Class slides

Simultaneous Equations:

1. **Elimination.**

Ex.1.

Solve the simultaneous equations

$$x+y=8 \longrightarrow 1$$
$$x-y=4 \longrightarrow 2$$

$① \rightarrow ②$

$$x+y=8$$
$$-x-y=4$$
$$\overline{0+2y=4}$$

$$2y=4$$
$$y=\frac{4}{2}=2$$

$$x+2=8$$
$$x=6$$

Ex.2

Use elimination to solve the simultaneous equations

$$7x+4y=17 \longrightarrow ① \rightarrow 3$$
$$3x+2y=11 \longrightarrow ② \rightarrow 7$$

Step1:

Step 2:

$$21x+12y=51$$
$$-21x-14y=77$$
$$\overline{0 \quad 26y \quad =-26}$$

Step3: $y=\frac{-26}{26}$ $\boxed{y=-1}$

Step4 $7x+4(-1)=17$

$$7x=17+4$$
$$x=\frac{21}{7}=\boxed{3}$$

Use elimination:

$$6x - 15y = -1 \longrightarrow ①$$
$$9x + 20y = 7 \longrightarrow ②$$

Step 1:   ① × 3
          ② × 2

Step 2:
$$18x - 45y = -3$$
$$-18x + 4oy = 14$$
$$\overline{}$$
$$0 \quad -85y = -17$$

Step 3: $y = +\dfrac{17}{85}5 = \dfrac{1}{5}$

Step 4: x

Use Substitution:

Use substitution to solve the simultaneous equations

$$2x - 5y = 4 \longrightarrow ①$$
$$x + y = -5 \longrightarrow ②$$

Step 1: Rearrange easy eq.

$$y = -5 - x \longrightarrow ②$$

Step 2:
$$2x - 5y = 4$$
$$2x - 5(-5 - x) = 4$$
$$2x + 25 + 5x = 4$$
$$x =$$

$$y =$$

Notes

Linear Simultaneous Equations – Elimination

What are simultaneous linear equations?

- When you have more than one equation in more than one unknown, then you are dealing with **simultaneous equations**

- An equation is **linear** if none of the unknowns in it is raised to a power other than one

- Solving a **pair of simultaneous equations** means finding **pairs of values** that make **both equations true** at the same time

- A linear equation in two unknowns will produce a straight line if you graph it... linear = line

- A pair of simultaneous equations will produce lines that will cross each other (if there is a solution!)

How do I use elimination to solve simultaneous linear equations?

Step 1: Multiply one (or both) of the equations by a constant (or constants) to get the numbers in front of **one** of the unknowns to match

Step 2: If the matching numbers have the **same** sign, then **subtract** one equation from the other. If the matching numbers have **different** signs then **add** the equations together

Step 3: Solve the new equation from Step 2 to find the value of one of the unknowns

Step 4: Substitute the value from Step 3 into one of the original equations, and solve to find the value of the other unknown

Step 5: Check your solution by substituting the values for the two unknowns into the original equation you **didn't** use in Step 4

Worked example

Solve the simultaneous equations:
$$-2x + 4y = 5$$
$$4x - 5y = -7$$

$$-2x + 4y = 5 \quad \text{①}$$
$$4x - 5y = -7 \quad \text{②}$$

> LABEL THE EQUATIONS

STEP 1:   [2×①] $-4x + 8y = 10$
          [②] $4x - 5y = -7$

> WE ONLY HAVE TO MULTIPLY ONE OF THE EQUATIONS HERE

STEP 2: $-4x + 8y = 10$
          $+ (4x - 5y = -7)$
          _____
          $3y = 3$

> THE SIGNS IN FRONT OF THE 4's ARE DIFFERENT, SO ADD

STEP 3: $y = 3 \div 3 = 1$

STEP 4: $4x - 5(1) = -7$
          $4x = -2$
          $x = -0.5$

> USING EQUATION ②

STEP 5: $-2(-0.5) + 4(1) = 5$
          $1 + 4 = 5$
          $5 = 5 \checkmark$

> USING EQUATION ①

$$x = -0.5 \quad y = 1$$

Linear Simultaneous Equations – Substitution

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- Solving a **pair of simultaneous equations** means finding **pairs of values** that make **both equations true** at the same time

- A linear equation in two unknowns will produce a straight line if you graph it... linear = line

- A pair of simultaneous equations will produce lines that will cross each other (if there is a solution!)

How do I use substitution to solve simultaneous linear equations?

Step 1: Rearrange one of the equations to make one of the unknowns the subject (if one of the equations is already in this form you can skip to Step 2)

Step 2: Substitute the expression found in Step 1 into the equation not used in Step 1

Step 3: Solve the new equation from Step 2 to find the value of one of the unknowns

Step 4: Substitute the value from Step 3 into the rearranged equation from Step 1 to find the value of the other unknown

Step 5: Check your solution by substituting the values for the two unknowns into the original equation you **didn't** rearrange in Step 1
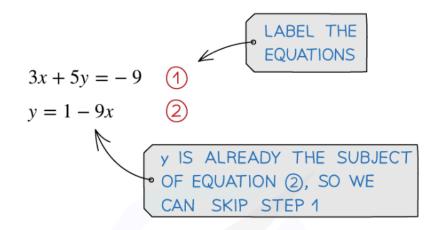
Worked example

? Solve the simultaneous equations:

$$3x + 5y = -9$$

$$y = 1 - 9x$$

$$3x + 5y = -9 \quad ①$$

$$y = 1 - 9x \quad ②$$

STEP 2: $3x + 5(1-9x) = -9$
$3x + 5 - 45x = -9$
$-42x = -14$

STEP 3: $x = -14 \div (-42) = \frac{1}{3}$

STEP 4: $y = 1 - 9(\frac{1}{3}) = 1 - 3 = -2$

STEP 5: $3(\frac{1}{3}) + 5(-2) = -9$
$1 - 10 = -9$
$-9 = -9 \checkmark$

$x = \frac{1}{3} \quad y = -2$