

# Simultaneous Equations (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

|              |               |
|--------------|---------------|
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| Total Marks: |               |

1. Alex bought 3 tins of paint and 4 brushes at a total cost of £23.

Brian bought 2 tins of paint and 3 brushes at a total cost of £16.

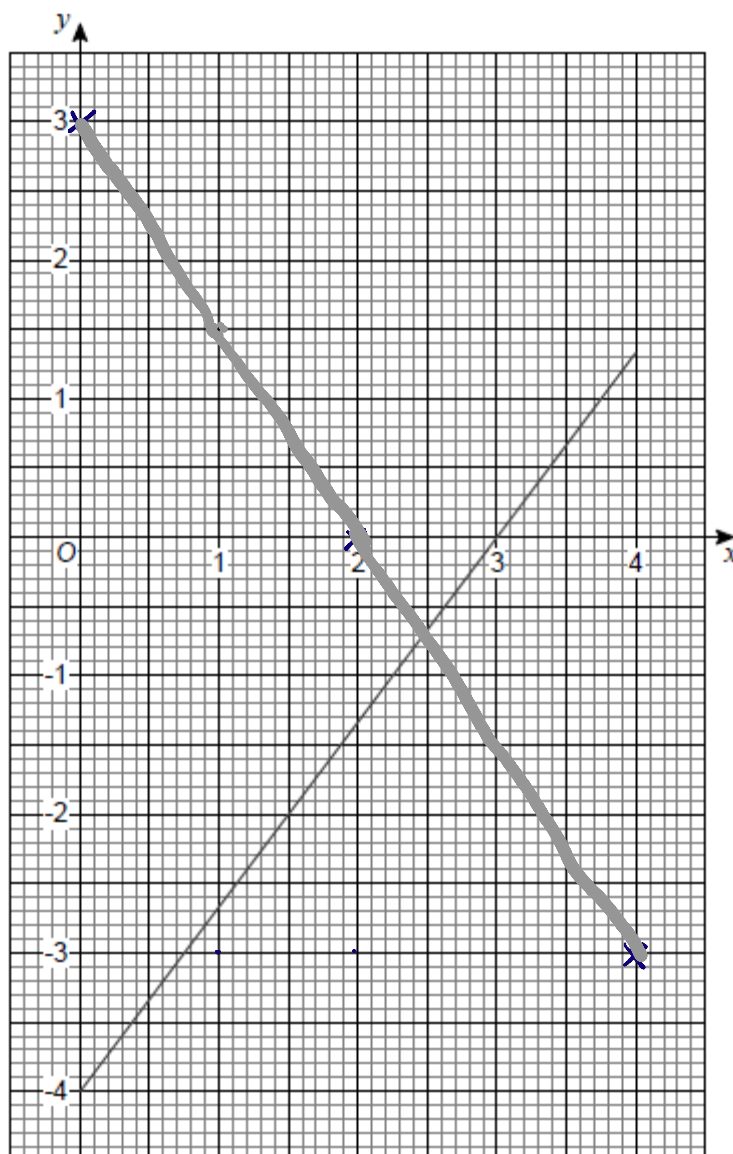
Using an algebraic method, calculate the price of a single tin of paint and the price of one brush.

$$\begin{array}{rcl}
 3P + 4B = 23 & \text{---} \textcircled{1} & (\times 2) \\
 2P + 3B = 16 & \text{---} \textcircled{2} & (\times 3) \\
 \hline
 6P + 8B = 46 & \text{---} \textcircled{3} & \\
 6P + 9B = 48 & \text{---} \textcircled{4} & \\
 \hline
 \textcircled{4} - \textcircled{3} & & B = \underline{\underline{\pounds 2}} \\
 \text{sub int } \textcircled{2} & & 2P + 3 \times 2 = 16 \\
 & & 2P = 10 \\
 & & P = \pounds 5
 \end{array}$$

The price of a single tin of paint = ..... £5 .....

