table[a[i, j], {i, 1, 2}, {j, 1, 4}] // MatrixForm
```

Out[]//MatrixForm=

$$\begin{pmatrix} \frac{1}{3} & \frac{1}{4} \\ \frac{1}{4} & \frac{1}{5} \end{pmatrix}$$

Out[]= $\left\{\left\{\frac{1}{3}, \frac{1}{4}\right\}, \left\{\frac{1}{4}, \frac{1}{5}\right\}\right\}$

Out[]= {{0.333333, 0.25}, {0.25, 0.2}}

Out[]//MatrixForm=

$$\begin{pmatrix} a[1,1] & a[1,2] & a[1,3] & a[1,4] \\ a[2,1] & a[2,2] & a[2,3] & a[2,4] \end{pmatrix}$$

In[]:=
```
m1 /. a[i_, j_] → (i^2 + j^2 + 1)
```

Out[]//MatrixForm=

$$\begin{pmatrix} 3 & 6 & 11 & 18 \\ 6 & 9 & 14 & 21 \end{pmatrix}$$

In[]:=
```
? IdentityMatrix
```

Out[]=

Symbol

IdentityMatrix[$n$] gives the $n \times n$ identity matrix.

In[]:=
```
IdentityMatrix[3] // MatrixForm
```

Out[]//MatrixForm=

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

In[]:=
```
Table[KroneckerDelta[i, j], {i, 1, 3}, {j, 1, 3}]
```

Out[]= {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}}

In[]:=
```
Table[If[i == j, 1, 0], {i, 1, 3}, {j, 1, 3}]
```

Out[]= {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}}

```
(*Rows and Columns Count*)
```

In[]:=
```
m1 =.;
m1 = {{1, 1, 1}, {2, 2, 2}, {3, 3, 3}, {4, 4, 4}};
norows = Length[m1]
nocol = Length[m1[[1]]]
```

Out[]= 4

Out[]= 3

In[ ]:=
```
If[norows == nocol, Print["square matrix"], Print["Rectangular matrix"]]
```

```
Rectangular matrix
```

```
m2 = {{1, 2, 3}, {7, 8, 10}, {20, 19, 1}};
```

In[ ]:=
```
If[Length[m2] == Length[m2[[1]]] &&
  Det[m2] ≠ 0, Print["it is not singular matrix and its inverse is"] ;
 inv = Inverse[m2], Print["singular"]]
```

```
it is not singular matrix and its inverse is
```

Out[ ]=
$$\left\{\left\{-\frac{182}{123}, \frac{55}{123}, -\frac{4}{123}\right\}, \left\{\frac{193}{123}, -\frac{59}{123}, \frac{11}{123}\right\}, \left\{-\frac{9}{41}, \frac{7}{41}, -\frac{2}{41}\right\}\right\}$$

In[ ]:=
```
? Det
```

Out[ ]=

Symbol

Det[*m*] gives the determinant of the square matrix *m*.

In[ ]:=
```
? Inverse
```

Out[ ]=

Symbol

Inverse[*m*] gives the inverse of a square matrix *m*.

In[ ]:=
```
? Transpose
```

Out[ ]=

Symbol

Transpose[*list*] transposes the first two levels in *list*.

Transpose[*list*, {$n_1$, $n_2$, …}] transposes *list* so that the $k^{\text{th}}$ level in *list* is the $n_k{}^{\text{th}}$ level in the result.

Transpose[*list*, $m \leftrightarrow n$] transposes levels *m* and *n* in *list*, leaving all other levels unchanged.

In[ ]:=
```
Transpose[inv]
```

Out[ ]=
$$\left\{\left\{-\frac{182}{123}, \frac{193}{123}, -\frac{9}{41}\right\}, \left\{\frac{55}{123}, -\frac{59}{123}, \frac{7}{41}\right\}, \left\{-\frac{4}{123}, \frac{11}{123}, -\frac{2}{41}\right\}\right\}$$

In[ ]:=
```
? Conjugate
```

Out[ ]=

Symbol

Conjugate[*z*] or $z^*$ gives the complex conjugate of the complex number *z*.

In[]:=
```
Conjugate[inv]
```

Out[]=
$$\left\{\left\{-\frac{182}{123}, \frac{55}{123}, -\frac{4}{123}\right\}, \left\{\frac{193}{123}, -\frac{59}{123}, \frac{11}{123}\right\}, \left\{-\frac{9}{41}, \frac{7}{41}, -\frac{2}{41}\right\}\right\}$$

In[]:=
```
mmm = {{1 + I, I, 2}, {I, 2 I, 6}, {2, 3, I}}
Conjugate[mmm]
```

Out[]=
$$\{\{1+i, i, 2\}, \{i, 2i, 6\}, \{2, 3, i\}\}$$

Out[]=
$$\{\{1-i, -i, 2\}, \{-i, -2i, 6\}, \{2, 3, -i\}\}$$

In[]:=
```
If[mmm == Transpose[mmm], Print["symetric"], Print["not symetric"]]
```

```
not symetric
```

In[]:=
```
If[mmm == Transpose[Conjugate[mmm]], Print["Hermition"], Print["not Hermition"]]
```

```
not Hermition
```

In[]:=
```
If[mmm == -Transpose[mmm], Print["skew symetric"], Print["not skew symetric"]]
```

```
not skew symetric
```

In[]:=
```
If[mmm == -Transpose[Conjugate[mmm]],
 Print["Skew Hermition"], Print["Not Skew Hermition"]]
```

```
Not Skew Hermition
```

```
(* Do more about Hermition, Symmetric, Skew Symmetric,
Not Symmetric, Not Hermition and Skew Hermition *)
```