Mathematics – Equation - Exercises - Solutions

Click the exercise number to start a video.

01 Solve a function:

Solve the function: $\mathbf{L = a + (n - 1)\,d}$

For a

a) $a = L - (n - 1)\,d$
b) $a = L - (n + 1)\,d$
c) $a = L + (n - 1)\,d$
d) $a = L + (n + 1)\,d$
e) None of the above

Solution:

$$L = a + (n-1)d \quad \Rightarrow \quad \underline{a = L - (n-1)d}$$

a

02 Solve a function:

Solve the function: $\mathbf{L = a + (n - 1)\,d}$

For d

a) $d = \dfrac{L - a}{n + 1}$
b) $d = \dfrac{L}{a + n - 1}$
c) $d = \dfrac{L - a}{n - 1}$
d) $d = \dfrac{L + a}{n - 1}$
e) None of the above

Solution:

$$L = a + (n-1)d \quad \Rightarrow \quad (n-1)d = L - a \quad \Rightarrow \quad d = \frac{L-a}{n-1}$$

c

03 Solve a function:

Solve the function: $\mathbf{L = a + (n - 1)\,d}$

For n

a) $n = \dfrac{-L + a + d}{d}$

b) $n = \dfrac{L - a - d}{d}$

c) $n = \dfrac{L + a + d}{d}$

d) $n = \dfrac{L - a + d}{d}$

e) None of the above

Solution:

$$L = a + (n-1)d \quad \Rightarrow \quad L = a + nd - d \quad \Rightarrow \quad nd = L - a + d \quad \Rightarrow \quad n = \frac{L - a + d}{d}$$

d

04 Equations:

Solve the system of linear equations: 3x + 18y - 10 = 0 2x - 2y + 5 = 0

a) $x = -\frac{5}{3}$, $y = \frac{5}{6}$

b) $x = \frac{5}{3}$, $y = -\frac{5}{6}$

c) $x = -\frac{5}{6}$, $y = \frac{5}{3}$

d) $x = \frac{5}{6}$, $y = -\frac{5}{3}$

e) None of the above

Solution:

The general solution of a linear equation system of two unknowns is given by:

$$a_{11}x_1 + a_{12}x_2 = b_1$$
$$a_{21}x_1 + a_{22}x_2 = b_2$$

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} \\ b_2 & a_{22} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}} \qquad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 \\ a_{21} & b_2 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}}$$

From this we have:

$$3x + 18y - 10 = 0$$
$$2x - 2y + 5 = 0$$
$$\Downarrow$$
$$3x + 18y = 10$$
$$2x - 2y = -5$$

$$x = \frac{\begin{vmatrix} 10 & 18 \\ -5 & -2 \end{vmatrix}}{\begin{vmatrix} 3 & 18 \\ 2 & -2 \end{vmatrix}} = \frac{10\cdot(-2) - 18\cdot(-5)}{3\cdot(-2) - 18\cdot 2} = \frac{70}{-42} = -\frac{5}{3}$$

$$y = \frac{\begin{vmatrix} 3 & 10 \\ 2 & -5 \end{vmatrix}}{\begin{vmatrix} 3 & 18 \\ 2 & -2 \end{vmatrix}} = \frac{3\cdot(-5) - 10\cdot 2}{3\cdot(-2) - 18\cdot 2} = \frac{-35}{-42} = \frac{5}{6}$$

$$(x, y) = \left(-\frac{5}{3}, \frac{5}{6}\right)$$

a

05 Square:

Solve for x by completing the square: $ax^2 + bx + c = 0$

a) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

b) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{a}$

c) $x = \dfrac{b \pm \sqrt{b^2 - 4ac}}{2a}$

d) $x = \dfrac{-b \pm \sqrt{4ac - b^2}}{2a}$

e) None of the above

Solution:

$$ax^2 + bx + c = 0 \quad \Rightarrow \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

a

06 Quadratic formula:

Solve for v by use of the quadratic formula: $4v^2 + 6v + 1 = 0$

a) $v = \frac{1}{4}(3 \pm \sqrt{5})$

b) $v = \frac{1}{2}(-3 \pm \sqrt{5})$

c) $v = \frac{1}{4}(-3 \pm \sqrt{5})$

d) $v = \frac{1}{4}(-3 \pm \sqrt{-5})$

e) None of the above

Solution:

$$4v^2 + 6v + 1 = 0 \quad \Rightarrow \quad v = \frac{-6 \pm \sqrt{6^2 - 4 \cdot 4 \cdot 1}}{2 \cdot 4}$$

$$= \frac{-6 \pm 2\sqrt{5}}{8} = \frac{-3 \pm \sqrt{5}}{4} = \underline{\frac{1}{4}(-3 \pm \sqrt{5})} \qquad \underline{\underline{b}}$$