The price of one brush = ..... £2 ..... [4]

2. Here is the graph of  $4x - 3y = 12$  for values of  $x$  from 0 to 4



By drawing a second graph on the grid, work out an approximate solution to the simultaneous equations

$$4x - 3y = 12 \text{ and } 3x + 2y = 6 \quad 2y = 6 - 3x \quad y = 3 - 1.5x$$

$$\star \text{ when } x = 4 \quad y = 3 - 1.5 \times 4 = 3 - 6 = -3$$

$$\star \text{ when } x = 2 \quad y = 3 - 1.5 \times 2 = 0$$

$$\star \text{ when } x = 0 \quad y = 3$$

$$\text{approximate solution } x = 1.5 \\ y = -0.7$$

[3]

3. Solve algebraically the simultaneous equations

$$\textcircled{1} x^2 + y^2 = 25$$

$$\textcircled{2} y - 2x = 5 \quad y = 5 + 2x \quad y^2 = (5 + 2x)(5 + 2x) = 25 + 10x + 10x + 4x^2$$

$$\text{Sub into } \textcircled{1} \quad x^2 + 4x^2 + 20x + 25 = 25 \\ 5x^2 + 20x = 0 \\ 5x(x + 4) = 0 \\ x = 0 \quad x = -4$$

$$\text{when } x = 0 \\ y = 5 + 2 \times 0 \\ y = 5$$

$$x = -4 \\ y = 5 + 2 \times -4 \\ = 5 - 8 \\ = -3$$

$$x = 0 \quad y = 5 \quad x = -4 \quad y = -3 \quad [5]$$

4. The prices of two phones are in the ratio  $x : y$ .

When the prices are both increased by £20, the ratio becomes  $5 : 2$ .

When the prices are both reduced by £5, the ratio becomes  $5 : 1$ .

Express the ratio  $x : y$  in its lowest terms.

$$+ £20 \quad \begin{matrix} x & y \\ x+20 & y+20 \\ 5 & 2 \end{matrix} \quad - £5 \quad \begin{matrix} x & y \\ x-5 & y-5 \\ 5 & 1 \end{matrix}$$

$$\frac{x+20}{y+20} = \frac{5}{2} \quad \frac{x-5}{y-5} = \frac{5}{1}$$

$$\begin{aligned} 2(x+20) &= 5(y+20) & x-5 &= 5(y-5) \\ 2x+40 &= 5y+100 & x-5 &= 5y-25 \\ 2x-60 &= 5y & x+20 &= 5y \end{aligned}$$

① - ②

$$\begin{aligned} 2x-60 &= x+20 \\ x &= 80 \end{aligned}$$

sub into ②  $2 \times 80 - 60 = 5y$   
 $100 = 5y$   $y = 20$

ratio  $x:y$   $80:20$   
 $8:2$

$4 : 1$  [6]

5. Solve.

$$4x + 3y = 5 \quad \text{①}$$

$$2x + 3y = 1 \quad \text{②}$$

① - ②  $2x = 4$   
 $x = 2$

sub into ②  $2 \times 2 + 3y = 1$   
 $3y = 1 - 4$   
 $y = -1$

$x = 2$   
 $y = -1$

[3]

3. Eddie and Caroline are going to the school play.

Eddie buys 6 adult tickets and 2 child tickets. He pays £39.

Caroline buys 5 adult tickets and 3 child tickets. She pays £36.50.

Work out the cost of an adult ticket and the cost of a child ticket.

$$\begin{array}{rcl}
 6A + 2C = 39 & \textcircled{1} & \times 3 \quad 18A + 6C = 117 \quad \textcircled{3} \\
 5A + 3C = 36.50 & \textcircled{2} & \times 2 \quad 10A + 6C = 73 \quad \textcircled{4} \\
 & & \textcircled{3} - \textcircled{4} \quad 8A = 44 \\
 & & A = \frac{44}{8} = \frac{22}{4} = £5.50
 \end{array}$$

sub into ①  $6 \times 5.50 + 2C = 39$

$$\begin{aligned}
 2C &= 39 - 33 \\
 &= 6 \\
 C &= £3
 \end{aligned}$$

Adult ticket £ 5.50

Child ticket £ 3.00 [5]

7.  $2x + 3y = 15.5 \quad \textcircled{1}$

$x + y = 6 \quad \textcircled{2} \quad x = 6 - y$

Work out the values of x and y.

sub  $x = 6 - y$  into ①

$$\begin{aligned}
 2x &= 12 - 2y \\
 12 - 2y + 3y &= 15.5 \\
 y &= 15.5 - 12 = \underline{3.5}
 \end{aligned}$$

$$x = 6 - 3.5 = 2.5$$

$$\begin{aligned}
 x &= \underline{2.5} \\
 y &= \underline{3.5}
 \end{aligned}$$

