Step 1 of 2

Given system is $2x + 3y = 1$

$$10x + 9y = 11$$

Given system can be written matrix form as

$$\begin{pmatrix} 2 & 3 \\ 10 & 9 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 11 \end{pmatrix}$$

The augmented matrix is

$$\begin{pmatrix} 2 & 3 & 1 \\ 10 & 9 & 11 \end{pmatrix}$$

Provide feedback (0)

Step 2 of 2

Subtract $\frac{10}{2} = 5$ times the first row from the second row to get

$$\begin{pmatrix} \boxed{2} & 3 & 1 \\ 0 & \boxed{-6} & 6 \end{pmatrix}$$

which is upper triangular system $2x + 3y = 1$

$$-6y = 6$$

Therefore the multiple $\boxed{l = 5}$ and the pivots are $\boxed{2, -6}$.

Provide feedback (0)

CH1.3 1P
CH1.3 3P

Step 1 of 4

Given system is $2x + 3y = 1$

$$10x + 9y = 11$$

Given system can be written matrix form as

$$\begin{pmatrix} 2 & 3 \\ 10 & 9 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 11 \end{pmatrix}$$

The augmented matrix is

$$\begin{pmatrix} 2 & 3 & 1 \\ 10 & 9 & 11 \end{pmatrix}$$

Provide feedback (0)

Step 2 of 4

Subtract $\frac{10}{2} = 5$ times the first row from the second row to get

$$\begin{pmatrix} \boxed{2} & 3 & 1 \\ 0 & \boxed{-6} & 6 \end{pmatrix}$$ which is an upper triangular system

$$2x + 3y = 1$$
$$-6y = 6$$

By back-substitution $-6y = 6$

$$\Rightarrow y = -1$$

And $2x + 3(-1) = 1$

$$\Rightarrow x = 2$$

Hence the solution is $\boxed{(2,-1)}$

Provide feedback (0)

Step 3 of 4

Verification:-

Hence the solution is $\boxed{(2,-1)}$

Provide feedback (0)

Step 3 of 4

Verification:-
Put $x=2, y=-1$ in the given system

$$2x+3y=2(2)+3(-1)$$
$$=1$$
$$10x+9y=10(2)+9(-1)$$
$$=11$$

Hence x times $(2,10)$ plus y times $(3,9)$ equals $(1,11)$.

Provide feedback (0)

Step 4 of 4

If right-hand side changes to $(4,44)$, then the augmented matrix is

$$\begin{pmatrix} 2 & 3 & 4 \\ 10 & 9 & 44 \end{pmatrix}$$

Subtract '5' times the first row from the second row

$$\begin{pmatrix} \boxed{2} & 3 & 4 \\ 0 & \boxed{-6} & 24 \end{pmatrix}$$

which is upper triangular system $2x+3y=4$
$$-6y=24$$

By back-substitution, we have $-6y=24$
$$\Rightarrow y=-4$$

And $2x+3(-4)=4$
$$\Rightarrow x=8$$

Hence the solution is $\boxed{(8,-4)}$

Chapter: CH1.3 Problem: 3P

show all steps

CH1.3 2P

CH1.3 4P

Step 1 of 4

Given system is $2x-4y=6$
$-x+5y=0$

Given system can be written as

$$\begin{pmatrix} 2 & -4 & 6 \\ -1 & 5 & 0 \end{pmatrix}$$

Subtract '$\frac{-1}{2}$' times the first row from the second row to get

$$\begin{pmatrix} 2 & -4 & 6 \\ 0 & 3 & 3 \end{pmatrix}$$ which is an upper triangular system.

Therefore the multiple is $\boxed{l=\frac{-1}{2}}$.

Provide feedback (0)

Step 2 of 4

The linear system of above is $2x-4y=6$
$3y=3$

By back-substitution, we have $3y=3$
$\Rightarrow y=1$

And $2x-4(1)=6$
$\Rightarrow x=5$

Hence the solution is $\boxed{(5,1)}$

Provide feedback (0)

Step 3 of 4

If right hand side changes sign, then the system becomes

$2x-4y=-6$

$\Rightarrow y = 1$

And $2x - 4(1) = 6$

$\Rightarrow x = 5$

Hence the solution is $\boxed{(5,1)}$

Provide feedback (0)

Step 3 of 4

If right hand side changes sign, then the system becomes

$2x - 4y = -6$

$-x + 5y = 0$

The system can be written as $\begin{pmatrix} 2 & -4 & -6 \\ -1 & 5 & 0 \end{pmatrix}$

Subtract '$\frac{-1}{2}$' times the first row from the second row to get

$\begin{pmatrix} 2 & -4 & -6 \\ 0 & 3 & -3 \end{pmatrix}$ which is an upper triangular system.

Provide feedback (0)

Step 4 of 4

By back-substitution, we have $3y = -3$

$\Rightarrow y = -1$

And $2x - 4y = -6$

$\Rightarrow 2x + 4 = -6$

$\Rightarrow x = -5$

Hence the solution is $\boxed{(-5,-1)}$.

Hence if the right-hand side of the system changes sign, so does the solution.

Provide feedback (0)

CH1.3 3P

CH1.3 5P

Step 1 of 3

Given system is $ax+by=f$
$cx+dy=g$

Given system can be written as

$$\begin{pmatrix} a & b & f \\ c & d & g \end{pmatrix}.$$

Subtract '$\frac{c}{a}$' times the first row from the second row to get

$$\begin{pmatrix} a & b & f \\ 0 & \frac{ad-bc}{a} & \frac{ag-fc}{a} \end{pmatrix}$$ which is upper triangular form.

Therefore multiple is $\boxed{l=\frac{c}{a}}$ and the pivots are $\boxed{a,\ \frac{ad-bc}{a}}$ (if $ad\neq bc$).

Provide feedback (0)

Step 2 of 3

The linear system of above is

$ax+by=f$

$$\left(\frac{ad-bc}{a}\right)y+\left(\frac{ag-fc}{a}\right)=0$$

By back-substitution, we have

$$\left(\frac{ad-bc}{a}\right)y=\left(\frac{fc-ag}{a}\right)$$

$$\Rightarrow y=\frac{fc-ag}{a}\cdot\frac{a}{ad-bc}$$

$$\Rightarrow \boxed{y=\frac{fc-ag}{ad-bc}} \text{ provided } a\neq 0, ad-bc\neq 0$$

Provide feedback (1)

$$\begin{pmatrix} a & b & f \\ 0 & \dfrac{ad-bc}{a} & \dfrac{ag-fc}{a} \end{pmatrix}$$ which is upper triangular form.

Therefore multiple is $\boxed{l = \frac{c}{a}}$ and the pivots are $\boxed{a, \frac{ad-bc}{a}}$ $(\text{if } ad \neq bc)$.

Provide feedback (0)

Step 2 of 3

The linear system of above is

$ax + by = f$

$\left(\dfrac{ad-bc}{a}\right)y + \left(\dfrac{ag-fc}{a}\right) = 0$

By back-substitution, we have

$\left(\dfrac{ad-bc}{a}\right)y = \left(\dfrac{fc-ag}{a}\right)$

$\Rightarrow y = \dfrac{fc-ag}{a} \cdot \dfrac{a}{ad-bc}$

$\Rightarrow \boxed{y = \dfrac{fc-ag}{ad-bc}}$ provided $a \neq 0, ad-bc \neq 0$

Provide feedback (1)

Step 3 of 3

If $ad - bc = 0$,then the second pivot becomes

$\dfrac{ad-bc}{a} = \dfrac{0}{a} = 0$

i.e. The second pivot is missing when $ad - bc = 0$.

