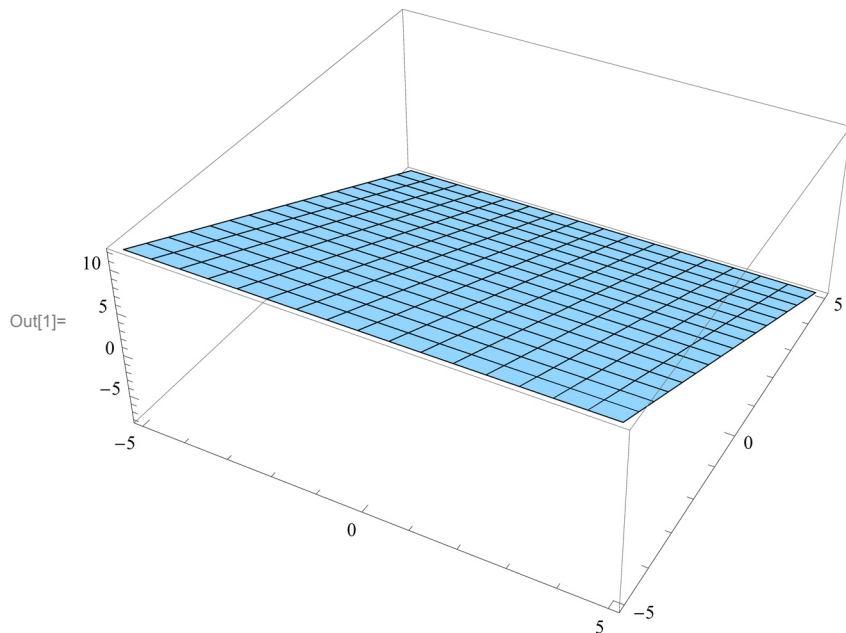


■ Lineare Gleichungssysteme

■ $2y + z = 2, \frac{1}{2}x + 3y = 2, 5x + 2z = 1$

In[1]:= `plot1 = Plot3D[Solve[2 y + z == 2, z][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]`