[3]

8. Solve the simultaneous equations

$$\begin{array}{rcl} 2x - 4y = 19 & \textcircled{1} & \times 3 \quad 6x - 12y = 57 \quad \textcircled{3} \\ 3x + 5y = 1 & \textcircled{2} & \times 2 \quad 6x + 10y = 2 \quad \textcircled{4} \end{array}$$

$$\begin{array}{rcl} \textcircled{3} - \textcircled{4} & -22y = 55 \\ y & = \frac{-55}{22} = -2.5 \end{array}$$

$$\begin{array}{rcl} \text{sub into } \textcircled{1} & 2x - 4 \times -2.5 = 19 \\ & 2x + 10 = 19 \\ & 2x = 9 \\ & x = 4.5 \end{array}$$

$$\begin{array}{l} x = 4.5 \\ y = -2.5 \end{array}$$

[4]

9. Solve these simultaneous equations algebraically.

$$y = x - 3 \quad \textcircled{1}$$

$$y = 2x^2 + 8x - 7 \quad \textcircled{2}$$

$$\textcircled{1} = \textcircled{2}$$

$$x - 3 = 2x^2 + 8x - 7$$

$$2x^2 - 7x - 4 = 0$$

$$(2x+1)(x-4) = 0$$

$$\begin{array}{l} 2x+1=0 \quad \text{or} \quad x-4=0 \\ x=-\frac{1}{2} \quad \quad \quad x=4 \end{array}$$

$$\begin{array}{l} \text{when } x = -\frac{1}{2} \\ y = -\frac{1}{2} - 3 = -3.5 \end{array}$$

$$\begin{array}{l} \text{when } x = 4 \\ y = 4 - 3 \\ = 1 \end{array}$$

$$\begin{array}{l} x = -\frac{1}{2}, y = -3.5 \\ x = 4, y = 1 \end{array} \quad [6]$$

10. Solve  $5x - y = 5$  - ①

$2y - x^2 = 11$  - ②

$$y = 5x - 5$$

$$2y = 10x - 10$$

You must show your working.

Do not use trial and improvement.

sub  $2y = 10x - 10$  into ②

$$10x - 10 - x^2 = 11$$

$$x^2 - 10x + 21 = 0$$

$$(x - 3)(x - 7) = 0$$

$$x = 3 \text{ or } x = 7$$

sub into ① when:-

$$x = 3$$

$$5 \times 3 - y = 5$$

$$y = \underline{\underline{10}}$$

$$x = 7$$

$$5 \times 7 - y = 5$$

$$y = \underline{\underline{30}}$$

$$x = 3 \quad y = 10 \quad \text{or} \quad x = 7 \quad y = 30$$

[6]

11. At a concert

3 adult and 4 child tickets cost £23

1 adult and 5 child tickets cost £15

Work out the cost of an adult ticket and the cost of a child ticket.

$$3A + 4C = 23 \quad \text{①}$$

$$1A + 5C = 15 \quad \text{②} \quad \times 3 \quad 3A + 15C = 45 \quad \text{③}$$

$$\text{③} - \text{①} \quad 11C = 22$$

$$C = \underline{\underline{£2}}$$

[4]

sub into ②

$$1A + 5 \times 2 = 15$$

$$1A = \underline{\underline{10}}$$

$$\text{Adult} = \underline{\underline{£10}} \quad \text{Child} = \underline{\underline{£2}}$$

## CREDITS AND NOTES

| Question | Awarding Body   | Question | Awarding Body |
|----------|-----------------|----------|---------------|
| 1        | WJEC Eduqas     | 11       | AQA           |
| 2        | AQA             |          |               |
| 3        | Pearson Edexcel |          |               |
| 4        | OCR             |          |               |
| 5        | OCR             |          |               |
| 6        | OCR             |          |               |
| 7        | AQA             |          |               |
| 8        | Pearson Edexcel |          |               |
| 9        | OCR             |          |               |
| 10       | AQA             |          |               |

### Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board's (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.



### Links:

AQA <http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300>

OCR <http://ocr.org.uk/gcsemaths>

Pearson Edexcel <http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html>

WJEC Eduqas <http://www.eduqas.co.uk/qualifications/mathematics/gcse/>

### Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material