

```

Pivot[A_, k_, l_] := Module[{B = A},
m = Dimensions[A][[1]]; n = Dimensions[A][[2]];
For[i = 1, i ≤ m, i++,
If[i == k,
B[[i]] = A[[i]] / A[[k, l]],
B[[i]] = -A[[i, l]] / A[[k, l]] * A[[k]] + A[[i]]
];
B
]

```

(*2.3: Exercise 22 *)

```

In[2]:= MatrixForm[A1 = {{1, 1, -1, 1, 1, 0, 0, 0, 3}, {2, -1, 1, -2, 0, 0, 1, 0, 2},
{3, 0, -1, 3, 0, -1, 0, 1, 2}, {-5, 1, 0, -1, 0, 1, 0, 0, -4}}]

```

Out[2]//MatrixForm=

$$\begin{pmatrix} 1 & 1 & -1 & 1 & 1 & 0 & 0 & 0 & 3 \\ 2 & -1 & 1 & -2 & 0 & 0 & 1 & 0 & 2 \\ 3 & 0 & -1 & 3 & 0 & -1 & 0 & 1 & 2 \\ -5 & 1 & 0 & -1 & 0 & 1 & 0 & 0 & -4 \end{pmatrix}$$

```

In[3]:= MatrixForm[A2 = Pivot[A1, 3, 1]]

```

Out[3]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & -\frac{2}{3} & 0 & 1 & \frac{1}{3} & 0 & -\frac{1}{3} & \frac{7}{3} \\ 0 & -1 & \frac{5}{3} & -4 & 0 & \frac{2}{3} & 1 & -\frac{2}{3} & \frac{2}{3} \\ 1 & 0 & -\frac{1}{3} & 1 & 0 & -\frac{1}{3} & 0 & \frac{1}{3} & \frac{2}{3} \\ 0 & 1 & -\frac{5}{3} & 4 & 0 & -\frac{2}{3} & 0 & \frac{5}{3} & -\frac{2}{3} \end{pmatrix}$$

```

In[4]:= MatrixForm[A3 = Pivot[A2, 2, 3]]

```

Out[4]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{3}{5} & 0 & -\frac{8}{5} & 1 & \frac{3}{5} & \frac{2}{5} & -\frac{3}{5} & \frac{13}{5} \\ 0 & -\frac{3}{5} & 1 & -\frac{12}{5} & 0 & \frac{2}{5} & \frac{3}{5} & -\frac{2}{5} & \frac{2}{5} \\ 1 & -\frac{1}{5} & 0 & \frac{1}{5} & 0 & -\frac{1}{5} & \frac{1}{5} & \frac{1}{5} & \frac{4}{5} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{pmatrix}$$

```

In[8]:= B0 = Drop[A3, None, {7, 8}];
B0[[4]] = {-2, 1, -1, 1, -1, 0, 0};
MatrixForm[B0]

```

Out[10]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{3}{5} & 0 & -\frac{8}{5} & 1 & \frac{3}{5} & \frac{13}{5} \\ 0 & -\frac{3}{5} & 1 & -\frac{12}{5} & 0 & \frac{2}{5} & \frac{2}{5} \\ 1 & -\frac{1}{5} & 0 & \frac{1}{5} & 0 & -\frac{1}{5} & \frac{4}{5} \\ -2 & 1 & -1 & 1 & -1 & 0 & 0 \end{pmatrix}$$

In[11]:= **B1 = B0; B1[[4]] = B0[[4]] + B0[[1]] + B0[[2]] + B0[[3]] * 2;**

MatrixForm[B1]

Out[12]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{3}{5} & 0 & -\frac{8}{5} & 1 & \frac{3}{5} & \frac{13}{5} \\ 0 & -\frac{3}{5} & 1 & -\frac{12}{5} & 0 & \frac{2}{5} & \frac{2}{5} \\ 1 & -\frac{1}{5} & 0 & \frac{1}{5} & 0 & -\frac{1}{5} & \frac{4}{5} \\ 0 & \frac{3}{5} & 0 & -\frac{13}{5} & 0 & \frac{3}{5} & \frac{23}{5} \end{pmatrix}$$

In[13]:= **MatrixForm[B2 = Pivot[B1, 3, 4]]**

Out[13]//MatrixForm=

$$\begin{pmatrix} 8 & -1 & 0 & 0 & 1 & -1 & 9 \\ 12 & -3 & 1 & 0 & 0 & -2 & 10 \\ 5 & -1 & 0 & 1 & 0 & -1 & 4 \\ 13 & -2 & 0 & 0 & 0 & -2 & 15 \end{pmatrix}$$

(*basic variables: x5, x3, x4 *)

(*coefficients: 1, 1, -1*)

(* z=2x1-x2+x3-x4+x5*)

In[27]:= **{1, 1, -1}.{8, 12, 5} - 2**

Out[27]=

13

In[17]:= **MatrixForm[A = {{1, 1, -1, 1, 1, 0, 3}, {2, -1, 1, -2, 0, 0, 2}, {3, 0, -1, 3, 0, 1, 2}}]**

Out[17]//MatrixForm=

$$\begin{pmatrix} 1 & 1 & -1 & 1 & 1 & 0 & 3 \\ 2 & -1 & 1 & -2 & 0 & 0 & 2 \\ 3 & 0 & -1 & 3 & 0 & 1 & 2 \end{pmatrix}$$

In[20]:= **MatrixForm[B = Transpose[{{1, 0, 0}, {-1, 1, -1}, {1, -2, 3}}]]**

Out[20]//MatrixForm=

$$\begin{pmatrix} 1 & -1 & 1 \\ 0 & 1 & -2 \\ 0 & -1 & 3 \end{pmatrix}$$

In[23]:= **Inverse[B].{3, 2, 2}**

Out[23]=

{9, 10, 4}