In[1]:=
```
m = {{5, -4}, {8, -7}}
```

Out[1]=
```
{{5, -4}, {8, -7}}
```

In[2]:=
```
A = MatrixForm[m]
```

Out[2]//MatrixForm=

$$\begin{pmatrix} 5 & -4 \\ 8 & -7 \end{pmatrix}$$

In[3]:=
```
lambda = Eigenvalues[m]
```

Out[3]=
```
{-3, 1}
```

In[4]:=
```
P = Det[m - x IdentityMatrix[2]]
```

Out[4]=
```
-3 + 2 x + x^2
```

In[5]:=
```
Factor[P]
```

Out[5]=
```
(-1 + x) (3 + x)
```

In[6]:=
```
Eigenvectors[m]
```

Out[6]=
```
{{1, 2}, {1, 1}}
```

In[7]:=
```
{x'[t] == 5 x[t] - 4 y[t], y'[t] == 8 x[t] - 7 y[t]}
```

Out[7]=
```
{x'[t] == 5 x[t] - 4 y[t], y'[t] == 8 x[t] - 7 y[t]}
```

In[8]:=
```
sol = DSolve[{x'[t] == 5 x[t] - 4 y[t], y'[t] == 8 x[t] - 7 y[t]}, {x, y}, t]
```

Out[8]=
```
{{x → Function[{t}, e^(-3 t) (-1 + 2 e^(4 t)) C[1] - e^(-3 t) (-1 + e^(4 t)) C[2]],
  y → Function[{t}, 2 e^(-3 t) (-1 + e^(4 t)) C[1] - e^(-3 t) (-2 + e^(4 t)) C[2]]}}
```

In[9]:=
```
m2 = {{2, -1}, {1, 0}}
```

Out[9]=
```
{{2, -1}, {1, 0}}
```

In[10]:=

In[11]:=
```
A = MatrixForm[m2]
```

Out[11]//MatrixForm=

$$\begin{pmatrix} 2 & -1 \\ 1 & 0 \end{pmatrix}$$

In[12]:=
```
lambda = Eigenvalues[m2]
```

Out[12]=
```
{1, 1}
```

In[13]:=
```
Eigenvectors[m2]
```

Out[13]=
```
{{1, 1}, {0, 0}}
```

In[14]:=
```
sol = DSolve[{x'[t] == 2 x[t] - y[t], y'[t] == x[t]}, {x, y}, t]
```

Out[14]=
```
{{x → Function[{t}, e^t (1 + t) C[1] - e^t t C[2]], y → Function[{t}, e^t t C[1] - e^t (-1 + t) C[2]]}}
```

In[15]:=
```
m3 = {{-2, -6}, {3, 4}}
```

Out[15]=
```
{{-2, -6}, {3, 4}}
```

In[16]:=

In[17]:=
```
Eigenvalues[m3]
```

Out[17]=
```
{1 + 3 i, 1 - 3 i}
```

In[18]:=
```
Eigenvectors[m3]
```

Out[18]=
```
{{-1 + i, 1}, {-1 - i, 1}}
```

In[19]:=
```
sol = DSolve[{x'[t] == -2 x[t] - 6 y[t], y'[t] == 3 x[t] + 4 y[t]}, {x, y}, t]
```

Out[19]=
```
{{x → Function[{t}, e^t C[1] (Cos[3 t] - Sin[3 t]) - 2 e^t C[2] Sin[3 t]],
  y → Function[{t}, e^t C[1] Sin[3 t] + e^t C[2] (Cos[3 t] + Sin[3 t])]}}
```

In[20]:=
```
m1 = {{5, 12, -6}, {-3, -10, 6}, {-3, -12, 8}}
```

Out[20]=
```
{{5, 12, -6}, {-3, -10, 6}, {-3, -12, 8}}
```

In[21]:=
```
A1 = MatrixForm[m1]
```

Out[21]//MatrixForm=

$$\begin{pmatrix} 5 & 12 & -6 \\ -3 & -10 & 6 \\ -3 & -12 & 8 \end{pmatrix}$$

In[22]:=
```
lambda = Eigenvalues[m1]
```

Out[22]=
```
{2, 2, -1}
```

In[23]:=
```
Eigenvectors[m1]
```

Out[23]=
```
{{2, 0, 1}, {-4, 1, 0}, {-1, 1, 1}}
```

In[24]:=
```
P = Det[m1 - x IdentityMatrix[3]]
```

Out[24]=
```
-4 + 3 x^2 - x^3
```

In[25]:=
```
Factor[P]
```

Out[25]=
```
-(-2 + x)^2 (1 + x)
```

In[26]:=
```
sol = DSolve[{x'[t] == 5 x[t] + 12 y[t] - 6 z[t],
    y'[t] == -3 x[t] - 10 y[t] + 6 z[t], z'[t] == -3 x[t] - 12 y[t] + 8 z[t]}, {x, y, z}, t]
```

Out[26]=
```
{{x → Function[{t}, e^-t (-1 + 2 e^3 t) C[1] + 4 e^-t (-1 + e^3 t) C[2] - 2 e^-t (-1 + e^3 t) C[3]],
  y → Function[{t}, -e^-t (-1 + e^3 t) C[1] - e^-t (-4 + 3 e^3 t) C[2] + 2 e^-t (-1 + e^3 t) C[3]],
  z → Function[{t}, -e^-t (-1 + e^3 t) C[1] - 4 e^-t (-1 + e^3 t) C[2] + e^-t (-2 + 3 e^3 t) C[3]]}}
```