Westminster Kingsway
central London's College

Simultaneous Equations

GCSE MATHS

Name: _____

Teacher: _____

Learning objectives

By the end this pack you will be able to:

1. **Find solutions to simultaneous equations using substitution method**
2. **Find solutions to simultaneous equations using elimination method**

Simultaneous Equations-solving by elimination

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Example 1- type 1

$3x + y = 10$

$2x + y = 7$

$3x + y = 10$

$-\ (2x + y) = 7$

$\mathbf{1x = 3}$

Then, $3(3) + y = 10$

$9 + y = 10$

Subtract 9 from both sides

$\mathbf{y = 1}$

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Example 2- type 1b

$2x - 3y = 1$

$7x + 3y = 44$

$2x - 3y = 1$

$+\ (7x + 3y) = 44$

$9x = 45$

Divide both sides by 9

$\mathbf{x = 5}$

Then, $2(5) + y = 1$

$10 + y = 1$

Subtract 10 from both sides

$\mathbf{y = -9}$

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$3x + y = 7$

$2x + y = 6$

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$2x + y = 21$

$x - y = 6$

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<tr>
<td colspan="2">Look at the equations in the question and decide whether you are going to add or subtract them</td>
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$3x + 2y = 24$

$x + 2y = 12$

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$8x + 3y = 19$

$3x - 3y = 3$

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<td colspan="2">(This is just like solving an equation but instead of adding or subtracting the same numerical value from both sides you are adding or subtracting algebraic expressions!)</td>
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Solving Simultaneous Equations

Example –type 2

$2x + 3y = 13$ (A)

$x + 5y = 17$ (B)

By multiplying all of the terms in one of the equations by the same number the equation remains valid. We can then get the same number of xs or ys in two equations.

$2 \times (B) = 2x + 10y = 34$ (C)

Now we have the same number of xs in equation (A) and (C) so when we subtract one from the other there are no x terms left.

$$\begin{array}{rl} & 2x + 10y = 34 \quad (C) \\ - & \underline{(2x + 3y) = 13 \quad (A)} \\ & 7y = 21 \end{array}$$

Divide both sides by 7

$y = 7$

This value can then be substituted into any of the equations with x in.

$x + 5(7) = 17$

$x + 35 = 17$

Subtract 35 from both sides

$x = -18$

$3x + 4y = 20$
$2x + y = 10$

$5x + 2y = 16$
$4x + y = 11$

$3x + 2y = 16$
$2x + y = 9$

$2x + y = 11$
$3x – 2y = 6$

<u>Example –type 3</u>

2x + 3y = 9 (A)

5x + 4y = 26 (B)

Multiply both equations so you get either the same number of xs or the same number of ys.

Multiply (A) by 5 and (B) by 2.

(A)x 5 10x + 15y = 45

(B)x 2 10x + 8y = 52

Now subtract the two equations.

7y = -7

y =-1

Sub. y = -1 into A

2x – 3 = 9

Add 3 to both sides

2x = 12

Divide both sides by 2

x = 6

2x + 5y = 16

3x + 4y = 17

5x + 2y = 31

2x + 3y = 19

4x + 3y = 15

5x – 4y = 11

3x + 5y = 25

2x + 3y = 16

Simultaneous Equations – Grade C

Core:

1. Find a and b for each pair of simultaneous equations:

a)

$5a + 2b = 14$

$6a + 2b = 16$

b)

$7a + 3b = 27$

$6a + 3b = 24$

c)

$10a - 2b = 30$

$3a - 2b = 2$

d)

$9a - 6b = 42$

$6a - 6b = 18$

2. Find a and b for each pair of simultaneous equations:

e) $4a + 7b = 27$

$4a - 7b = 13$

f) $3a + 2b = 35$

$2a - 2b = 10$

3. Find a and b for each pair of simultaneous equations:

g)

$5a + 6b = 28$

$6a + 2b = 18$

h)

$4a + 4b = 36$

$6a - 2b = 22$

Question:

In a shop there are no prices up, but if Tom is charged £2.80 for 3 cakes and 2 cups of Tea and Andy buys 4 cakes and 4 cups of tea for £4.60, how much does 1 cup of tea and 1 cake cost?

Killer Questions

1. Solve the simultaneous equations

$$3x - 4y = 13$$
$$2x + 3y = 3$$

x = ...

y = ...

(Total 4 marks)

2. Solve the simultaneous equations

$$3x + 7y = 26$$
$$4x + 5y = 13$$

x = ...

y = ...

(Total 4 marks)

Solving Simultaneous Equations by substitution

Equations	Solve by substituting for first unknown	Solve by substituting for remaining unknown	CHECK by substituting
1. $3x - y = 1$ $y = 2x$			
2. $x + 2y = 15$ $y = 2x$			
3. $2x + y = 17$ $y = 6x + 1$			

4. $3x + 2y = 4$ $x = y - 2$			
5. $5x + 6y = 34$ $y = x + 2$			
6. $5x - 2y = 23$ $x = y + 1$			

Extension Work

1. Solve

$2x - 3y = 11$
$5x + 2y = 18$

X=……

Y=……
(Total 3 marks)

2. Solve the simultaneous equations

$2x + 3y = -3$

$3x - 2y = 28$

X=……

Y=……
(Total 3 marks)

3. Solve the simultaneous equations

$6x - 2y = 33$

$4x + 3y = 9$

X=.....

Y=.....

(Total 3 marks)

4. Solve

$x + 2y = 4$

$3x - 4y = 7$

X=.....

Y=.....

(Total 3 marks)

Homework Exam Questions

1.

ABC is an isosceles triangle.

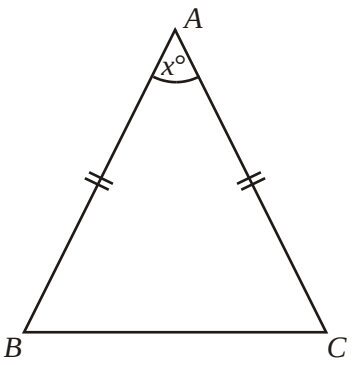

Diagram **NOT** accurately drawn

AB = *AC*
Angle *A* = x^o

(a) Find an expression, in terms of *x*, for the size of angle *B*.

.....(2)

(b) Solve the simultaneous equations.

$3p + q = 11$

$p + q = 3$

p=.....

q=.....

(3)
(Total 5 marks)