Ex2

In[28]:=
```
A1 = {{10, 0, 0, 0}, {1, 8, 0, 0}, {1, -2, 2, 0}, {3, 2, -8, 1}};
C1 = {{0, 0, -1, 5}, {0, 0, 3, 0}, {0, 0, 0, -7}, {0, 0, 0, 0}};
B1 = Inverse[A1].C1 // MatrixForm
```
逆　矩阵格式

Out[30]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & -\frac{1}{10} & \frac{1}{2} \\ 0 & 0 & \frac{31}{80} & -\frac{1}{16} \\ 0 & 0 & \frac{7}{16} & -\frac{61}{16} \\ 0 & 0 & \frac{121}{40} & -\frac{255}{8} \end{pmatrix}$$

In[31]:=
```
Det[{{x, 0, 1/10, -1/2}, {0, x, 31/80, 1/16}, {0, 0, x - 7/16, 61/16}, {0, 0, -121/40, x + 255/8}}]
```
行列式

Out[31]=

$$-\frac{193\,x^2}{80}+\frac{503\,x^3}{16}+x^4$$

In[38]:=
```
FactorSquareFree[-193 x^2/80 + 503 x^3/16 + x^4]
```
无平方因子

Out[38]=

$$\frac{1}{80}\,x^2\left(-193+2515\,x+80\,x^2\right)$$

In[44]:=
```
NRoots[1/80 x^2 (-193 + 2515 x + 80 x^2) == 0, x]
```
根的数值近似

Out[44]=

$$x == -31.5141 \;||\; x == 0. \;||\; x == 0. \;||\; x == 0.0765531$$

In[39]:=
```
Solve[1/80 x^2 (-193 + 2515 x + 80 x^2) == 0, x, Complexes]
```
解方程　复数域

Out[39]=

$$\left\{\{x\to 0\},\{x\to 0\},\left\{x\to \frac{1}{160}\left(-2515-33\sqrt{5865}\right)\right\},\left\{x\to \frac{386}{2515+33\sqrt{5865}}\right\}\right\}$$

In[59]:=
```
A2 = {{10, 0, 0, 0}, {0, 8, 0, 0}, {0, 0, 2, 0}, {0, 0, 0, 1}};
C2 = {{0, 0, -1, 5}, {-1, 0, 3, 0}, {-1, 2, 0, -7}, {-3, -2, 8, 0}};
B2 = Inverse[A2].C2;
     逆
re = CharacteristicPolynomial[B2, x]
     (广义)特征多项式
Solve[re == 0]
解方程
r = Eigenvalues[B2]
    特征值
```

Out[62]=

$$-\frac{27}{80}+\frac{23\,x}{80}+\frac{1163\,x^2}{40}+x^4$$

Out[63]=

$$\left\{\left\{x\to \text{-0.113...}\right\},\left\{x\to \text{0.103...}\right\},\left\{x\to \text{4.94...}\times 10^{-3}-\text{5.39...}\,i\right\},\left\{x\to \text{4.94...}\times 10^{-3}+\text{5.39...}\,i\right\}\right\}$$

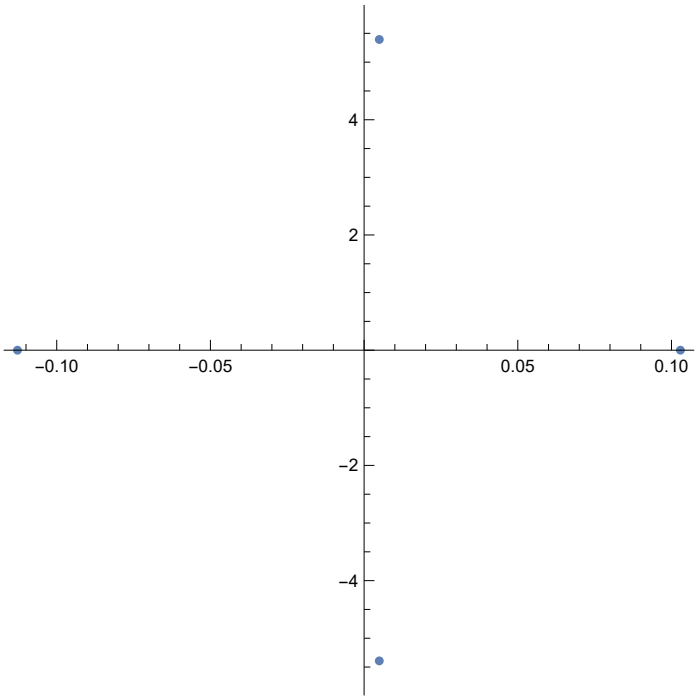
In[65]:=
```
N[{{x → Root[-27 + 23 #1 + 2326 #1^2 + 80 #1^4 &, 1, 0]},
数值运算 根
  {x → Root[-27 + 23 #1 + 2326 #1^2 + 80 #1^4 &, 2, 0]},
      根
  {x → Root[-27 + 23 #1 + 2326 #1^2 + 80 #1^4 &, 3, 0]},
      根
  {x → Root[-27 + 23 #1 + 2326 #1^2 + 80 #1^4 &, 4, 0]}}]
      根
```