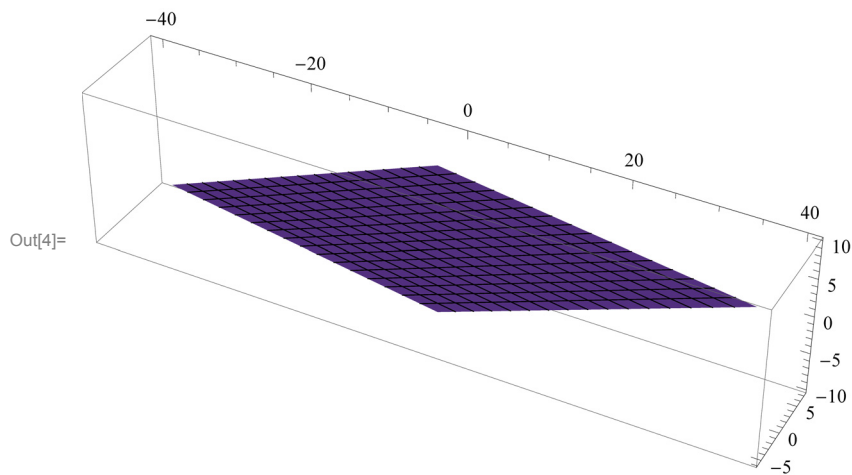
In[2]:= $\frac{1}{2}x + 3y = 2$

Out[2]= $\frac{x}{2} + 3y = 2$

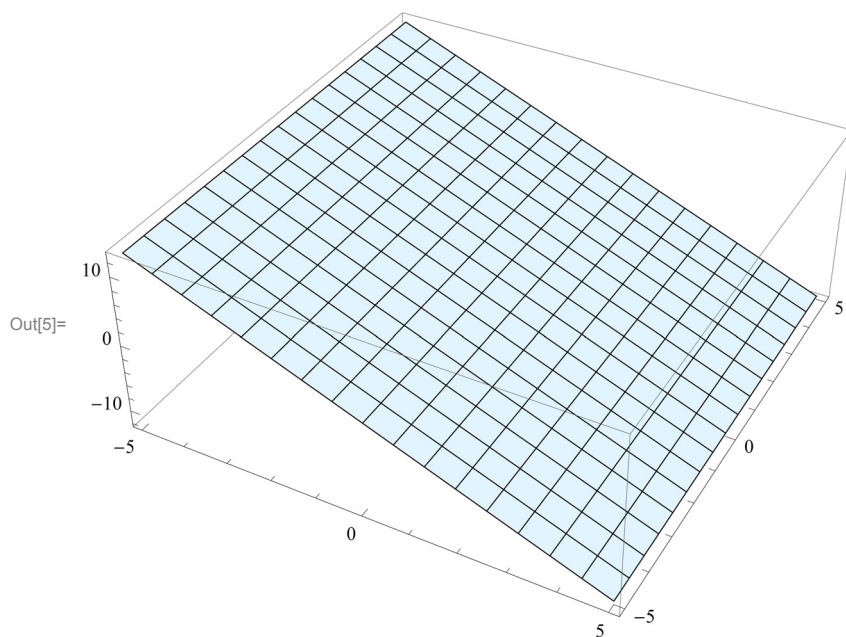
In[3]:= `par = {0, 2/3, 0} + r * ({2, 1/3, 0} - {0, 2/3, 0}) + s * ({2, 1/3, 1} - {0, 2/3, 0})`

Out[3]= $\left\{2r + 2s, -\frac{r}{3} - \frac{s}{3} + \frac{2}{3}, s\right\}$

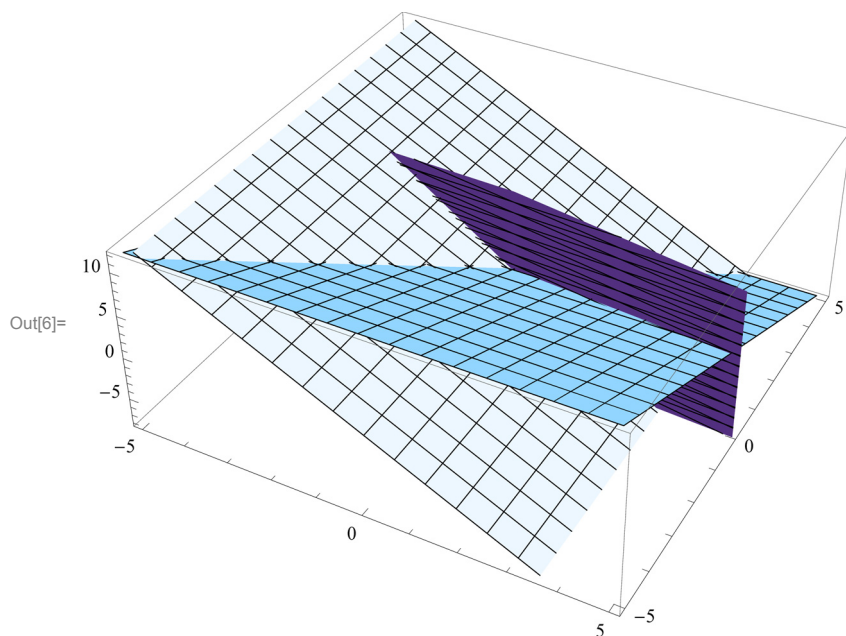
In[4]:= `plot2 = ParametricPlot3D[par, {r, -10, 10}, {s, -10, 10}]`



```
In[5]:= plot3 = Plot3D[Solve[5 x + 2 z == 1, z][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]
```



```
In[6]:= Show[plot1, plot2, plot3]
```