07 Equation with square root:

Solve for x: $\sqrt{x+2}+2=-x$

a) $x=-2$
b) $x=-2$ and -1
c) No real solution
d) $x=2$ and 1
e) None of the above

Solution:

$$\sqrt{x+2}+2=-x$$
$$\sqrt{x+2}=-(2+x)$$
$$\Downarrow$$
$$x+2=(2+x)^2$$
$$x^2+3x+2=0$$
$$x=\frac{-3\pm\sqrt{3^2-4\cdot1\cdot2}}{2\cdot1}=\frac{-3\pm\sqrt{1}}{2}=\frac{-3\pm1}{2}$$
$$\underline{x=-2} \quad \vee \quad \underline{x=-1}$$
$$x=-2:\ \text{VS}:\sqrt{x+2}+2=\sqrt{-2+2}+2=2$$
$$\text{HS}:-x=-(-2)=2$$
$$x=-1:\ \text{VS}:\sqrt{x+2}+2=\sqrt{-1+2}+2=1+2=3$$
$$\text{HS}:-x=-(-1)=1$$
$$\underline{x=-2} \qquad \underline{\underline{a}}$$

08 Roots:

Determine the value or values of the constant k for which the roots of the equation $kw^2 + kw + 4 = 0$ are:

real and equal

a) k = 0 and 4
b) k = 0 and 16
c) k = 4
d) k = 16
e) None of the above

Solution:

$$kw^2 + kw + 4 = 0$$

$$w = \frac{-k \pm \sqrt{k^2 - 4 \cdot k \cdot 4}}{2k} = \underline{\frac{-k \pm \sqrt{k^2 - 16k}}{2k}}$$

Real and equal:

$$k^2 - 16k = 0$$

$$k(k - 16) = 0$$

$$\underline{(k = 0} \quad \vee) \quad \underline{k = 16} \qquad \underline{\underline{d}}$$

k = 0 kan ikke benyttes siden den opprinnelige ligning da vil være 0 + 0 + 4 = 0

09 Roots:

Determine the value or values of the constant k for which the roots of the equation $kw^2 + kw + 4 = 0$ are:

real and unequal

a) k less than 0 or greater than 16
b) k greater than 0 but less than 16
c) k equal to 0 and 16
d) No value of k
e) None of the above

Solution:

$$kw^2 + kw + 4 = 0$$

$$w = \frac{-k \pm \sqrt{k^2 - 4 \cdot k \cdot 4}}{2k} = \frac{-k \pm \sqrt{k^2 - 16k}}{2k}$$

Real and unequal:

$$k^2 - 16k > 0$$

$$k(k-16) > 0$$

$$\underline{k < 0} \quad \vee \quad \underline{k > 16} \qquad \underline{\underline{a}}$$

10 Roots:

Determine the value or values of the constant k for which the roots of the equation $kw^2 + kw + 4 = 0$ are:

complex and unequal

a) k less than 0 or greater than 16
b) k greater than 0 but less than 16
c) k equal to 0 and 16
d) No value of k
e) None of the above

Solution:

$$kw^2 + kw + 4 = 0$$

$$w = \frac{-k \pm \sqrt{k^2 - 4 \cdot k \cdot 4}}{2k} = \frac{-k \pm \sqrt{k^2 - 16k}}{2k}$$

Complex and unequal:

$$k^2 - 16k < 0$$

$$k(k-16) < 0$$

$$\underline{k > 0} \quad \wedge \quad \underline{k < 16} \qquad \underline{\underline{b}}$$

11 Equations:

Solve algebraically: 3x - 2y = 4 , $2x^2$ - 3xy + 6x + 2y = -4

a) (0, -2), (6, -7)
b) (0, 2), (6, 7)
c) (0, -2), (6, 7)
d) (0, 2), (6, -7)
e) None of the above

Solution:

$$3x - 2y = 4$$

$$2x^2 - 3xy + 6x + 2y = -4$$

$$\Downarrow$$

$$y = \frac{3}{2}x - 2$$

$$2x^2 - 3x(\frac{3}{2}x - 2) + 6x + 2(\frac{3}{2}x - 2) = -4$$

$$2x^2 - \frac{9}{2}x^2 + 6x + 6x + 3x - 4 = -4$$

$$4x^2 - 9x^2 + 30x = 0$$

$$30x - 5x^2 = 0$$

$$5x(6 - x) = 0$$

$$x(6 - x) = 0$$

$$\underline{x = 0} \quad \vee \quad \underline{x = 6}$$

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

$$x = 6 \Rightarrow y = \frac{3}{2} \cdot 6 - 2 = \underline{7}$$

$$\underline{(0, -2) \quad \vee \quad (6, 7)}$$

c

12 Equations:

Solve algebraically: $x^2 - y^2 + 7 = 0$, $2x^2 + 3y^2 = 66$

a) (3, 4)
b) (3, 4)(3, -4)
c) (3, 4)(-3, 4)
d) (3, 4)(3, -4)(-3, 4)(-3, -4)
e) None of the above

