

The elimination method solving systems of linear equations

jordanbell.info

1. Find the point of intersection of the two lines

$$4x - 7y = 19$$

$$3x - 2y = 11$$

(Nelson, *Foundations of Mathematics 10*, Section 5.3, page 217, question 3d)

[illegible]

Solution: Given

$$4x - 7y = 19$$

$$3x - 2y = 11$$

Multiply the first equation by 3

$$12x - 21y = 57$$

$$3x - 2y = 11$$

Multiply the second equation by -4

$$12x - 21y = 57$$

$$-12x + 8y = -44$$

Add the two equations together

$$12x - 12x - 21y + 8y = 57 - 44$$

Collect like terms

$$-13y = 13$$

Isolate y

$$y = -1$$

Use $y = -1$ with the equation $3x - 2y = 11$

$$3x - 2(-1) = 11$$

$$3x + 2 = 11$$

Isolate $3x$

$$3x = 9$$

Isolate x

$$x = 3$$

The POI of the two lines is

$$(3, -1)$$

2. Find the point of intersection of the two lines

$$5x + 2y = 48$$

$$x + y = 15$$

(Nelson, *Foundations of Mathematics 10*, Section 5.3, page 217, question 4c)

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Solution: Given

$$5x + 2y = 48$$

$$x + y = 15$$

Multiply the second equation by -2

$$5x + 2y = 48$$

$$-2x - 2y = -30$$

Add the two equations together

$$5x - 2x + 2y - 2y = 48 - 30$$

Collect like terms

$$3x = 18$$

Isolate x

$$x = 6$$

Use $y = 6$ with the equation $x + y = 15$

$$6 + y = 15$$

Isolate y

$$y = 9$$

The POI of the two lines is

$$(6, 9)$$

3. Find the point of intersection of the two lines

$$x + 2y = 2$$

$$2x + y = 1$$

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Solution: Given

$$x + 2y = 2$$

$$2x + y = 1$$

Multiply first equation by 2

$$2x + 4y = 4$$

$$2x + y = 1$$

Multiply second equation by -1

$$2x + 4y = 4$$

$$-2x - y = -1$$

Add the two equations

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

Collect like terms

$$3y = 3$$

Isolate y

$$y = 1$$

Use $y = 1$ with $2x + y = 1$

$$2x + 1 = 1$$

Isolate $2x$

$$2x = 0$$

Isolate x

$$x = 0$$

The POI of the two lines is

$$(0, 1)$$

4. Find the point of intersection of the two lines

$$5x - 4y = 11$$

$$-3x - 13y = 6$$

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Solution: Given

$$\begin{aligned}5x - 4y &= 11 \\ -3x - 13y &= 6\end{aligned}$$

Multiply first equation by 3:

$$\begin{aligned}15x - 12y &= 33 \\ -3x - 13y &= 6\end{aligned}$$

Multiply second equation by 5

$$\begin{aligned}15x - 12y &= 33 \\ -15x - 65y &= 30\end{aligned}$$

Add the two equations

$$15x - 15x - 12y - 65y = 33 + 30$$

Collect like terms

$$-77y = 63$$

Isolate y

$$y = \frac{63}{-77}$$

Write fractions in lowest terms (common factor 7)

$$y = -\frac{9}{11}$$

Use $y = -\frac{9}{11}$ with $5x - 4y = 11$

$$5x - 4\left(-\frac{9}{11}\right) = 11$$

$$5x + \frac{36}{11} = 11$$

Isolate $5x$

$$5x = 11 - \frac{36}{11}$$

Make common denominator

$$5x = \frac{121}{11} - \frac{36}{11}$$

Combine like terms

$$5x = \frac{85}{11}$$

Isolate x

$$x = \left(\frac{1}{5}\right) \left(\frac{85}{11}\right)$$

Fraction multiplication properties

$$x = \left(\frac{85}{5}\right) \left(\frac{1}{11}\right)$$

$$x = 17 \left(\frac{1}{11}\right)$$

$$x = \frac{17}{11}$$

The POI of the two lines is

$$\left(\frac{17}{11}, -\frac{9}{11}\right)$$