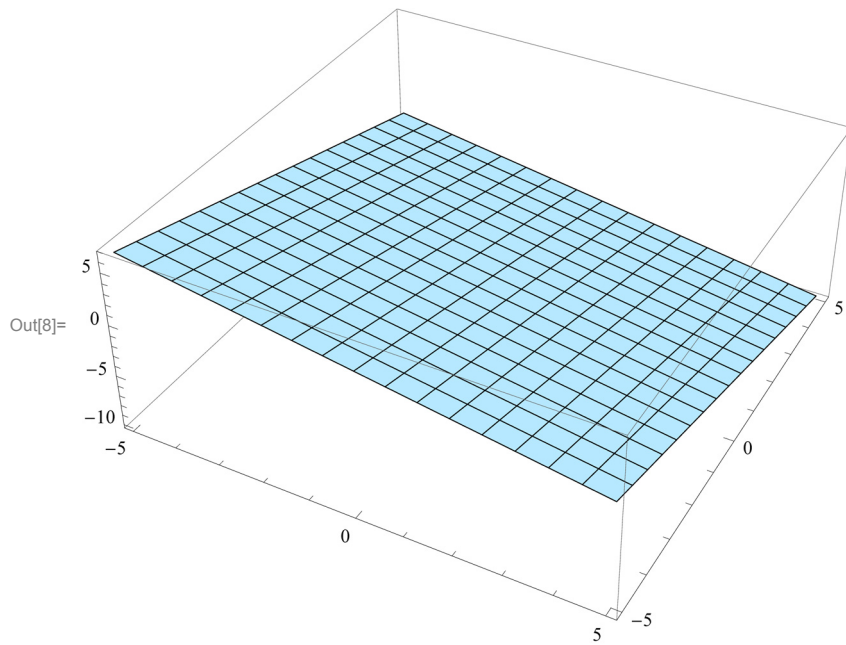


```
In[7]:= Solve[{2 y + z == 2, 1/2 x + 3 y == 2, 5 x + 2 z == 1}, {x, y, z}]
```

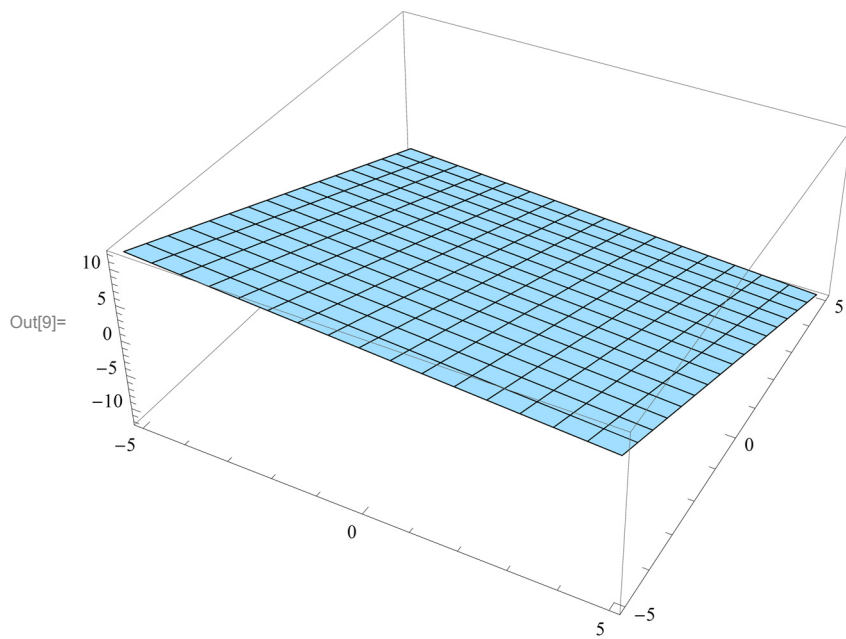
Out[7]= $\left\{ \left\{ x \rightarrow -\frac{1}{17}, y \rightarrow \frac{23}{34}, z \rightarrow \frac{11}{17} \right\} \right\}$

$$\blacksquare \quad 2x + 3y + 3z = -5, \quad x + 5y + \frac{5}{2}z = 0, \quad 7x + 21y + \frac{27}{2}z = -10$$