Provide feedback (0)

Chapter: CH1.3 Problem: 5P show all steps

CH1.3 4P

CH1.3 6P

Step 1 of 3

We have to choose a right-hand side which gives no solution, and another right hand-side which gives infinitely many solutions, and we have to find two of those solutions:

$3x+2y=10$

$6x+4y=$ __

Provide feedback (0)

Step 2 of 3

If we choose the right hand side as 21, then the system has no solution.

Because by row operation $R_2 \to R_2 - 2R_1$, it leads to $0=1$,which is absurd.

So the system has no solution, if we take the right-hand side as $\boxed{21}$

Provide feedback (0)

Step 3 of 3

If we choose the right hand side as $\boxed{20}$ then the system has infinitely many solutions

Because they are parallel planes

For instance,

$3x+2y=10$

$6x+4y=20$

By inspection, the two solutions of the system are $\boxed{(2, 2) \text{ and } (0, 5).}$

Provide feedback (0)

Chapter: CH1.3 Problem: 6P show all steps

CH1.3 5P

CH1.3 7P

Step 1 of 3

Given system is

$$2x + by = 16$$

$$4x + 8y = g$$

We have to choose a coefficient b that makes this system singular, and we have to choose a right-hand side g that makes it solvable, and then we have to find two solutions in that singular case.

Provide feedback (0)

Step 2 of 3

If we choose b as $\boxed{4}$ and g as $\boxed{16}$, then the system is solvable, and in that case it is singular.

$$2x + 4y = 16$$

$$4x + 8y = 16$$

The column picture for this system as follows:

The row form of the system as follows:

$$\begin{bmatrix} 2 & 4 \\ 4 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 16 \\ 16 \end{bmatrix}$$

Provide feedback (1)

Step 3 of 3

By performing the row operation $R_2 \to R_2 - 2R_1$, we get

$$\begin{bmatrix} 2 & 4 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 16 \\ 0 \end{bmatrix}$$

$$\Rightarrow 2x + 4y = 16$$

By inspection, we have two solutions as $\boxed{(4, 2) \text{ and } (0, 4)}$

CH1.3 6P

CH1.3 8P

Step 1 of 3

Given system is $ax + 3y = -3$

$$4x + 6y = 6$$

Given system can be written as

$$\begin{pmatrix} a & 3 & -3 \\ 4 & 6 & 6 \end{pmatrix}$$

Provide feedback (0)

Step 2 of 3

(a)

Subtract ' 4 ' times the first row from ' a ' times the second row

$$\begin{pmatrix} a & 3 & -3 \\ 0 & 6a-12 & 6a-12 \end{pmatrix}$$

If $6a - 12 = 0$ i.e. $a = 2$, then we cannot proceed for the elimination.

Hence, the system has no solution.

Therefore $\boxed{\text{the elimination breaks down permanently when } a = 2}$.

Provide feedback (0)

Step 3 of 3

(b)

If $a = 0$, then

$$\begin{pmatrix} a & 3 & -3 \\ 4 & 6 & 6 \end{pmatrix} = \begin{pmatrix} 0 & 3 & -3 \\ 4 & 6 & 6 \end{pmatrix}$$

If we exchange the rows then only we can proceed for the elimination.

So we have $\begin{pmatrix} 4 & 6 & 6 \\ 0 & 3 & -3 \end{pmatrix}$

Step 2 of 3

(a)

Subtract '4' times the first row from 'a' times the second row

$$\begin{pmatrix} a & 3 & -3 \\ 0 & 6a-12 & 6a-12 \end{pmatrix}$$

If $6a-12=0$ i.e. $a=2$, then we cannot proceed for the elimination.
Hence, the system has no solution.
Therefore $\boxed{\text{the elimination breaks down permanently when } a=2}$.

Provide feedback (0)

Step 3 of 3

(b)

If $a=0$, then

$$\begin{pmatrix} a & 3 & -3 \\ 4 & 6 & 6 \end{pmatrix} = \begin{pmatrix} 0 & 3 & -3 \\ 4 & 6 & 6 \end{pmatrix}$$

If we exchange the rows then only we can proceed for the elimination.

So we have $\begin{pmatrix} 4 & 6 & 6 \\ 0 & 3 & -3 \end{pmatrix}$

By back ward substitution, we have

$3y=-3$

$\Rightarrow \boxed{y=-1}$

And $4x+6y=6$

$\Rightarrow 4x-6=6$

$\Rightarrow 4x=12$

$\Rightarrow \boxed{x=3}$

So $\boxed{\text{if } a=0 \text{, elimination stops for a row exchange and the solution is } (3,-1)}$.

Provide feedback (0)

Chapter: CH1.3 Problem: 8P

show all steps

CH1.3 7P

CH1.3 9P

Step 1 of 4

We have to find that for which three numbers k does elimination break down , which is fixed by a row exchange, and also we have to find that, in each case is the number of solutions 0 or 1 or ∞:

$$kx+3y=6$$

$$3x+ky=-6$$

Provide feedback (0)

Step 2 of 4

When $k=3$ then the system has no solution since when $k=3$ the lines becomes

$$3x+3y=6$$

$$3x+3y=-6$$

This is impossible.

$\boxed{\text{So the number solutions of the system is 0 if } k=3}$

Provide feedback (1)

Step 3 of 4

When $k=1$ then the system has unique solution since when $k=1$ the lines becomes

$$x+3y=6$$

$$3x+y=-6$$

By elimination of second row, since 1 is pivot and by performing (row 2) $-$ 3(times row1) gives

$$x+3y=6$$

$$-8y=-24$$

By solving the above two equations gives the solution as $(-3,3)$

$\boxed{\text{So the system has unique solution when } (-3,3) \text{ when } k=1.}$

This is impossible.

$\boxed{\text{So the number solutions of the system is 0 if } k=3}$

Provide feedback (1)

Step 3 of 4

When $k=1$ then the system has unique solution since when $k=1$ the lines becomes

$$x+3y=6$$

$$3x+y=-6$$

By elimination of second row, since 1 is pivot and by performing (row 2) – 3(times row1) gives

$$x+3y=6$$

$$-8y=-24$$

By solving the above two equations gives the solution as $(-3,3)$

$\boxed{\text{So the system has unique solution when } (-3,3) \text{ when } k=1.}$

Provide feedback (1)

Step 4 of 4

When $k=-3$, the system has infinitely many solution since when $k=-3$ the lines becomes

$$-3x+3y=6$$

$$3x-3y=-6$$

By adding equation 1 + equation 2 becomes 0=0 and hence we get only equation as

$$-3x+3y=6$$

$\boxed{\text{So the system has infinitely many solutions, when } k=-3}$

Provide feedback (0)

Step 1 of 3

Given two equations are

$3x - 2y = b_1$

$6x - 4y = b_2$

We have to find that what relation between b_1 and b_2 will give the solution for the system and we have to find that how many of solutions the system has. And we have to draw the column picture for this.

Provide feedback (0)

Step 2 of 3

We can observe that $6x-4y$ is 2 times of $3x-2y$, therefore if $b_2 = 2b_1$ then the system becomes as only one equation. So that in this case the system has infinite number of solutions.