Solution:

$$x^2 - y^2 + 7 = 0$$
$$2x^2 + 3y^2 = 66$$
$$\Downarrow$$
$$y^2 = x^2 + 7$$
$$2x^2 + 3(x^2 + 7) = 66$$
$$5x^2 + 21 = 66$$
$$5x^2 = 45$$
$$x^2 = 9$$
$$\underline{x = \pm 3}$$
$$x = \pm 3 \Rightarrow y = \pm\sqrt{(\pm 3)^2 + 7} = \pm\sqrt{16} = \underline{\pm 4}$$
$$\underline{(3,4),(3,-4),(-3,4),(-3,-4)} \qquad \underline{\underline{d}}$$

13 Equation system:

For the system of linear equations:	**4u - 3v + w + 5 = 0**
	3u - v - 2w = 7
	u - 2v = w

Express the determinant of the system

a) $\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & 0 \end{vmatrix}$

b) $\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}$

c) $\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & 1 \end{vmatrix}$

d) $\begin{vmatrix} 4 & -3 & 1 & 5 \\ 3 & -1 & -2 & -7 \\ 1 & -2 & -1 & 0 \end{vmatrix}$

e) None of the above

Solution:

The general solution of a linear equation system of three unknowns is given by:

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 &= b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 &= b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 &= b_3 \end{aligned}$$

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} & a_{13} \\ b_2 & a_{22} & a_{23} \\ b_3 & a_{32} & a_{33} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}} \qquad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 & a_{13} \\ a_{21} & b_2 & a_{23} \\ a_{31} & b_3 & a_{33} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}} \qquad x_3 = \frac{\begin{vmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ a_{31} & a_{32} & b_3 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}}$$

From this we have:

$$\begin{aligned} &4u - 3v + w + 5 = 0 \\ &3u - v - 2w = 7 \\ &u - 2v = w \\ &\Updownarrow \\ &4u - 3v + w = -5 \\ &3u - v - 2w = 7 \\ &u - 2v - w = 0 \end{aligned}$$

Determinant for the system (the determinant of the denominator)
is the coefficients in front of the unknown *u*, *v* and *w*.

$$\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}$$

b

14 Equation system:

For the system of linear equations:	**4u - 3v + w + 5 = 0**
	3u - v - 2w = 7
	u - 2v = w

Express the numerator determinant for u

a) $\begin{vmatrix} -5 & -3 & 1 \\ 7 & -1 & -2 \\ 0 & -2 & 1 \end{vmatrix}$

b) $\begin{vmatrix} -5 & -3 & 1 \\ 7 & -1 & -2 \\ 0 & -2 & 0 \end{vmatrix}$

c) $\begin{vmatrix} -5 & -3 & 1 \\ 7 & -1 & -2 \\ 0 & -2 & -1 \end{vmatrix}$

d) $\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}$

e) None of the above

Solution:

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 &= b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 &= b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 &= b_3 \end{aligned} \qquad \begin{aligned} 4u - 3v + w &= -5 \\ 3u - v - 2w &= 7 \\ u - 2v - w &= 0 \end{aligned}$$

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} & a_{13} \\ b_2 & a_{22} & a_{13} \\ b_3 & a_{32} & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \quad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 & a_{13} \\ a_{21} & b_2 & a_{13} \\ a_{31} & b_3 & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \quad x_3 = \frac{\begin{vmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ a_{31} & a_{32} & b_3 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}}$$

Determinant for the numerator of *u*
is the the same as the coefficients in front of the unknown *u*, *v* and *w*,
except that the first column is replaced by the right side of the equation system.

$\begin{vmatrix} -5 & -3 & 1 \\ 7 & -1 & -2 \\ 0 & -2 & -1 \end{vmatrix}$ <u>c</u>

15 Equation system:

For the system of linear equations:	4u - 3v + w + 5 = 0
	3u - v - 2w = 7
	u - 2v = w

Express the numerator determinant for v

a) $\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}$

b) $\begin{vmatrix} 4 & 5 & 1 \\ 3 & 7 & -2 \\ 1 & 0 & -1 \end{vmatrix}$

c) $\begin{vmatrix} 4 & -5 & 1 \\ 3 & 7 & -2 \\ 1 & 0 & 1 \end{vmatrix}$

d) $\begin{vmatrix} 4 & -5 & 1 \\ 3 & 7 & -2 \\ 1 & 0 & -1 \end{vmatrix}$

e) None of the above

Solution:

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 &= b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 &= b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 &= b_3 \end{aligned} \qquad \begin{aligned} 4u - 3v + w &= -5 \\ 3u - v - 2w &= 7 \\ u - 2v - w &= 0 \end{aligned}$$

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} & a_{13} \\ b_2 & a_{22} & a_{13} \\ b_3 & a_{32} & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \qquad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 & a_{13} \\ a_{21} & b_2 & a_{13} \\ a_{31} & b_3 & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \qquad x_3 = \frac{\begin{vmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ a_{31} & a_{32} & b_3 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}}$$

Determinant for the numerator of *v*
is the the same as the coefficients in front of the unknown *u*, *v* and *w*,
except that the second column is replaced by the right side of the equation system.