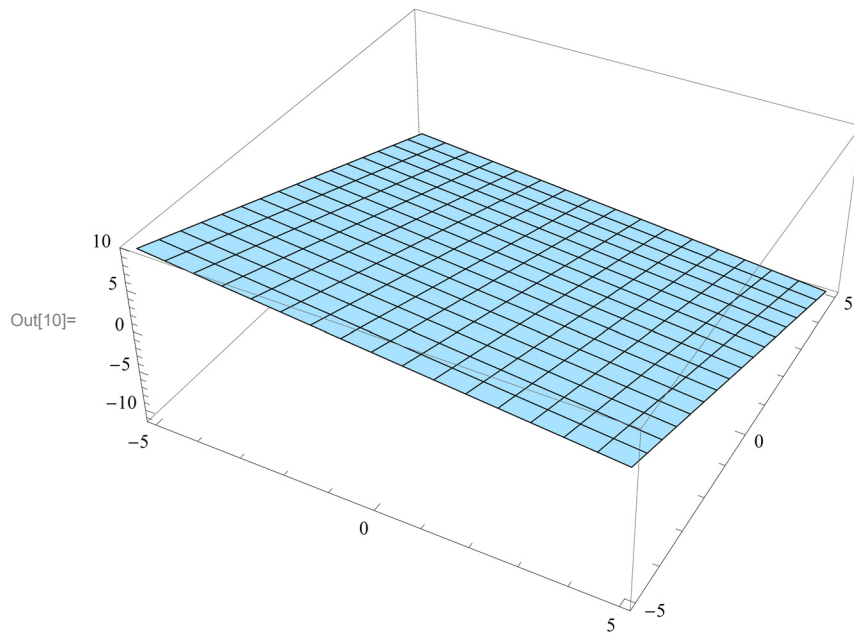
In[8]:= plot1 = Plot3D[Solve[$2x + 3y + 3z = -5$, z][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]



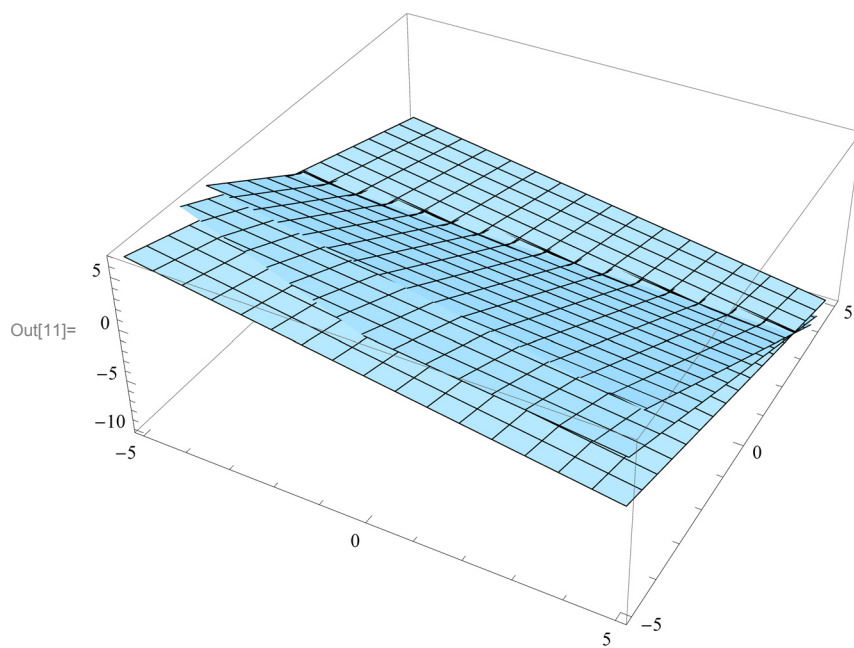
In[9]:= plot2 = Plot3D[Solve[$x + 5y + \frac{5}{2}z = 0$, z][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]



```
In[10]:= plot3 = Plot3D[Solve[7 x + 21 y +  $\frac{27}{2}$  z == -10, z][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]
```



```
In[11]:= Show[plot1, plot2, plot3]
```