Out[65]=

$$\{\{x\to -0.112772\},\{x\to 0.102891\},\{x\to 0.00494015-5.39321\,i\},\{x\to 0.00494015+5.39321\,i\}\}$$

In[53]:=
```
ListPlot[(Tooltip[{Re[#1], Im[#1]}] &) /@ r, AspectRatio → 1]
```
绘制点集 提示条 实部 虚部 宽高比

Out[53]=



EX3

In[70]:=
```
D3 = {{4, 0, 0}, {0, 4, 0}, {0, 0, 4}};
L3 = {{0, 0, 0}, {-1, 0, 0}, {-1, -1, 0}};
U3 = {{0, -1, -1}, {0, 0, -1}, {0, 0, 0}};
Lw = Inverse[D3 - w L3].((1 - w) D3 + w U3) // MatrixForm
```
逆 矩阵格式

Out[73]//MatrixForm=

$$\begin{pmatrix} 1-w & -\frac{w}{4} & -\frac{w}{4} \\ -\frac{1}{4}(1-w)w & 1-w+\frac{w^2}{16} & -\frac{w}{4}+\frac{w^2}{16} \\ \frac{1}{16}(1-w)\left(-4w+w^2\right) & -\frac{1}{4}(1-w)w-\frac{1}{64}w\left(-4w+w^2\right) & 1-w+\frac{w^2}{16}-\frac{1}{64}w\left(-4w+w^2\right) \end{pmatrix}$$

In[74]:=
```
b3 = {{4}, {-2}, {-2}};
f3 = w Inverse[D3 - w L3].b3 // MatrixForm
```
逆 矩阵格式

Out[75]//MatrixForm=

$$\begin{pmatrix} w \\ \left(-\frac{1}{2}-\frac{w}{4}\right)w \\ w\left(-\frac{1}{2}+\frac{w}{8}+\frac{1}{16}\left(-4w+w^2\right)\right) \end{pmatrix}$$

EX4

In[76]:=
```
D4 = {{15, 0, 0}, {0, 8, 0}, {0, 0, 20}};
L4 = {{0, 0, 0}, {3, 0, 0}, {-2, -1, 0}};
U4 = {{0, 3, -2}, {0, 0, -1}, {0, 0, 0}};
b4 = {{14}, {6}, {23}};
B4 = Inverse[D4 - L4].U4 // MatrixForm
     逆                  矩阵格式
fgs4 = Inverse[D4 - L4].b4 // MatrixForm
       逆                  矩阵格式
Lw4 = Inverse[D4 - w L4].((1 - w) D4 + w U4) // MatrixForm
      逆                                     矩阵格式

f4 = w Inverse[D4 - w L4].b4 // MatrixForm
     逆                    矩阵格式
```

Out[80]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{1}{5} & -\frac{2}{15} \\ 0 & \frac{3}{40} & -\frac{7}{40} \\ 0 & -\frac{19}{800} & \frac{53}{2400} \end{pmatrix}$$

Out[81]//MatrixForm=

$$\begin{pmatrix} \frac{14}{15} \\ \frac{11}{10} \\ \frac{601}{600} \end{pmatrix}$$

Out[82]//MatrixForm=

$$\begin{pmatrix} 1-w & \frac{w}{5} & -\frac{2w}{15} \\ \frac{3}{8}(1-w)w & 1-w+\frac{3w^2}{40} & -\frac{w}{8}-\frac{w^2}{20} \\ \frac{1}{160}(1-w)\left(-16w-3w^2\right) & -\frac{1}{20}(1-w)w+\frac{1}{800}w\left(-16w-3w^2\right) & 1-w+\frac{w^2}{160}-\frac{w\left(-16w-3w^2\right)}{1200} \end{pmatrix}$$

Out[83]//MatrixForm=

$$\begin{pmatrix} \frac{14w}{15} \\ \left(\frac{3}{4}+\frac{7w}{20}\right)w \\ w\left(\frac{23}{20}-\frac{3w}{80}+\frac{7\left(-16w-3w^2\right)}{1200}\right) \end{pmatrix}$$