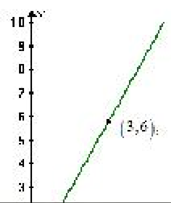
The column form for the system is

$$x\begin{pmatrix}3\\6\end{pmatrix}+y\begin{pmatrix}-2\\-4\end{pmatrix}=\begin{pmatrix}b_1\\2b_1\end{pmatrix}$$

Provide feedback (0)

Step 3 of 3

The column picture for this system is as follows:



Chapter: CH1.3 Problem: 9P show all steps

Step 2 of 3

We can observe that $6x-4y$ is 2 times of $3x-2y$, therefore if $b_2 = 2b_1$ then the system becomes as only one equation. So that in this case the system has infinite number of solutions.

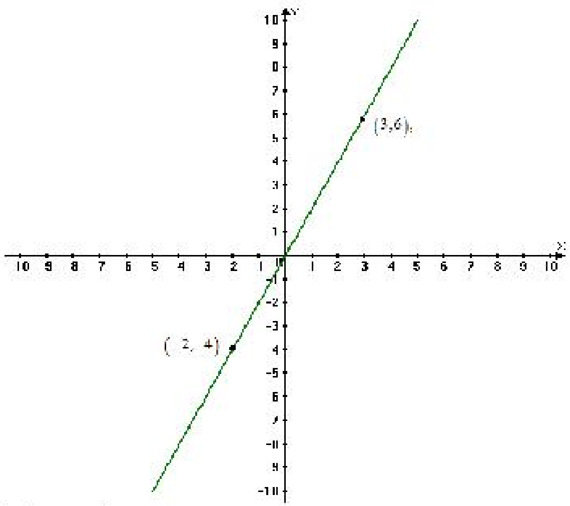
The column form for the system is

$$x\begin{pmatrix}3\\6\end{pmatrix}+y\begin{pmatrix}-2\\-4\end{pmatrix}=\begin{pmatrix}b_1\\2b_1\end{pmatrix}$$

Provide feedback (0)

Step 3 of 3

The column picture for this system is as follows:



The columns $(3,6),(-2,-4)$ are lies on the same line.

Provide feedback (0)

CH1.3 9P

CH1.3 11P

Step 1 of 3

Given system is $2x+3y+z=8$

$$4x+7y+5z=20$$
$$-2y+2z=0$$

We have to reduce this system to upper triangular form by two row operations and then solve by back-substitution for z, y, x.

Step 2 of 3

Given system can be written as

$$\begin{pmatrix} 2 & 3 & 1 & 8 \\ 4 & 7 & 5 & 20 \\ 0 & -2 & 2 & 0 \end{pmatrix}$$

Subtract '2' times the row 1 from the row 2

$$\sim \begin{pmatrix} 2 & 3 & 1 & 8 \\ 0 & 1 & 3 & 4 \\ 0 & -2 & 2 & 0 \end{pmatrix}$$

Subtract '-2' times the row 2 from the row 3.

$$\sim \begin{pmatrix} 2 & 3 & 1 & 8 \\ 0 & 1 & 3 & 4 \\ 0 & 0 & 8 & 8 \end{pmatrix}$$

which is upper triangular form.

The pivots are circled in $\begin{pmatrix} \boxed{2} & 3 & 1 & 8 \\ 0 & \boxed{1} & 3 & 4 \\ 0 & 0 & \boxed{8} & 8 \end{pmatrix}$

That is 2, 1, 8.

Subtract '-2' times the row 2 from the row 3.

$$\sim\begin{pmatrix} 2 & 3 & 1 & 8 \\ 0 & 1 & 3 & 4 \\ 0 & 0 & 8 & 8 \end{pmatrix}$$

which is upper triangular form.

The pivots are circled in $\begin{pmatrix} \boxed{2} & 3 & 1 & 8 \\ 0 & \boxed{1} & 3 & 4 \\ 0 & 0 & \boxed{8} & 8 \end{pmatrix}$

That is 2, 1, 8.

Step 3 of 3

Back ward substitution:-

We have $2x+3y+z=8$

$$y+3z=4$$

$$8z=8$$

$$8z=8 \Rightarrow \boxed{z=1}$$

$y+3z=4$

$\Rightarrow y+3(1)=4$

$\Rightarrow \boxed{y=1}$

And $2x+3y+z=8$

$\Rightarrow 2x+3(1)+1=8$

$\Rightarrow \boxed{x=2}$

Hence the solution is $\boxed{x=2, y=1, z=1}$

Chapter: CH1.3 Problem: 11P

show all steps

CH1.3 10P

CH1.3 12P

Step 1 of 5

Given system is $2x-3y=3$

$$4x-5y+z=7$$

$$2x-y-3z=5$$

We have to solve this system by applying elimination and back-substitution.

Provide feedback (0)

Step 2 of 5

Given system can be written as

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

Subtract '2' times the row 1 from the row 2 ... (1)

Subtract '1' time the row 1 from the row 3 ... (2)

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

Subtract '2' times the row 2 from the row 3 ... (3)

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

which is upper triangular form.

The pivots are circled in $\begin{pmatrix} \boxed{2} & -3 & 0 & 3 \\ 0 & \boxed{1} & 1 & 1 \\ 0 & 0 & \boxed{-5} & 0 \end{pmatrix}$

That is $\boxed{2, 1, -5}$.

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Chapter: CH1.3 Problem: 11P show all steps

Step 3 of 5

Back ward substitution:-
From above upper triangular form, we have

$$2x-3y=3$$
$$y+z=1$$
$$-5z=0$$

$-5z=0 \Rightarrow \boxed{z=0}$

Provide feedback (0)

Step 4 of 5

$y+z=1$

$\Rightarrow y+0=1$

$\Rightarrow \boxed{y=1}$

$2x-3y=3$

$\Rightarrow 2x-3(1)=3$

$\Rightarrow \boxed{x=3}$

Hence the solution is $\boxed{x=3, y=1, z=0}$

Provide feedback (0)

Step 5 of 5

Operations are

(i) Subtract '2' times the row 1 from the row 2
(ii) Subtract '1' time the row 1 from the row 3 and
(iii) Subtract '2' times the row 2 from the row 3

Provide feedback (0)

CH1.3 11P

We have to find that which number d forces a row exchange and we have to find the triangular system (not singular) for that d. And we have to find that which d makes this system as singular (no third pivot):

$$2x+5y+z=0$$
$$4x+dy+z=2$$
$$y-z=3$$

CH1.3 13P

Step 2 of 3

If $d=10$ then the system is

$$2x+5y+z=0$$
$$4x+10y+z=2$$
$$y-z=3$$

By applying (row 2) – 2 (row 1) to eliminate second pivot gives

$$2x+5y+z=0$$
$$-z=2$$
$$y-z=3$$

$\boxed{\text{So if } d=10 \text{ then the system requires row exchange}}$.

Step 3 of 3

To convert it into triangular system, we exchange of 2nd and 3rd row in the above system.

$$2x+5y+z=0$$
$$y-z=3$$
$$z=-2$$

This is the required triangular system.