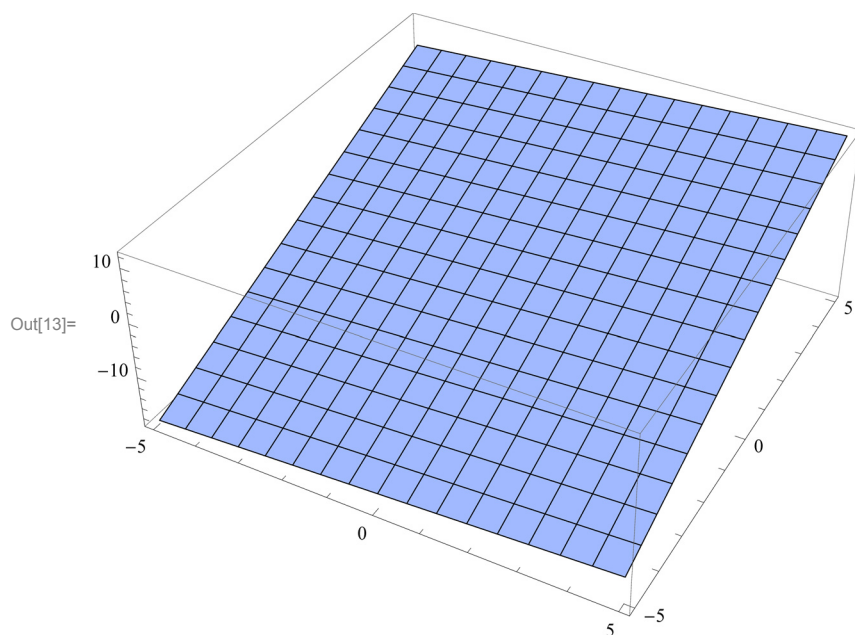
```
In[12]:= Solve[{2 x + 3 y + 3 z == -5, x + 5 y +  $\frac{5}{2}$  z == 0, 7 x + 21 y +  $\frac{27}{2}$  z == -10}, {x, y, z}]
```

Solve::svars : Equations may not give solutions for all "solve" variables. >>

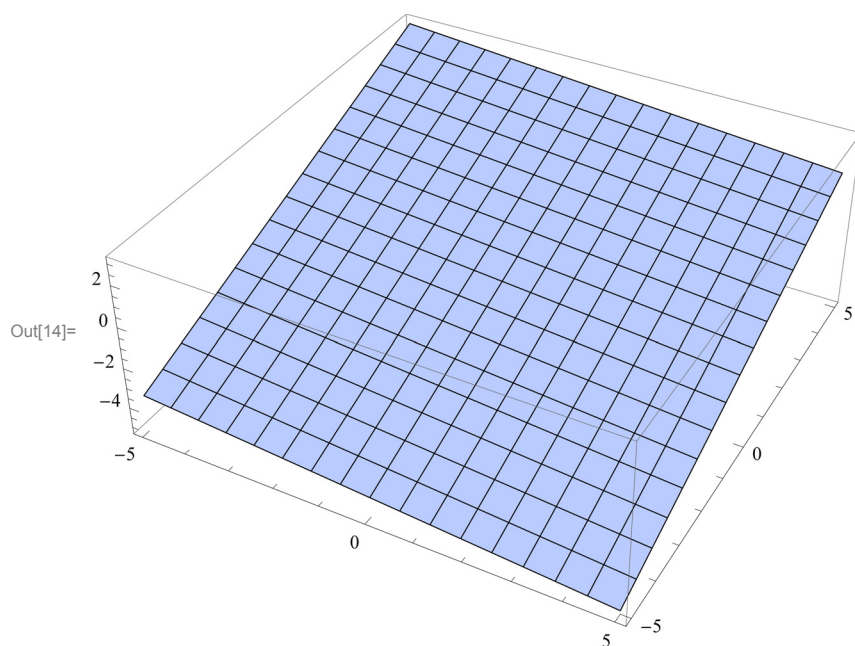
Out[12]= $\left\{ \left\{ y \rightarrow \frac{4x}{15} + \frac{5}{3}, z \rightarrow -\frac{14x}{15} - \frac{10}{3} \right\} \right\}$

$$\blacksquare \quad \frac{2}{3}x + 4y - \frac{3}{2}z = 5, \quad \frac{1}{2}x - 2y + 3z = -3, \quad \frac{7}{6}x + \frac{26}{3}y - 4z = -1$$

