

Note: IB calls it

Simultaneous equations

System of equations: graphing +substitution + elimination

Page ~~DONE~~ 2-16 (only even)

Page ~~DONE~~ 4-26 (only even)
4-14 (only even)

**HOMEWORK due before quiz on Thursday, Nov. 8: LOG INTO
www.mymaths.com and finish the Review Worksheets I have
set up for you in this online program.**

DON'T FORGET TO LOGIN WITH YOUR PASSWORD I GAVE YOU TODAY

Overview

- 1 variable → 1 equation

$$2x + 10 = 5$$

- 2 variables → 2 equations

$$\begin{cases} 2x + y = 10 \\ x + y = 20 \end{cases}$$

The Elimination Method

- Objectives

- Use the elimination method to solve a system of equations
- The **elimination method** uses opposites to eliminate one of the variables
- Choose an appropriate method to solve a system of equations

The Elimination Method

- Given the system, solve by elimination:
 – Brown → 1st step | – green → using the other equation
 – Blue → 2nd step

$$\begin{cases} 3x + 4y = 7 \\ 2x - 4y = 13 \end{cases}$$

$2(4) - 4y = 13$
 $8 - 4y = 13$
 $-4y = 13 - 8$
 $-4y = 5$
 $y = -\frac{5}{4} = -1.25$

$3(4) + 4y = 7$
 $12 + 4y = 7$
 $4y = 7 - 12$
 $4y = -5$ $y = -\frac{5}{4}$

$5x = 20$
 $5x + 0 = 20$
 $5x = 20$
 $x = 4$

- Brown = 1st step Manipulate System
- Blue = 2nd step Solve for 1 variable

Another example...

- green = last step
Substitute and solve for 2nd variable

$$\begin{cases} 6x + 5y = 32 \\ 6x + 3y = 48 \end{cases} \rightarrow \begin{cases} 6x + 5y = 32 \\ -6x - 3y = -48 \end{cases}$$

$$2y = -16$$

$$y = \frac{-16}{2}$$

$$y = -8$$

$$6x + 5(-8) = 32$$

$$6x - 40 = 32$$

$$6x = 32 + 40$$

$$6x = 72 \rightarrow x = 12$$

- Brown = 1st step = manipulate system
- Blue = 2nd step = eliminate variable and solve for the other
- green = last step = substitute variable and solve for the 2nd variable

What if they don't match?!?!?

■ Solve by elimination:

$$\begin{cases} 2x - y = 7 \\ 5x + 4y = 11 \end{cases} \rightarrow \begin{cases} 8x - 4y = 28 \\ 5x + 4y = 11 \end{cases}$$

$$13x = 39$$

$$x = 3$$

$$2x - y = 7$$

$$2(3) - y = 7$$

$$6 - y = 7$$

$$-y = 7 - 6$$

$$-y = 1$$

$$y = -1$$

- Brown = 1st step = Manipulate System
- Blue = 2nd step = Eliminate variable and Solve for the other
- Green = Last step = Substitute and solve 2nd variable

What if they don't match?!?!?

- Solve by elimination:

$$\begin{array}{l} 5(2x+3y)=1(5) \\ (-2)(5x+7y)=3(-2) \end{array} \quad \left\{ \begin{array}{l} 10x+15y=5 \\ -10x-14y=-6 \end{array} \right.$$

$$y = -1$$

$$2x+3y=1$$

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

$$2x-3=1$$

$$2x=1+3$$

$$2x=4$$

$$x=2$$

It does not matter if you manipulate the equation differently as far as you are able to ELIMINATE a variable. See below, same system as previous slide.

$$\begin{array}{l} (7)(2x+3y)=1(7) \\ (-3)(5x+7y)=3(-3) \end{array}$$

$$\left\{ \begin{array}{l} 14x+21y=7 \\ -15x-21y=-9 \end{array} \right.$$

$$-x = -2$$

$$x = 2$$

$$2x+3y=1$$

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

$$4+3y=1$$

$$3y=1-4$$

$$3y=-3$$

$$y=-1$$

NOTE: remember some books like to give the answer as the coordinates of a point

(2, -1)

This point will be which point???

point of intersection

Choosing a Method

Example	Method	Why
$6x + y = 10$ $y = 3x + 5$	Substitution	The "y" is already isolated in one of the equation
$2x - 5y = -20$ $4x + 5y = 14$	elimination	bc the "-5y" and "5y" would easily <u>eliminate</u> when we add the 2 equations
$9a - 2b = -11$ $8a - 4b = 25$	Most students would use ELIMINATION . However, some may want to use SUBSTITUTION by isolating the "b" in 1st equation.	It is fairly easy to manipulate the system by multiplying 1st equa. by (-2)
$y = 3x + 2$ $y = -\frac{1}{4}x + 7$	SUBSTITUTION, using the y-method OR GRAPHING, if you have graphing paper.	bc the equation are given in the form of $y=mx+b$

What is the point of learning this? → SOLVE WORD PROBLEMS (real life situations)

More examples of one equation or Simultaneous!

In the display window of the local store there are bicycles and tricycles. There are 9 cycles and 21 wheels. How many bicycles and tricycles are in the display?

$x = \#$ of bicycles
 $y = \#$ of tricycles

$$\begin{cases} x + y = 9 \\ 2x + 3y = 21 \end{cases}$$

Now solve by elimination by multiplying 1st equation by (-2) or (-3)

You can also solve by substitution by isolating the x or y in 1st equation (i.e. $y=9-x$)

Take a rectangle where one side is 3cm longer than the other. If the perimeter is 30cm, what is the length of each side.

$s = \text{length of width}$
 $l = \text{length of the other side}$

$$\begin{cases} l = 3 + s \\ 30 = 2s + 2l \end{cases}$$

Now solve by substitution. Take $(3+s)$ and put it in the second equation instead of l

Typical word problem. Each person/situation will create each equation

Rent-a-Car

Deema and Ramzi both rent cars from the same agency. The agency rents cars a daily fee and a mileage fee. Deema rented the car for 3 days and drove the car 450 miles. Ramzi had a car for 6 days and drove his car 600 miles. Deema had to pay 1275dhs, while Ramzi had to pay 1950dhs. What was the cost per day and the mileage charge?

$d = \text{price daily (dhs)}$

$m = \text{price per mile (dhs)}$

$$\begin{cases} 1275 = 3d + 450m \\ 1950 = 6d + 600m \end{cases}$$

Now solve by elimination by multiplying 1st equation by (-2)