$\boxed{\text{If } d=11 \text{ then we can observe that the system becomes singular without third pivot}}$

CH1.3 12P

CH1.3 14P

Step 1 of 4

We have to find that which number b leads later to a row exchange, which number b leads to a missing pivot, and in that singular case we have to find a non-zero solution x, y, z:

$$x + by = 0$$
$$x - 2y - z = 0$$
$$y + z = 0$$

Provide feedback (0)

Step 2 of 4

After eliminating first pivot when applying (row2) – (row 1) the second pivot position will contain $-2-b$

If $b = -2$, we exchange with row 3 since the system is

$$\begin{aligned} x - 2y \quad &= 0 \\ x - 2y - z &= 0 \\ y + z &= 0 \end{aligned}$$

$\boxed{\text{So we can exchange row 3 if } b = -2}$

Provide feedback (0)

Step 3 of 4

If $b = -1$, the second equation is $-y - z = 0$. And the system is

$$\begin{aligned} x - y \quad &= 0 \\ x - 2y - z &= 0 \\ y + z &= 0 \end{aligned}$$

Performing (row 2) – (row1) gives

$$x - y \quad = 0$$

After eliminating first pivot when applying (row2) − (row 1) the second pivot position will contain $-2-b$

If $b=-2$, we exchange with row 3 since the system is

$$\begin{aligned} x-2y \quad &= 0 \\ x-2y-z &= 0 \\ y+z &= 0 \end{aligned}$$

$\boxed{\text{So we can exchange row 3 if } b=-2}$

Provide feedback (0)

Step 3 of 4

If $b=-1$, the second equation is $-y-z=0$. And the system is

$$\begin{aligned} x-y \quad &= 0 \\ x-2y-z &= 0 \\ y+z &= 0 \end{aligned}$$

Performing (row 2) − (row1) gives

$$\begin{aligned} x-y \quad &= 0 \\ -y-z &= 0 \\ y+z &= 0 \end{aligned}$$

Provide feedback (0)

Step 4 of 4

Adding (row 3) + (row 2) give

$$\begin{aligned} x-y \quad &= 0 \\ -y-z &= 0 \end{aligned}$$

To solving these equations by letting $x=y=1$, one of the solutions is $\boxed{(1,1,-1)}$

Provide feedback (0)

CH1.3 13P

CH1.3 15P

Step 1 of 3

(a) We have to construct a 3 by 3 system that needs two row exchanges to reach a triangular form and a solution.
Let the required 3 by 3 system be

$$x+y+2z = 2$$
$$x+y+z = 4$$
$$x+2y+z = 1$$

Provide feedback (0)

Step 2 of 3

First to eliminate x and y we use first and second row then the first row contain only z and then to eliminate x and z use second and third, the third row contain only y for the solution.
So this system requires two row exchanges for solution.

Provide feedback (1)

Step 3 of 3

(b) We have to construct a 3 by 3system that needs a row exchange to keep going, but breaks down the later.
Let the required 3 by 3 system be

$$y+z = 2$$
$$x+y+z = 4$$
$$3y+3z = 6$$

If we perform the row operation (row2)-(row1), we get the value $x=2$, but we can't find directly y or z from the third equation and with this value.
So the above system needs row exchange but breaks down the later.

Provide feedback (0)

Chapter: CH1.3 Problem: 15P

show all steps

CH1.3 14P

CH1.3 16P

Step 1 of 2

If rows 1 and 2 are the same, then we have to find that how far we can get with elimination (allowing row exchange). If columns 1 and 2 are the same, then we have to find that which pivot is missing:

$$\begin{array}{ll} 2x-y+z=0 & 2x+2y+z=0 \\ 2x-y+z=0 & 4x+4y+z=0 \\ 4x+y+z=2 & 6x+6y+z=2 \end{array}$$

Provide feedback (0)

Step 2 of 2

If row $1=$ row 2 then row 2 becomes 0 after the first step because both rows are equal.
Now exchange the zero rows with row 3 and there is no third pivot.
If column $1=$ column2 there no second pivot after elimination.

Provide feedback (0)

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Chapter: CH1.3 Problem: 16P

show all steps

CH1.3 15P

CH1.3 17P

Step 1 of 4

We have to construct a 3 by 3 system that has 9 different coefficients on the left-hand side, but rows 2 and 3 become zero in elimination. And we have to find that how many solutions to our system with $b=(1,10,100)$ and how many with $b=(0,0,0)$

Provide feedback (0)

Step 2 of 4

Let the required 3 by 3 system be

$$x+2y+3z \quad =1$$
$$4x+8y+12z=4$$
$$5x+10y+15z=5$$

The above system has 9 different coefficients in the left hand side. By performing row 2 − 4 times row 1 and row 3 − 5 times row 1, row 2 and row 3 will be eliminated.

Provide feedback (0)

Step 3 of 4

When $b=(1,10,100)$, then the system has no solution because after elimination it leads to $0=6$, this is absurd, so there is no solution.

Provide feedback (0)

Step 4 of 4

When $b=(0,0,0)$, then the system has infinite solutions since after elimination of row2 and row 3, we get a single row as $x+2y+3z=0$.

Provide feedback (0)

Chapter: CH1.3 Problem: 17P

show all steps

CH1.3 16P

CH1.3 18P

Step 1 of 4

Given equations are

$$x+4y-2z=1$$
$$x+7y-6z=6$$
$$3y+qz=t$$

We have to find that which number q makes this system singular and which right-hand side t give it infinitely many solutions. Also we have to find the solution that has $z=1$

Provide feedback (0)

Step 2 of 4

Performing row 2 − row1 gives

$$x+4y-2z=1$$
$$3y-4z=5$$
$$3y+qz=t$$

Now performing row3 − row 2 gives

$$x+4y-2z=1$$
$$3y-4z=5$$
$$(q+4)z=t-5$$

Provide feedback (0)

Step 3 of 4

When $q+4=0$ then $\boxed{q=-4}$, the system is singular – no third pivot, then if $\boxed{t=5}$, the third equation is $0=0$.

So we have two equations in three variables, hence the system has infinite number of solutions.

Chapter: CH1.3 Problem: 17P show all steps

Provide feedback (0)

Step 2 of 4

Performing row 2 − row1 gives

$$x+4y-2z=1$$
$$3y-4z=5$$
$$3y+qz=t$$

Now performing row3 − row 2 gives

$$x+4y-2z=1$$
$$3y-4z=5$$
$$(q+4)z=t-5$$

Provide feedback (0)

Step 3 of 4

When $q+4=0$ then $\boxed{q=-4}$, the system is singular – no third pivot, then if $\boxed{t=5}$, the third equation is $0=0$.

So we have two equations in three variables, hence the system has infinite number of solutions.

Provide feedback (0)

Step 4 of 4

Choose $z=1$, the equation $3y-4z=5$ gives $y=3$ and equation 1 gives $x=-9$

Therefore one of the solutions is $\boxed{(-9,3,1)}$

Provide feedback (0)

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Chapter: CH1.3 Problem: 18P

show all steps

CH1.3 17P

CH1.3 19P

Step 1 of 2

Recall the fact that, a system of n linear equations represented by the matrix form

$AX = B$ has the following conditions:

(i) a unique solution if $\operatorname{rank}(A) = \operatorname{rank}[A \mid B] = n$

(ii) infinitely many solutions if $\operatorname{rank}(A) = \operatorname{rank}[A \mid B] < n$

(iii) no solution if $\operatorname{rank}(A) \neq \operatorname{rank}[A \mid B]$

Hence, any linear system of equations has unique solution or infinite number of solutions or no solution. So, there is no possibility for the system having exactly two solutions.

Provide feedback (0)

Step 2 of 2

(a)

If (x, y, z) and (X, Y, Z) are two solutions of the system, then the other solution is at their mid-point.

$$\left(\frac{x+X}{2}, \frac{y+Y}{2}, \frac{z+Z}{2}\right)$$

(b)

If the 25 planes meet at two points then they also meet at the mid point of the two points.

Provide feedback (0)

Chapter: CH1.3 Problem: 19P show all steps

CH1.3 18P

Step 1 of 2

Given that the three planes can fail to have an intersection point, when two planes are parallel. And the system is singular if row 3 of A is a __________ of the first two rows.