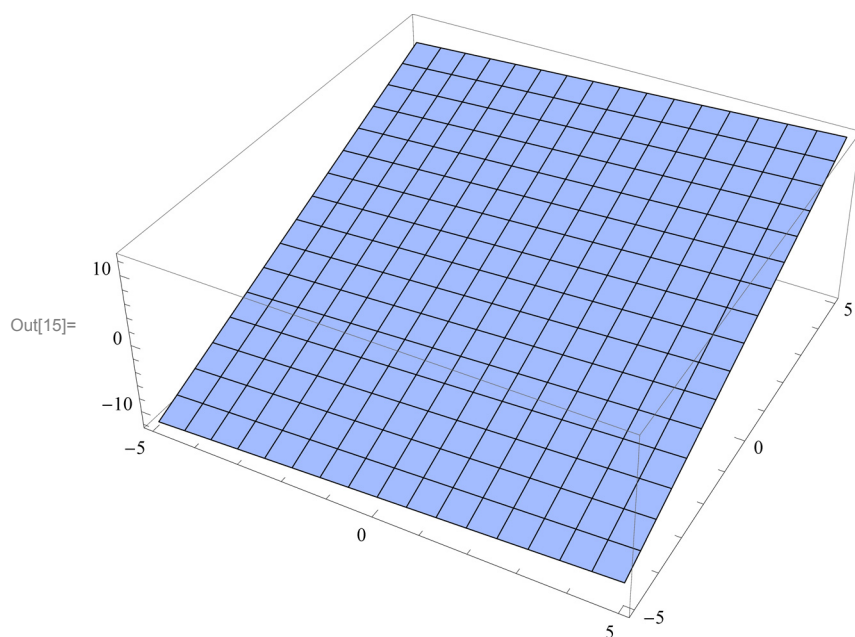
In[13]:= `plot1 = Plot3D[Solve[ $\frac{2}{3}x + 4y - \frac{3}{2}z = 5, z$ ][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]`



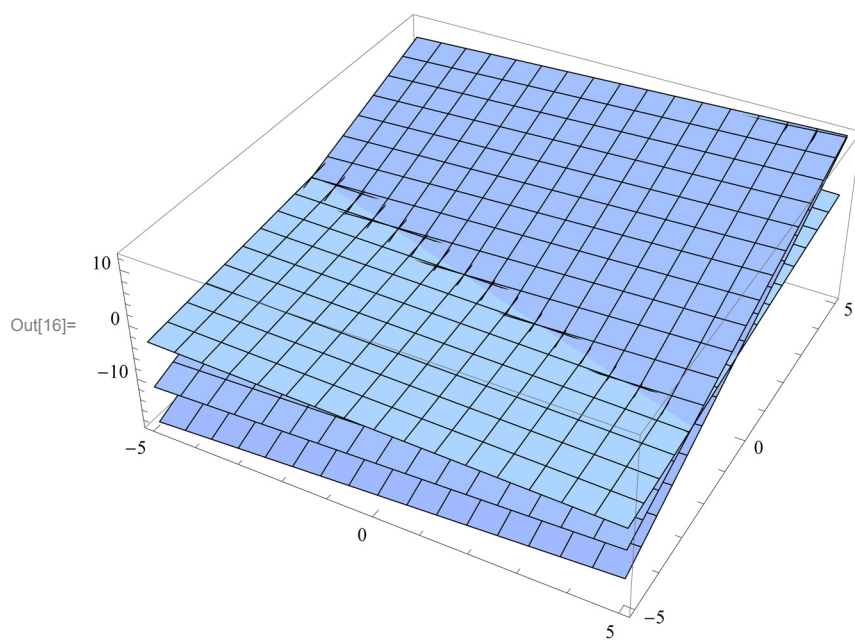
In[14]:= `plot2 = Plot3D[Solve[ $\frac{1}{2}x - 2y + 3z = -3, z$ ][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]`



```
In[15]:= plot3 = Plot3D[Solve[ $\frac{7}{6}x + \frac{26}{3}y - 4z == -1, z$ ][[1, 1, 2]], {x, -5, 5}, {y, -5, 5}]
```



```
In[16]:= Show[plot1, plot2, plot3]
```



```
In[17]:= Solve[ $\left\{ \frac{2}{3}x + 4y - \frac{3}{2}z == 5, \frac{1}{2}x - 2y + 3z == -3, \frac{7}{6}x + \frac{26}{3}y - 4z == -1 \right\}, \{x, y, z\}$ ]
```

