Note Title 14/03/2011

SIMULTANEOUS EQUATIONS

An equation such as $2x + 3 = 12$ has just <u>one</u> solution.

An equation such as

$$2x + 3y = 12$$

has an <u>infinite</u> number of solutions.

e.g $x = 3$, $y = 2$

or $x = 9$, $y = -2$ <u>etc</u>

We can make a table of these solutions and show them as a straight line graph.

If we have <u>two</u> equations of this type

e.g
$$2x + 3y = 12$$
$$4x - y = 31$$

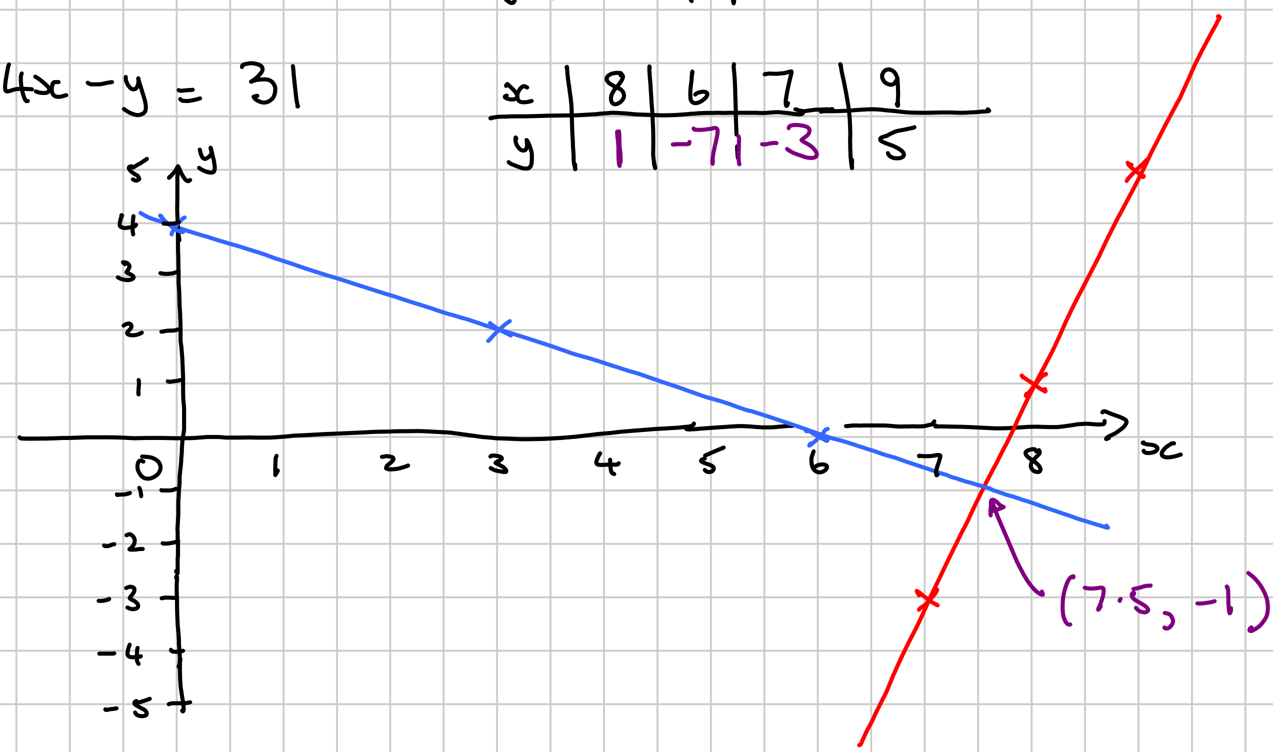
the solutions of each equation will form a line. Where the lines cross will be a solution of both equations SIMULTANEOUSLY.

— $2x + 3y = 12$

x	6	0	3
y	0	4	2

— $4x - y = 31$

x	8	6	7	9
y	1	-7	-3	5



Solution is $x = 7.5$, $y = -1$

Elimination Method

This is based on the fact that if we ADD or SUBTRACT two equations, we get another valid equation.

Examples

(1)

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

(1) − (2) $\quad 3y = 6$

$$y = 2$$

Subst in (1) : $\quad 3x + 10 = 16$

$$(-10) \qquad (-10)$$

$$3x = 6$$

$$x = 2$$

(2)

$$5x + 3y = 16 \quad (1)$$
$$2x - 3y = 19 \quad (2)$$

(1) + (2) $\quad 7x = 35$

$$x = 5$$

Sub in (1) $\quad 25 + 3y = 16$

$$(-25) \qquad (-25)$$

$$3y = -9$$

$$y = -3$$

Check in (2) : $\quad 10 - -9 = 19$ ✓

- We can eliminate either x (as in e.g 1) or y (as in eg 2)
- If the coefficients are equal with the SAME SIGN, SUBTRACT the equations.
- If the coefficients are equal with OPPOSITE SIGNS, ADD the equations.

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$$5x - 2y = 17 \quad (1)$$
$$3x - 4y = 6 \quad (2)$$

(1) ×2
$$10x - 4y = 34 \quad (3)$$
$$3x - 4y = 6 \quad (2)$$

(3) − (2)
$$7x = 28$$
$$\underline{x = 4}$$

Sub in (1)
$$20 - 2y = 17$$
(−20) (−20)
$$-2y = -3$$
(÷ −2) (÷ −2)
$$\underline{y = 1.5}$$

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$$2x + 3y = 17 \quad (1)$$
$$5x - 2y = 14 \quad (2)$$

(1) ×2
$$4x + 6y = 34 \quad (3)$$
(2) ×3
$$15x - 6y = 42 \quad (4)$$

(3) + (4)
$$19x = 76$$
$$\underline{x = 4}$$

Sub in (1)
$$8 + 3y = 17$$
$$3y = 9$$
$$\underline{y = 3}$$

Problems leading to Sim. Eqns

Example Tickets for the school play are priced at £3 for students and £5 for adults. At the opening night all 200 tickets are sold and the takings are £856. How many tickets were bought by students and how many by adults?

Let x = no of adult tickets
y = no of student tickets

Total no of tickets: $x + y = 200$ ①

Total takings: $5x + 3y = 856$ ②

① ×5 $5x + 5y = 1000$ ③

③ − ② $2y = 144$
$y = 72$

Sub in ① $x + 72 = 200$
$x = 128$

128 adult tickets and 72 student tickets