Simultaneous Equations

Elimination

1. $4x + 3y = 14 \quad (\times 5)$

$5x + 7y = 11 \quad (\times 4)$

$5 \times 4x + 5 \times 3y = 5 \times 14$

$20x + 15y = 70$

$4 \times 5x + 4 \times 7y = 4 \times 11$

$20x + 28y = 44$

$$\begin{array}{r} 20x + 15y = 70 \\ -\ 20x + 28y = 44 \\ \hline 0x - 13y = 26 \end{array}$$

$-13y = 26$

$y = \frac{26}{-13} = -2$

$$4x + 3x - 2 = 14$$

$$4x - 6 = 14$$

$$4x = 14 + 6$$

$$4x = 20$$

$$x = \frac{20}{4} = 5$$

$$5 \times 5 + 7 \times -2 = 11$$

$$25 - 14 = 11 \quad \checkmark$$

2.

$$2a + 2c = 33$$

$$-\quad 2a + 6c = 55$$

$$0a - 4c = -22$$

$$-4c = -22$$

$$c = \frac{-22}{-4} = 5.5$$

$$2a + 2 \times 5.5 = 33$$

$2a + 2 \times 5.5 = 33$

$2a + 11 = 33$

$2a = 33 - 11$

$2a = 22$

$a = \frac{22}{2} = 11$

$2 \times 11 + 6 \times 5.5 = 55$

$22 + 33 = 55$ ✓

Substitution

1. $5x - 3y = 26$

$4x + 2y = 34$

$5x = 26 + 3y$

$x = \frac{26 + 3y}{5}$

$4(26 + 3y) + 2y = 34$

$$4\left(\frac{26+3y}{5}\right)+2y=34$$

$$\frac{104+12y}{5}+2y=34$$

$$104+12y+10y=170$$

$$104+22y=170$$

$$22y=170-104$$

$$22y=66$$

$$y=\frac{66}{22}=3$$

$$5x-3\times3=26$$

$$5x-9=26$$

$$5x=26+9$$

$$5x=35$$

$$x=\frac{35}{5}=7$$

$(4 \times 7) + (2 \times 3) = 34$

$28 + 6 = 34$ ✓

Elimination

2. $7x + y = 25$

$+ \quad 5x - y = 11$

$12x + 0y = 36$

$12x = 36$

$x = \frac{36}{12} = 3$

$7 \times 3 + y = 25$

$21 + y = 25$

$y = 25 - 21$

$y = 4$

3. $2x + 13y = 36$

$13x + 12y = 69$

$$13x + 12y = 69$$

$$2x = 36 - 13y$$

$$x = \frac{36 - 13y}{2}$$

$$13\left(\frac{36-13y}{2}\right) + 12y = 69$$

$$\frac{468 - 169y}{2} + 12y = 69$$

$$468 - 169y + (2 \times 12y) = (2 \times 69)$$

$$468 - 169y + 24y = 138$$

$$468 - 145y = 138$$

$$-145y = 138 - 468$$

$$-145y = -330$$

$$y = \frac{-330}{-145} = 2.28$$

$$2x + (13 \times 2.28) = 36$$

$$2x + 29.6 = 36$$

$$2x = 36 - 29.6$$

$$2x = 6.4$$

$$x = \frac{6.4}{2} = 3.2$$

$13 \times 3.2 + 12 \times 2.28 = 68.96$ ✓

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4. $y = x^2 + 1$

$y = 9 - x^2$

$x^2 + 1 = 9 - x^2$

$x^2 + x^2 + 1 = 9$

$2x^2 + 1 = 9$

$2x^2 - 8 = 0$

$$2x^2 + 0x - 8$$

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

$$= \frac{-0 \pm \sqrt{0^2 - 4 \times 2 \times -8}}{2 \times 2}$$

$$= \frac{\pm \sqrt{64}}{4}$$

$$= \pm \frac{8}{4}$$

$$x = \pm 2 \qquad x = 2 \qquad x = -2$$

$$y = x^2 + 1$$

$$y = 2^2 + 1 = 5$$

$$y = -2^2 + 1 = 5$$

$y = 9 - x^2$

$y + x^2 = 9$

$5 + 2^2 = 9$

$5 + 4 = 9$ ✓

$5 + -2^2 = 9$

$5 + 4 = 9$ ✓