Out[17]= {}

$$\blacksquare \begin{pmatrix} 2 & 1 & 3 & 0 & 2 \\ 3 & 0 & 1 & 1 & 1 \\ 1 & 2 & -2 & 0 & 5 \end{pmatrix} * \mathbf{x} = \begin{pmatrix} 2 \\ 0 \\ 2 \end{pmatrix}$$

In[18]:= **A** = {{2, 1, 3, 0, 2}, {3, 0, 1, 1, 1}, {1, 2, -2, 0, 5}}

$$\text{Out[18]} = \begin{pmatrix} 2 & 1 & 3 & 0 & 2 \\ 3 & 0 & 1 & 1 & 1 \\ 1 & 2 & -2 & 0 & 5 \end{pmatrix}$$

In[19]:= **b** = {{2}, {0}, {2}}

$$\text{Out[19]} = \begin{pmatrix} 2 \\ 0 \\ 2 \end{pmatrix}$$

In[20]:= **X** = {{**x**₁}, {**x**₂}, {**x**₃}, {**x**₄}, {**x**₅}}

$$\text{Out[20]} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{pmatrix}$$

In[21]:= **Solve[A.X == b, {x₁, x₂, x₃, x₄, x₅}]**

Solve::svars : Equations may not give solutions for all "solve" variables. >>

$$\text{Out[21]} = \left\{ \left\{ x_3 \rightarrow -\frac{8x_1}{19} - \frac{x_2}{19} + \frac{6}{19}, x_4 \rightarrow -\frac{42x_1}{19} + \frac{9x_2}{19} - \frac{16}{19}, x_5 \rightarrow -\frac{7x_1}{19} - \frac{8x_2}{19} + \frac{10}{19} \right\} \right\}$$

In[22]:= **special = LinearSolve[A, b]**

$$\text{Out[22]} = \begin{pmatrix} -\frac{2}{21} \\ \frac{4}{3} \\ \frac{2}{7} \\ 0 \\ 0 \end{pmatrix}$$

In[23]:= **kern = NullSpace[A]**

$$\text{Out[23]} = \begin{pmatrix} -3 & -14 & 2 & 0 & 7 \\ -8 & 7 & 3 & 21 & 0 \end{pmatrix}$$

In[24]:= **general = special + Transpose[kern] . {λ, μ}**

$$\text{Out[24]} = \begin{pmatrix} -3\lambda - 8\mu - \frac{2}{21} \\ -14\lambda + 7\mu + \frac{4}{3} \\ 2\lambda + 3\mu + \frac{2}{7} \\ 21\mu \\ 7\lambda \end{pmatrix}$$

In[25]:= **Solve[A.X == b, {x₁, x₂, x₃, x₄, x₅}]**

Solve::svars : Equations may not give solutions for all "solve" variables. >>

$$\text{Out[25]} = \left\{ \left\{ x_3 \rightarrow -\frac{8x_1}{19} - \frac{x_2}{19} + \frac{6}{19}, x_4 \rightarrow -\frac{42x_1}{19} + \frac{9x_2}{19} - \frac{16}{19}, x_5 \rightarrow -\frac{7x_1}{19} - \frac{8x_2}{19} + \frac{10}{19} \right\} \right\}$$