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

16 Equation system:

For the system of linear equations:	4u - 3v + w + 5 = 0
	3u - v - 2w = 7
	u - 2v = w

Express the numerator determinant for w

a) $\begin{vmatrix} 4 & -3 & -5 \\ 3 & -1 & 7 \\ 1 & -2 & 0 \end{vmatrix}$

b) $\begin{vmatrix} 4 & -3 & -5 \\ 3 & -1 & 7 \\ 1 & -2 & -1 \end{vmatrix}$

c) $\begin{vmatrix} 4 & -3 & -5 \\ 3 & -1 & 7 \\ 1 & 0 & 0 \end{vmatrix}$

d) $\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}$

e) None of the above

Solution:

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 &= b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 &= b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 &= b_3 \end{aligned} \qquad \begin{aligned} 4u - 3v + w &= -5 \\ 3u - v - 2w &= 7 \\ u - 2v - w &= 0 \end{aligned}$$

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} & a_{13} \\ b_2 & a_{22} & a_{13} \\ b_3 & a_{32} & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \quad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 & a_{13} \\ a_{21} & b_2 & a_{13} \\ a_{31} & b_3 & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \quad x_3 = \frac{\begin{vmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ a_{31} & a_{32} & b_3 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}}$$

Determinant for the numerator of *w*
is the same as the coefficients in front of the unknown *u*, *v* and *w*,
except that the third column is replaced by the right side of the equation system.

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

17 Equation system:

For the system of linear equations: **4u - 3v + w + 5 = 0**
3u - v - 2w = 7
u - 2v = w

Solve for u, v, and w

a) u = 2, v = 1, w = -3
b) u = 1, v = 2, w = -3
c) u = 2, v = -3, w = 1
d) u = 1, v = -3, w = 2
e) None of the above

Solution:

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 &= b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 &= b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 &= b_3 \end{aligned} \qquad \begin{aligned} 4u - 3v + w &= -5 \\ 3u - v - 2w &= 7 \\ u - 2v - w &= 0 \end{aligned}$$

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} & a_{13} \\ b_2 & a_{22} & a_{13} \\ b_3 & a_{32} & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \quad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 & a_{13} \\ a_{21} & b_2 & a_{13} \\ a_{31} & b_3 & a_{23} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{33} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}} \quad x_3 = \frac{\begin{vmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ a_{31} & a_{32} & b_3 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{13} \\ a_{31} & a_{32} & a_{23} \end{vmatrix}}$$

Determinant in the denominator equal for all unknown

$$\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix} = 4 \cdot \begin{vmatrix} -1 & -2 \\ -2 & -1 \end{vmatrix} - (-3) \cdot \begin{vmatrix} 3 & -2 \\ 1 & -1 \end{vmatrix} + 1 \cdot \begin{vmatrix} 3 & -1 \\ 1 & -2 \end{vmatrix}$$

$$\begin{aligned} &= 4 \cdot [(-1)\cdot(-1) - (-2)\cdot(-2)] \\ &\quad +3 \cdot [3 \cdot (-1) - (-2) \cdot 1] \\ &\quad +1 \cdot [3 \cdot (-2) - (-1) \cdot 1] \\ &= 4 \cdot [1-4] + 3 \cdot [-3+2] + 1 \cdot [-6+1] \\ &= -12 - 3 - 5 \\ &= \underline{-20} \end{aligned}$$

$$u = \frac{\begin{vmatrix} -5 & -3 & 1 \\ 7 & -1 & -2 \\ 0 & -2 & -1 \end{vmatrix}}{\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}} = \frac{-20}{-20} = \underline{1} \quad v = \frac{\begin{vmatrix} 4 & -5 & 1 \\ 3 & 7 & -2 \\ 1 & 0 & -1 \end{vmatrix}}{\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}} = \frac{-40}{-20} = \underline{2} \quad w = \frac{\begin{vmatrix} 4 & -3 & -5 \\ 3 & -1 & 7 \\ 1 & -2 & 0 \end{vmatrix}}{\begin{vmatrix} 4 & -3 & 1 \\ 3 & -1 & -2 \\ 1 & -2 & -1 \end{vmatrix}} = \frac{60}{-20} = \underline{-3}$$

$(u, v, w) = (1, 2 - 3)$ $\underline{\underline{b}}$