

substitution

$$\boxed{(-12, -2)}$$

$$\begin{cases} 3x + 2y = -40 \\ x = 5y - 2 \end{cases}$$

$$x = 5(-2) - 2$$

$$x = -10 - 2$$

$$\boxed{x = -12}$$

check

$$3(-12) + 2(-2) = -40$$

$$-36 - 4 = -40$$

$$-40 = -40 \checkmark$$

$$3(5y - 2) + 2y = -40$$

$$15y - 6 + 2y = -40$$

$$17y - 6 = -40$$

$$\frac{17y}{17} = \frac{-34}{17}$$

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

Elimination \Leftrightarrow linear combinations

\Downarrow
get rid of
a variable

\Downarrow
multiply by a constant & add

$$\Rightarrow \begin{cases} 3x + 5y = 41 \\ (-1)(3x - 2y) = (13)(-1) \end{cases}$$

$(7, 4)$

$$\begin{array}{r|l} 3x + 5y = 41 & \\ -3x + 2y = -13 & \\ \hline & 7y = 28 \\ & \underline{\quad} \\ & y = 4 \end{array}$$

$$\begin{aligned} \checkmark 3x + 5(4) &= 41 \\ 3x + 20 &= 41 \\ 3x &= 21 \\ x &= 7 \end{aligned}$$

check

$$\begin{aligned} 3(7) - 2(4) &= 13 \\ 21 - 8 &= 13 \\ 13 &= 13 \checkmark \end{aligned}$$

$$\begin{cases} 5(4x + 3y) = (16)5 \\ -4(5x - 7y) = (-66)(-4) \end{cases}$$

$$\begin{array}{r} \cancel{20x} + 15y = 80 \\ -\cancel{20x} + 28y = 264 \end{array} \quad (-2, 8)$$

$$\begin{array}{r} 43y = 344 \\ \hline 43 \quad 43 \\ \hline y = 8 \end{array}$$

$$\begin{aligned} 4x + 3(8) &= 16 \\ 4x + 24 &= 16 \\ 4x &= -8 \\ x &= -2 \end{aligned}$$

$$\begin{cases} 7(4x + 3y) = (16)7 \\ 3(5x - 7y) = (-66)3 \end{cases}$$

$$\begin{array}{r} 28x + 21y = 112 \\ 15x - 21y = -198 \end{array}$$

$$\begin{array}{r} 43x \quad = \quad -88 \\ \hline 43 \quad 43 \end{array} \quad x = -2$$

$$\begin{array}{r} 5(-2) - 7y = -66 \\ -10 - 7y = -66 \\ +10 \quad +10 \\ -7y = -56 \\ \hline -7 \quad -7 \\ \hline y = 8 \end{array}$$

Substitution

$$(-5, -2)$$

$$3x - 5y = -5$$

$$x = 4y + 3$$

$$3(4y + 3) - 5y = -5$$

$$12y + 9 - 5y = -5$$

$$7y + 9 = -5$$

$$7y = -14$$

$$y = -2$$

$$x = 4(-2) + 3$$

$$x = -8 + 3$$

$$x = -5$$

check

$$3(-5) - 5(-2) = -5$$

$$-15 + 10 = -5$$

$$-5 = -5 \checkmark$$

Elimination



linear combination

↓
get rid of
a variable

↓
mult by a number & add

$$\begin{aligned}
 -2(3x + 5y) &= (7)(-2) \\
 6x - 3y &= 27
 \end{aligned}$$

$$\begin{aligned}
 (4)(-1) \quad 3(3x + 5y) &= (7)3 \\
 5(6x - 3y) &= (27)5
 \end{aligned}$$

$$\begin{array}{r|l}
 -6x - 10y & = -14 \\
 6x - 3y & = 27 \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 9x + 15y & = 21 \\
 30x - 15y & = 135 \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 -13y & = 13 \\
 \hline
 -13 & -13
 \end{array}$$

$$\frac{39x}{39} = \frac{156}{39}$$

check

$$\begin{aligned}
 6(4) - 3(-1) &= 27 \\
 24 + 3 &= 27 \\
 27 &= 27 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 3x + 5(-1) &= 7 \\
 3x - 5 &= 7 \\
 3x &= 12 \\
 \frac{3x}{3} &= \frac{12}{3} \quad \boxed{x=4}
 \end{aligned}$$

$$y = 4$$

$$\begin{aligned}
 6(4) - 3y &= 27 \\
 24 - 3y &= 27 \\
 -24 - 24 &= 27 - 24 \\
 -3y &= 3 \quad \boxed{y=-1}
 \end{aligned}$$

Substitution

$$x = 4y - 3$$

$$3x - 5y = -22$$

$$3(4y - 3) - 5y = -22$$

$$12y - 9 - 5y = -22$$

$$\begin{array}{r} 7y - 9 = -22 \\ +9 \quad +9 \\ \hline \end{array}$$

$$\begin{array}{r} 7y = -13 \\ \frac{7y}{7} = \frac{-13}{7} \end{array}$$

$$y \approx -1.857$$

$$x = 4(-1.857) - 3$$

$$x = -10.428$$

Check

$$3(-10.428) - 5(-1.857) = -22$$
$$-22 = -22 \checkmark$$

$$(-10.428, -1.857)$$

Elimination
↓
Get rid of
one variable

Linear Combination
↓
mult by a number &
add.

~~$4(2) - 3(3) = 8 - 9 = -1$~~ ✓

$$\begin{array}{r} -3(4x - 3y) = (-1)(-3) \\ 12x + 7y = 45 \\ \hline -12x + 9y = 3 \\ 12x + 7y = 45 \\ \hline 16y = 48 \\ \frac{16y}{16} = \frac{48}{16} \\ y = 3 \end{array}$$

$12x + 7(3) = 45$
 $12x + 21 = 45$
 $\frac{12x}{12} = \frac{24}{12}$
 $x = 2$

$(2, 3)$

$$\begin{array}{r} 7(4x - 3y) = (-1)(7) \\ 3(12x + 7y) = (45)3 \\ \hline 28x - 21y = -7 \\ 36x + 21y = 135 \\ \hline 64x = 128 \\ \frac{64x}{64} = \frac{128}{64} \\ x = 2 \end{array}$$

$4(2) - 3y = -1$
 $8 - 3y = -1$
 $-3y = -9$
 $y = 3$