We have to fill this blank and we have to find a third equation that can't be solved if $x+y+z=0, x-2y-z=1$

Provide feedback (0)

CH1.3 20P

Step 2 of 2

The system is singular if row 3 is a <u>combination of row1 and row2</u>.
From the end view the three planes form a triangle.
This happens if rows 1 +rows 2 = rows 3 on the left hand side but not right hand side.
For example:

$$x+y+z=0$$
$$x-2y-z=1$$
$$2x-y=9$$

Here no two planes are parallel but still no solution.

Provide feedback (0)

Chapter: CH1.3 Problem: 20P show all steps

CH1.3 19P

CH1.3 21P

Step 1 of 8

Given system is $2x+y=0$

$$x+2y+z=0$$
$$y+2z+t=0$$
$$z+2t=5$$

We have to find the pivots and the solution for these equations.

Provide feedback (0)

Step 2 of 8

Given system can be written as

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

Subtract '$\frac{1}{2}$' times the row 1 from the row 2

$$\sim \begin{pmatrix} 2 & 1 & 0 & 0 & 0 \\ 0 & \frac{3}{2} & 1 & 0 & 0 \\ 0 & 1 & 2 & 1 & 0 \\ 0 & 0 & 1 & 2 & 5 \end{pmatrix}$$

Provide feedback (0)

Step 3 of 8

Subtract '$\frac{2}{3}$' times the row 2 from the row 3.

Step 3 of 8

Subtract '$\frac{2}{3}$' times the row 2 from the row 3.

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

Subtract '$\frac{3}{4}$' times the row 2 from the row 3.

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

Provide feedback (1)

Step 4 of 8

which is upper triangular form.

The pivots are circled in $\begin{pmatrix} \boxed{2} & 1 & 0 & 0 & 0 \\ 0 & \boxed{\frac{3}{2}} & 1 & 0 & 0 \\ 0 & 0 & \boxed{\frac{4}{3}} & 1 & 0 \end{pmatrix}$

Step 4 of 8

which is upper triangular form.

The pivots are circled in $\begin{pmatrix} \boxed{2} & 1 & 0 & 0 & 0 \\ 0 & \boxed{\frac{3}{2}} & 1 & 0 & 0 \\ 0 & 0 & \boxed{\frac{4}{3}} & 1 & 0 \\ 0 & 0 & 0 & \boxed{\frac{5}{4}} & 5 \end{pmatrix}$

That is $\boxed{2, \frac{3}{2}, \frac{4}{3}, \frac{5}{4}}$

Provide feedback (0)

Step 5 of 8

Back ward substitution:-

From upper triangular form, We have

$$\begin{aligned} 2x + y \quad &= 0 \\ \frac{3}{2}y + z \quad &= 0 \\ \frac{4}{3}z + t &= 0 \\ \frac{5}{4}t &= 5 \end{aligned}$$

Provide feedback (0)

Step 6 of 8

5

Provide feedback (1)

Step 4 of 8

which is upper triangular form.

The pivots are circled in $\begin{pmatrix} \boxed{2} & 1 & 0 & 0 & 0 \\ 0 & \boxed{\frac{3}{2}} & 1 & 0 & 0 \\ 0 & 0 & \boxed{\frac{4}{3}} & 1 & 0 \\ 0 & 0 & 0 & \boxed{\frac{5}{4}} & 5 \end{pmatrix}$

That is $\boxed{2, \frac{3}{2}, \frac{4}{3}, \frac{5}{4}}$

Provide feedback (0)

Step 5 of 8

Back ward substitution:-

From upper triangular form, We have

$$\begin{aligned} 2x+y &= 0 \\ \frac{3}{2}y+z &= 0 \\ \frac{4}{3}z+t &= 0 \\ \frac{5}{4}t &= 5 \end{aligned}$$

Provide feedback (0)

Step 6 of 8

$$\frac{5}{4}t = 5$$

$$\Rightarrow \boxed{t = 4}$$

$$\frac{4}{3}z + t = 0$$

$$\Rightarrow \frac{4}{3}z + 4 = 0$$

$$\Rightarrow \boxed{z = -3}$$

$$\frac{3}{2}y + z = 0$$

$$\Rightarrow \frac{3}{2}y - 3 = 0$$

$$\Rightarrow \boxed{y = 2}$$

$$2x + y = 0$$

$$\Rightarrow 2x + 2 = 0$$

$$\Rightarrow \boxed{x = -1}$$

Provide feedback (0)

Step 7 of 8

Solutions are $\boxed{x = -1, y = 2, z = -3, t = 4}$

Provide feedback (0)

Step 8 of 8

Chapter: CH1.3 Problem: 20P show all steps

$\Rightarrow \frac{?}{3}z+4=0$

$\Rightarrow \boxed{z=-3}$

$\frac{3}{2}y+z=0$

$\Rightarrow \frac{3}{2}y-3=0$

$\Rightarrow \boxed{y=2}$

$2x+y=0$

$\Rightarrow 2x+2=0$

$\Rightarrow \boxed{x=-1}$

Provide feedback (0)

Step 7 of 8

Solutions are $\boxed{x=-1, y=2, z=-3, t=4}$

Provide feedback (0)

Step 8 of 8

Operations are

(i) Subtract '$\frac{1}{2}$' times the row 1 from the row 2

(ii) Subtract '$\frac{2}{3}$' times the row 2 from the row 3

(iii) Subtract '$\frac{3}{4}$' times the row 2 from the row 3

Provide feedback (0)

CH1.3 22P

CH1.3 24P

Step 1 of 4

Given system is $u+v+w=2$

$u+3v+3w=0$

$u+3v+5w=2$

We have to find the triangular system after forward elimination and the solution.

Step 2 of 4

Given system can be written as

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

Subtract '1' time the row 1 from the row 2

Subtract '1' time the row 1 from the row 3

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

Step 3 of 4

Subtract '1' times the row 2 from the row 3.

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

which is upper triangular form.

Hence the triangular system after forward elimination

$$\begin{array}{|l} u+v+w=2 \\ \quad 2v+2w=-2 \end{array}$$

$$\begin{pmatrix} 0 & 2 & 4 & 0 \end{pmatrix}$$

Provide feedback (0)

Step 3 of 4

Subtract '1' times the row 2 from the row 3.

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

which is upper triangular form.
Hence the triangular system after forward elimination

$$\boxed{\begin{aligned} u+v+w &= 2 \\ 2v+2w &= -2 \\ 2w &= 2 \end{aligned}}$$

Provide feedback (0)

Step 4 of 4

From above upper triangular form, we have

$$2w = 2$$
$$\Rightarrow w = 1$$
$$2v + 2w = -2$$
$$\Rightarrow 2v + 2(1) = -2$$
$$\Rightarrow v = -2$$
$$u + v + w = 2$$
$$\Rightarrow u - 2 + 1 = 2$$
$$\Rightarrow u = 3$$

Therefore the solution is $\boxed{u = 3, v = -2, w = 1}$

Provide feedback (0)

CH1.3 23P

CH1.3 25P

Step 1 of 4

Given system is
$$\begin{aligned} 2u - v \quad &= 0 \\ -u + 2v - w \quad &= 0 \\ -v + 2w - z &= 0 \\ -w + 2z &= 5 \end{aligned}$$
We have to find the pivots and solve this system.

