Simultaneous Linear Equations

Ex 1

$$5x + 2y = 10 \quad (1)$$
$$7x + 3y = 16 \quad (2)$$

(1) × 3 $\quad 15x + 6y = 30 \quad (3)$

(2) × 2 $\quad 14x + 6y = 32 \quad (4)$

(3) − (4) $\quad x = -2$

$\underline{x = -2}$

Sub for x in (1)

$$5(-2) + 2y = 10$$
$$-10 + 2y = 10$$
$$2y = 10 + 10$$
$$2y = 20$$
$$y = \frac{20}{2}$$
$$y = 10$$

$\underline{y = 10}$

Ex 2

$$4x - 5y = 22 \quad (1)$$
$$3x - 2y = 13 \quad (2)$$

(1) × 2 $\quad 8x - 10y = 44 \quad (3)$

(2) × 5 $\quad 15x - 10y = 65 \quad (4)$

(4) − (3) $\quad 7x = 21$

$$x = \frac{21}{7}$$

$\underline{x = 3}$

Sub for x in ①

$$4(3) - 5y = 22$$
$$12 - 5y = 22$$
$$-5y = 22 - 12$$
$$-5y = 10$$
$$y = \frac{10}{-5} \qquad \underline{y = -2}$$

Ex 3

$$4x - 7y = 9 \quad ①$$
$$3x + 2y = 14 \quad ②$$

① × 2 $\quad 8x - 14y = 18 \quad ③$

② × 7 $\quad 21x + 14y = 98 \quad ④$

③ + ④ $\quad 29x = 116$

$$x = \frac{116}{29} \qquad \underline{x = 4}$$

Sub for x in ②

$$3(4) + 2y = 14$$
$$12 + 2y = 14$$
$$2y = 14 - 12$$
$$2y = 2$$
$$y = \frac{2}{2} \qquad \underline{y = 1}$$

6 Solve these simultaneous equations.

a $2x + y = 8$
$5x + 3y = 12$

b $3x + 2y = 19$
$4x - y = 29$

c $8a - 3b = 30$
$3a + b = 7$

d $2v + 3w = 12$
$5v + 4w = 23$

e $9p + 5q = 15$
$3p - 2q = -6$

f $3x - 2y = 11$
$2x - y = 8$

a)

$2x + y = 8$ (1)

$5x + 3y = 12$ (2)

(1) ×3 $\quad 6x + 3y = 24$ (3)

(3) - (2) $\quad \underline{x = 12}$

Sub for x in (1)

$2(12) + y = 8$

$24 + y = 8$

$y = 8 - 24$

$\underline{y = -16}$

$\begin{cases} x = 12 \\ y = -16 \end{cases}$

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b)

$3x + 2y = 19$ (1)

$4x - y = 29$ (2)

② × 2 $\quad 8x - 2y = 58$ ③

① + ③ $\quad 11x = 77$

$x = \frac{77}{11}$ $\quad \underline{x = 7}$

Sub for x in ①

$3(7) + 2y = 19$

$21 + 2y = 19$

$2y = 19 - 21$

$2y = -2$

$y = \frac{-2}{2}$ $\quad \underline{y = -1}$

$\begin{cases} x = 7 \\ y = -1 \end{cases}$

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c) $8a - 3b = 30$ ①

$3a + b = 7$ ②

② × 3 $\quad 9a + 3b = 21$ ③

① + ③ $\quad 17a = 51$

$a = \frac{51}{17}$ $\quad \underline{a = 3}$

Sub for a in ②

$3(3) + b = 7$

$9 + b = 7$

$b = 7 - 9$ $\quad \underline{b = -2}$

$\begin{cases} a = 3 \\ b = -2 \end{cases}$

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d)

$$2v + 3w = 12 \quad (1)$$
$$5v + 4w = 23 \quad (2)$$

(1) × 4 $\quad 8v + 12w = 48 \quad (3)$

(2) × 3 $\quad 15v + 12w = 69 \quad (4)$

(4) − (3) $\quad 7v = 21$

$$v = \frac{21}{7} \qquad \underline{v = 3}$$

Sub for v in (1)

$$2(3) + 3w = 12$$
$$6 + 3w = 12$$
$$3w = 12 - 6$$
$$3w = 6$$
$$w = \frac{6}{3} \qquad \underline{w = 2}$$

$$\begin{cases} v = 3 \\ w = 2 \end{cases}$$

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e)

$$9p + 5q = 15 \quad (1)$$
$$3p - 2q = -6 \quad (2)$$

(1) × 2 $\quad 18p + 10q = 30 \quad (3)$

(2) × 5 $\quad 15p - 10q = -30 \quad (4)$

(3) + (4) $\quad 33p = 0$

$$\underline{p = 0} \qquad \underline{p = 0}$$

Sub for p in (1)

$$9(0) + 5q = 15$$
$$5q = 15$$
$$q = \frac{15}{5}$$
$$\underline{q = 3}$$

$$\begin{cases} p = 0 \\ q = 3 \end{cases}$$

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f)

$$3x - 2y = 11 \quad (1)$$
$$2x - y = 8 \quad (2)$$

(2) ×2

$$4x - 2y = 16 \quad (3)$$

(3) − (1)

$$\underline{x = 5}$$

Sub for x in (2)

$$2(5) - y = 8$$
$$10 - y = 8$$
$$-y = 8 - 10$$
$$-y = -2$$
$$\underline{y = 2}$$

$$\begin{cases} x = 5 \\ y = 2 \end{cases}$$