Step 2 of 4

Given system can be written as
$$\begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & -1 & 2 & 5 \end{bmatrix}$$
apply $R_2 \to 2R_2 + R_1$
$$\sim \begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ 0 & 3 & -2 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & -1 & 2 & 5 \end{bmatrix}$$
apply $R_3 \to 3R_3 + R_2$
$$\sim \begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ 0 & 3 & -2 & 0 & 0 \\ 0 & 0 & 4 & -3 & 0 \\ 0 & 0 & -1 & 2 & 5 \end{bmatrix}$$

Step 3 of 4

Step 3 of 4

apply $R_4 \to 4R_4 + R_3$

$$\sim\begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ 0 & 3 & -2 & 0 & 0 \\ 0 & 0 & 4 & -3 & 0 \\ 0 & 0 & 0 & 5 & 20 \end{bmatrix}$$

which is upper triangular form.

The pivots are circled in $\begin{bmatrix} \boxed{2} & -1 & 0 & 0 & 0 \\ 0 & \boxed{3} & -2 & 0 & 0 \\ 0 & 0 & \boxed{4} & -3 & 0 \\ 0 & 0 & 0 & \boxed{5} & 20 \end{bmatrix}$.

That is $\boxed{2,3,4,5}$.

Provide feedback (0)

Step 4 of 4

From above upper triangular form, we have

$$\begin{aligned} 2u - v \quad\quad\quad &= 0 \\ 3v - 2w \quad\quad &= 0 \\ 4w - 3z &= 0 \\ 5z &= 20 \end{aligned}$$

By back ward substitution,

$5z = 20$

$\Rightarrow \boxed{z = 4}$

$4w - 3z = 0$

$\Rightarrow 4w - 3(4) = 0$

$\Rightarrow \boxed{w = 3}$

$3v - 2w = 0$

$\Rightarrow 3v - 2(3) = 0$

The pivots are circled in $\begin{bmatrix} 0 & \boxed{3} & -2 & 0 & 0 \\ 0 & 0 & \boxed{4} & -3 & 0 \\ 0 & 0 & 0 & \boxed{5} & 20 \end{bmatrix}$.

That is $\boxed{2,3,4,5}$.

Provide feedback (0)

Step 4 of 4

From above upper triangular form, we have

$$\begin{aligned} 2u - v &= 0 \\ 3v - 2w &= 0 \\ 4w - 3z &= 0 \\ 5z &= 20 \end{aligned}$$

By back ward substitution,

$5z = 20$

$\Rightarrow \boxed{z = 4}$

$4w - 3z = 0$

$\Rightarrow 4w - 3(4) = 0$

$\Rightarrow \boxed{w = 3}$

$3v - 2w = 0$

$\Rightarrow 3v - 2(3) = 0$

$\Rightarrow \boxed{v = 2}$

$2u - v = 0$

$\Rightarrow 2u - 2 = 0$

$\Rightarrow \boxed{u = 1}$

Solutions are $\boxed{u = 1, v = 2, w = 3, z = 4}$

Provide feedback (0)

CH1.3 24P

CH1.3 26P

Step 1 of 4

Consider the system of equations is

$$u+v+w=-2$$

$$3u+3v-w=6$$
$$u-v+w=-1$$

Find the solution to above system by applying elimination.

Step 2 of 4

Write the system in the matrix form

$$\begin{bmatrix} 1 & 1 & 1 & -2 \\ 3 & 3 & -1 & 6 \\ 1 & -1 & 1 & -1 \end{bmatrix}$$

Apply $R_2 \to R_2 - 3R_1$,

$R_3 \to R_3 - R_1$

$$\sim \begin{bmatrix} 1 & 1 & 1 & -2 \\ 0 & 0 & -4 & 12 \\ 0 & -2 & 0 & 1 \end{bmatrix}$$

Apply $R_2 \leftrightarrow R_3$

$$\sim \begin{bmatrix} 1 & 1 & 1 & -2 \\ 0 & -2 & 0 & 1 \\ 0 & 0 & -4 & 12 \end{bmatrix}$$

This is upper triangular form.

Provide feedback (0)

Step 3 of 4

From above upper triangular form, we have

$$\begin{aligned} u+v+w &= -2 \\ -2v &= 1 \\ -4w &= 12 \end{aligned}$$

From $-4w = 12$

$$\frac{-4w}{-4} = \frac{12}{-4}$$

$$\boxed{w = -3}$$

From $-2v = 1$

$$v = \boxed{\frac{-1}{2}}$$

From $u+v+w=-2$

$$u + \left(\frac{-1}{2}\right) - 3 = -2 \qquad \left(\text{Since } v = -\frac{1}{2}, w = -3\right)$$

$$u = -2 + \frac{1}{2} + 3$$

$$u = 1 + \frac{1}{2}$$

$$\boxed{u = \frac{3}{2}}$$

Therefore solutions are $\boxed{u = \frac{3}{2}, v = \frac{-1}{2}, w = -3}$.

Provide feedback (0)

$u = -2 + \frac{1}{2} + 3$

$u = 1 + \frac{1}{2}$

$\boxed{u = \frac{3}{2}}$

Therefore solutions are $\boxed{u = \frac{3}{2}, v = \frac{-1}{2}, w = -3}$.

Provide feedback (0)

Step **4** of 4

In the given $\begin{bmatrix} 1 & 1 & 1 & -2 \\ 3 & 3 & -1 & 6 \\ 1 & -1 & 1 & -1 \end{bmatrix}$ if we replace the coefficient -1 of v by1, then we get

$$\begin{bmatrix} 1 & 1 & 1 & -2 \\ 3 & 3 & -1 & 6 \\ 1 & 1 & 1 & -1 \end{bmatrix}$$

Apply $R_2 \to R_2 - 3R_1, R_3 \to R_3 - R_1$

$$\sim \begin{bmatrix} 1 & 1 & 1 & -2 \\ 0 & 0 & -4 & 12 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Therefore the system becomes singular (2 equal columns) and hence it has no solution.

Hence the change of coefficient -1 of v by 1 would make the system impossible to proceed and elimination break down.

Provide feedback (0)

CH1.3 25P

CH1.3 27P

Step 1 of 4

We have to solve by elimination the system of equations

$x - y = 0$

$3x + 6y = 18$

Also we have to draw a graph representing each equation as a straight line in the x-y plane; the lines intersect at the solution, also we have to add one more line – the graph of the new second equation which arises after elimination.

Provide feedback (0)

Step 2 of 4

Given equations are

$x - y = 0$

$3x + 6y = 18$

Performing row 2 - 3 times of row 1 gives

$x - y = 0$

$9y = 18$

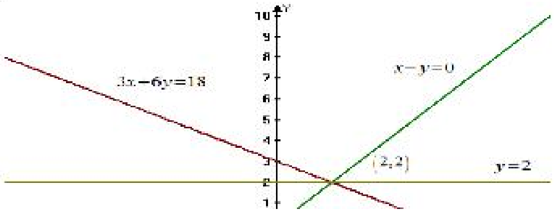
By back substitution gives $y = 2$ and $x = 2$

Hence the solution is $\boxed{(2,2)}$

Provide feedback (0)

Step 3 of 4

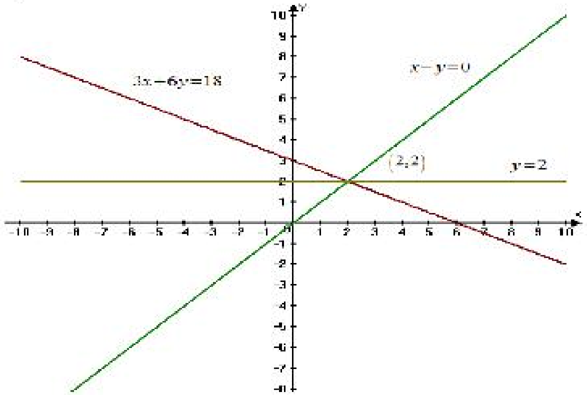
The required graph is shown as follows:

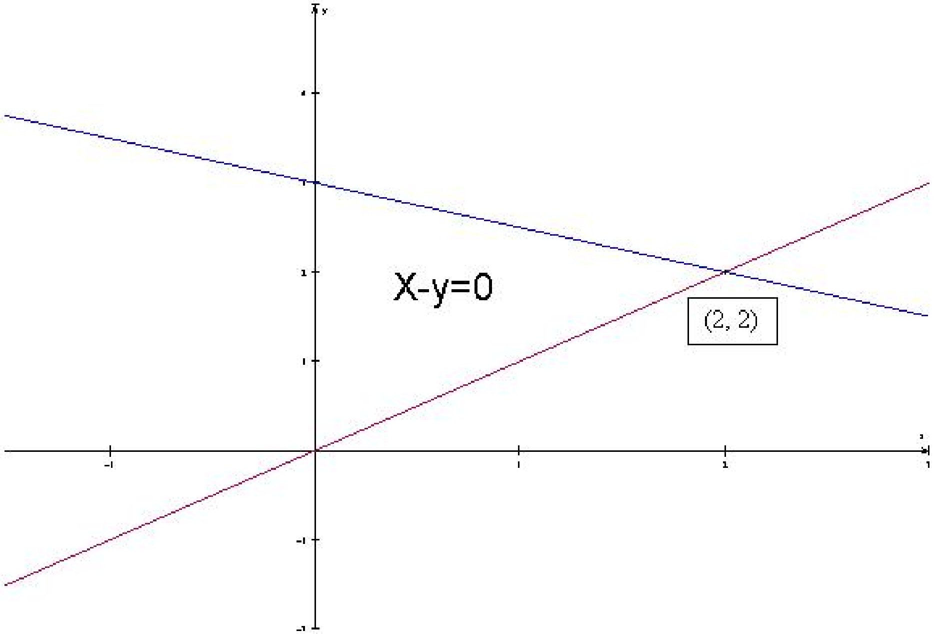


Provide feedback (0)

Step 3 of 4

The required graph is shown as follows:

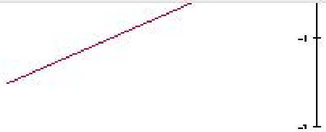




The graph of the new second equation after elimination.

Provide feedback (0)

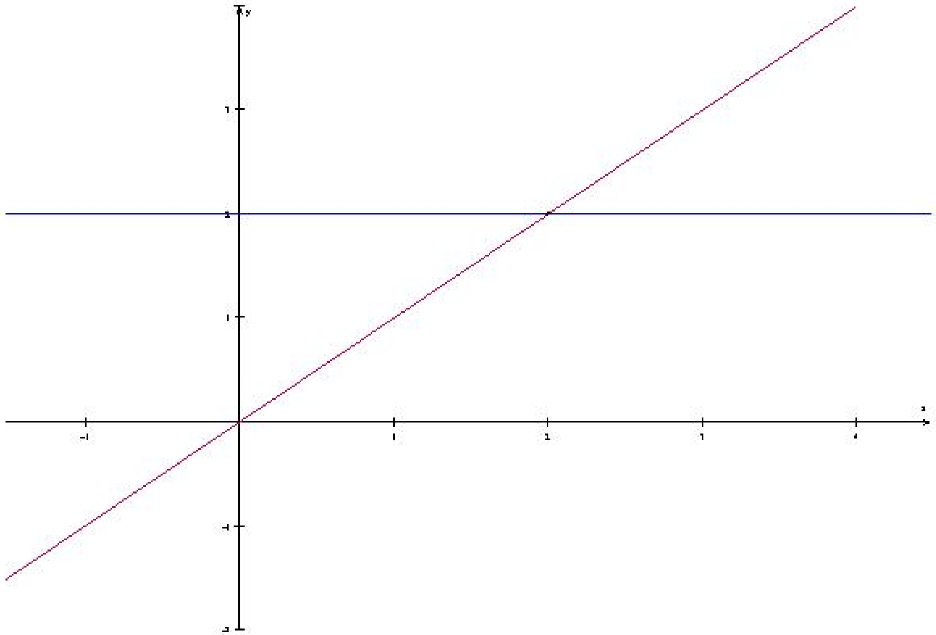
Step 4 of 4



The graph of the new second equation after elimination.

Provide feedback (0)

Step 4 of 4



Provide feedback (0)

Chapter: CH1.3 Problem: 27P

show all steps

CH1.3 26P

CH1.3 28P

Step 1 of 4

We have to find three values of a for which elimination breaks down, temporarily or permanently, in

$au + v \ \ = 1$

$4u + av = 2$

Breakdown at the first step and can be fixed by exchanging rows-but not breakdown at the last step.

Provide feedback (0)

Step 2 of 4

If $a = 0$ then the equations are

$v = 1$

$4u \ \ = 2$

Now they require row exchange and the system is non singular.

Provide feedback (0)

Step 3 of 4

If $a = 2$ then the equations are

$2u + v \ \ = 1$

$4u + 2v = 2$

It is singular system with 2 pivots by applying row $2 - 2$times of row1 becomes

$2u + v = 1$

Now this has infinite solutions.

Provide feedback (1)

Step 4 of 4

If $a = -2$ then the equations are

$-2u + v \ \ = 1$

$4u + av = 2$

Breakdown at the first step and can be fixed by exchanging rows-but not breakdown at the last step.

Provide feedback (0)

Step 2 of 4

If $a = 0$ then the equations are

$v = 1$

$4u \quad = 2$

Now they require row exchange and the system is non singular.

Provide feedback (0)

Step 3 of 4

If $a = 2$ then the equations are

$2u + v \quad = 1$

$4u + 2v = 2$

It is singular system with 2 pivots by applying row $2 - 2$times of row1 becomes

$2u + v = 1$

Now this has infinite solutions.

Provide feedback (1)

Step 4 of 4

If $a = -2$ then the equations are

$-2u + v \quad = 1$

$4u - 2v = 2$

It is singular system with no solution because after elimination of first step it becomes

$0 = 1$ position.

Provide feedback (0)

CH1.3 27P

CH1.3 29P

Step 1 of 3

(a) Suppose there is a system of three equations in three variables namely u, v, and w.
Suppose equation (3) started with zero coefficient.
That means equation (3) has only v and w terms.
But equation (1) has all the u, v, and w terms.
So, in this case, we are not needed to use any subtraction of a multiple of equation (1) from equation (3) to make it to the echelon form or triangular form to see the non singularity of the system.
Therefore, the given statement is true

Step 2 of 3

(b) While bringing a system in the matrix form to the echelon form, we use the coefficient of 1^{st} variable of the 1^{st} equation to make the coefficients of the 1^{st} variable in the 2^{nd} and 3^{rd} equations zero.
Then we use the 2^{nd} variable of the 2^{nd} equation to make the 2^{nd} variable of the 3^{rd} equation zero.
Then we see an upper triangular form in the coefficient matrix part.
In view of this procedure, we can say that the given statement is $\boxed{\text{false}}$ as it is not necessary that even after making the 1^{st} coefficient of the 3^{rd} equation zero, the 2^{nd} coefficient remains to be zero.

Step 3 of 3

(c) True
If the system is having three equations in three variables and the 3^{rd} equation is with $0u$ and $0v$, then it is already in the reduced form and so, we are not required to reduce further to check the non singularity of the system.

CH1.3 28P

CH1.3 30P

Step 1 of 2

Given that the multiplications of two complex numbers $(a+ib)(c+id)=(ac-bd)+i(bc+ad)$, involves four separate multiplications ac, bd, bc, ad. Ignoring i, we have to verify that can we compute $ac-bd$ and $bc+ad$ with only three multiplications.

Provide feedback (0)

Step 2 of 2

The first term $ac-bd$ can be calculate as $(a-b)(c+d)-ad+bc$

It consist only one additional multiplication.

The second term $bc+ad$ can be calculate as $(a+b)(c+d)-ac-bd$

It consist only one additional multiplication.

$\boxed{\text{So we can compute } ac-bd \text{ and } bc+ad \text{ with only three multiplications}}$

Provide feedback (0)

CH1.3 29P

CH1.3 31P

Step 1 of 6

(i)
Given system is

$u+v+w=6$

$u+2v+2w=11$

$2u+3v-4w=3$

We have to find the solution to this system by applying elimination.

Step 2 of 6

Given system can be written as

$$\begin{bmatrix} 1 & 1 & 1 & 6 \\ 1 & 2 & 2 & 11 \\ 2 & 3 & -4 & 3 \end{bmatrix}$$

apply $R_2 \to R_2 - R_1, R_3 \to R_3 - 2R_1$

$$\sim \begin{bmatrix} 1 & 1 & 1 & 6 \\ 0 & 1 & 1 & 5 \\ 0 & 1 & -6 & -9 \end{bmatrix}$$

apply $R_3 \to R_3 - R_2$

$$\sim \begin{bmatrix} 1 & 1 & 1 & 6 \\ 0 & 1 & 1 & 5 \\ 0 & 0 & -7 & -14 \end{bmatrix}$$

which is upper triangular form.

that is $u+v+w=6$

$v+w=5$

$-7w=-14$

Step 3 of 6

By back-ward substitution, we have

$-7w = -14$

$\Rightarrow \boxed{w = 2}$

$v + w = 5$

$\Rightarrow v + 2 = 5$

$\Rightarrow \boxed{v = 3}$

$u + v + w = 6$

$\Rightarrow u + 3 + 2 = 6$

$\Rightarrow \boxed{u = 1}$

Solutions are $\boxed{u = 1, v = 3, w = 2}$

Provide feedback (0)

Step 4 of 6

(ii)

Given system is

$u + v + w = 7$

$u + 2v + 2w = 10$

$2u + 3v - 4w = 3$

We have to find the solution to this system by applying elimination.

Provide feedback (0)

Step 5 of 6

Given system can be written as

$$\begin{bmatrix} 1 & 1 & 1 & 7 \\ 1 & 2 & 2 & 10 \\ 2 & 3 & -4 & 3 \end{bmatrix}$$

apply R ... → R ... R ... R ... → R ... 2R ...

Step 5 of 6

Given system can be written as

$$\begin{bmatrix} 1 & 1 & 1 & 7 \\ 1 & 2 & 2 & 10 \\ 2 & 3 & -4 & 3 \end{bmatrix}$$

apply $R_2 \to R_2 - R_1, R_3 \to R_3 - 2R_1$

$$\sim \begin{bmatrix} 1 & 1 & 1 & 7 \\ 0 & 1 & 1 & 3 \\ 0 & 1 & -6 & -11 \end{bmatrix}$$

apply $R_3 \to R_3 - R_2$

$$\sim \begin{bmatrix} 1 & 1 & 1 & 7 \\ 0 & 1 & 1 & 3 \\ 0 & 0 & -7 & -11 \end{bmatrix}$$

which is upper triangular form.

that is $u + v + w = 7$

$$v + w = 3$$

$$-7w = -14$$

Provide feedback (0)

Step 6 of 6

By back-ward substitution, we have

$-7w = -14$

$\Rightarrow \boxed{w = 2}$

$v + w = 3$

$\Rightarrow v + 2 = 3$

$\Rightarrow \boxed{v = 1}$

$u + v + w = 7$

$\Rightarrow u + 1 + 2 = 7$

CH1.3 30P

CH1.3 32P

Step 1 of 6

Given system is $ax+2y+3z=b_1$

$$ax+ay+4z=b_2$$

$$ax+ay+az=b_3$$

We have to find for which three numbers' a 'will elimination fail to give three pivots.

Step 2 of 6

Given system can be written as

$$\begin{bmatrix} a & 2 & 3 & b_1 \\ a & a & 4 & b_2 \\ a & a & a & b_3 \end{bmatrix}$$

apply $R_2 \to R_2 - R_1, R_3 \to R_3 - R_1$

$$\begin{bmatrix} a & 2 & 3 & b_1 \\ 0 & a-2 & 1 & b_2-b_1 \\ 0 & a-2 & a-3 & b_3-b_1 \end{bmatrix}$$

apply $R_3 \to R_2 - R_1$

$$\begin{bmatrix} a & 2 & 3 & b_1 \\ 0 & a-2 & 1 & b_2-b_1 \\ 0 & 0 & a-4 & b_3-b_2 \end{bmatrix}$$

Step 3 of 6

The pivots are circled in $\begin{bmatrix} \boxed{a} & 2 & 3 & b_1 \\ 0 & \boxed{a-2} & 1 & b_2-b_1 \\ 0 & 0 & \boxed{a-4} & b_3-b_2 \end{bmatrix}$

That is a, $a-2$, $a-4$

Step 3 of 6

The pivots are circled in $\begin{bmatrix} \boxed{a} & 2 & 3 & b_1 \\ 0 & \boxed{a-2} & 1 & b_2-b_1 \\ 0 & 0 & \boxed{a-4} & b_3-b_2 \end{bmatrix}$

That is $a, a-2, a-4$.

Hence it is clear that the elimination will fail when

$a = 0$

$a-2=0$ or

$a-4=0$

i.e. for $a=0, a=2, a=4$ the elimination will fail.

Provide feedback (0)

Step 4 of 6

Case (i):- If $a=0$

The system becomes

$$\begin{bmatrix} 0 & 2 & 3 & b_1 \\ 0 & 0 & 4 & b_2 \\ 0 & 0 & 0 & b_3 \end{bmatrix}$$

In the above matrix, all the entries in column 1(row 3) are zero.

Hence elimination fails for $a=0$ ($\boxed{\text{zero column}}$).

Provide feedback (0)

Step 5 of 6

Case (ii):- If $a=2$

The system becomes

$$\begin{bmatrix} 2 & 2 & 3 & b_1 \\ 2 & 2 & 4 & b_2 \\ 2 & 2 & 2 & b_3 \end{bmatrix}$$

In the above matrix, all the entries in column 1(row 3) are zero.
Hence elimination fails for $a = 0$ ($\boxed{\text{zero column}}$).

Step 5 of 6

Case (ii):- If $a = 2$

The system becomes

$$\begin{bmatrix} 2 & 2 & 3 & b_1 \\ 2 & 2 & 4 & b_2 \\ 2 & 2 & 2 & b_3 \end{bmatrix}$$

In the above matrix, all the entries in column 1 are equal to all the entries in column 2. Hence elimination fails for $a = 2$ ($\boxed{\text{equal columns}}$).

Step 6 of 6

Case (iii):- If $a = 4$

The system becomes

$$\begin{bmatrix} 4 & 2 & 3 & b_1 \\ 4 & 4 & 4 & b_2 \\ 4 & 4 & 4 & b_3 \end{bmatrix}$$

In the above matrix, upto the coefficient matrix all the entries in row 2 are equal to all the entries in row3. Hence elimination fails for $a = 4$ ($\boxed{\text{equal rows}}$).