



KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS



KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 11

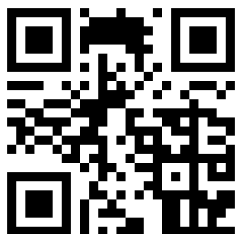
Mathematics

Catch Up Student

2026

2027

HGS Maths



Tasks



Dr Frost Course



Name: _____

Class: _____

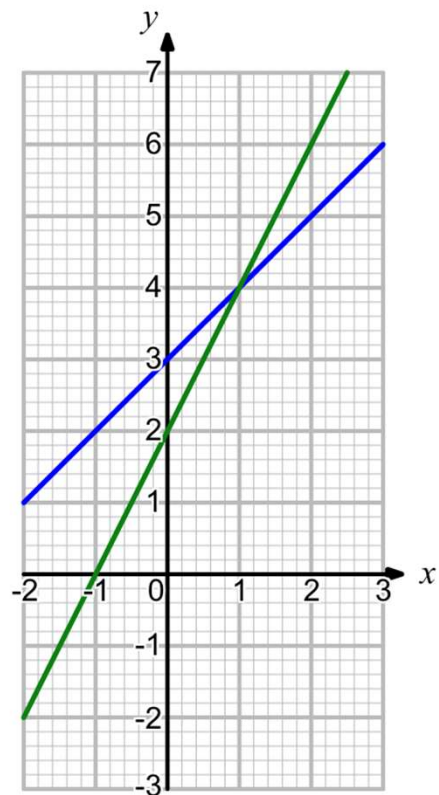
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1 Graphical Simultaneous Equations

Worked Example

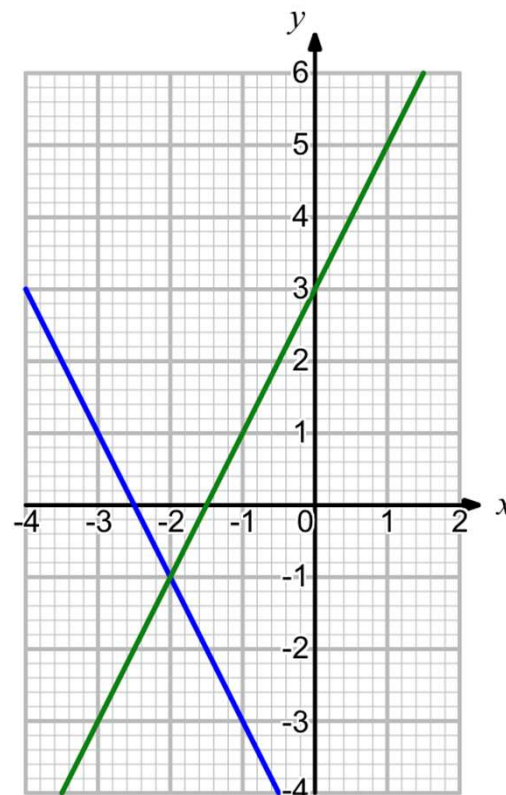
The diagram shows the graphs of $y = x + 3$ and $y = 2x + 2$



Use the graphs to find the solutions of the simultaneous equations $\begin{cases} y = x + 3 \\ y = 2x + 2 \end{cases}$

Worked Example

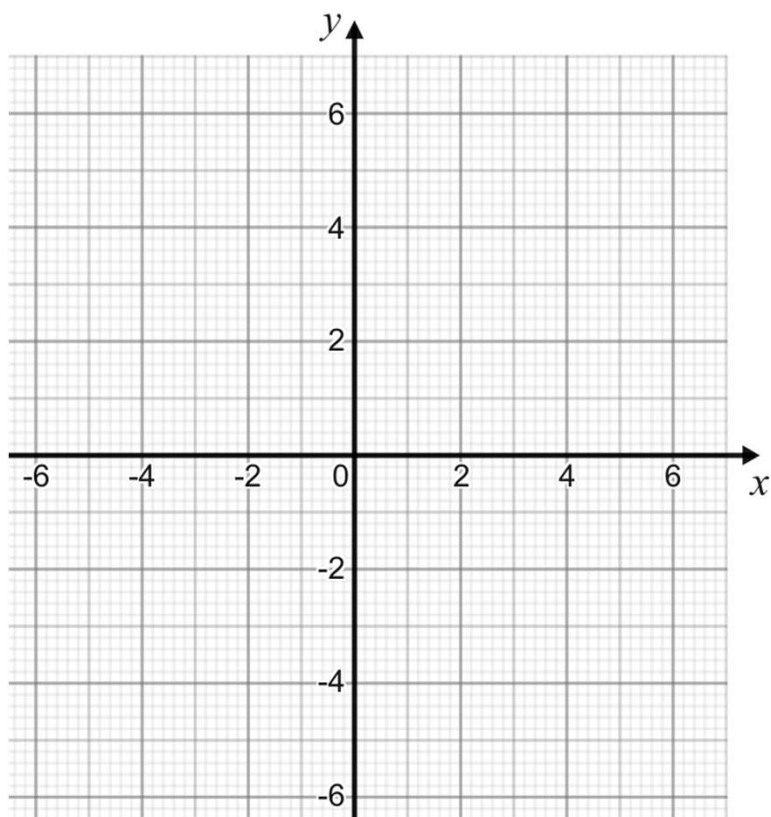
The diagram shows the graphs of $y = -2x - 5$ and $y = 2x + 3$



Use the graphs to find the solutions of the simultaneous equations $\begin{cases} y = -2x - 5 \\ y = 2x + 3 \end{cases}$

Worked Example

On the grid, draw the graphs of $y = \frac{1}{3}x - 4$ and $y = x - 2$

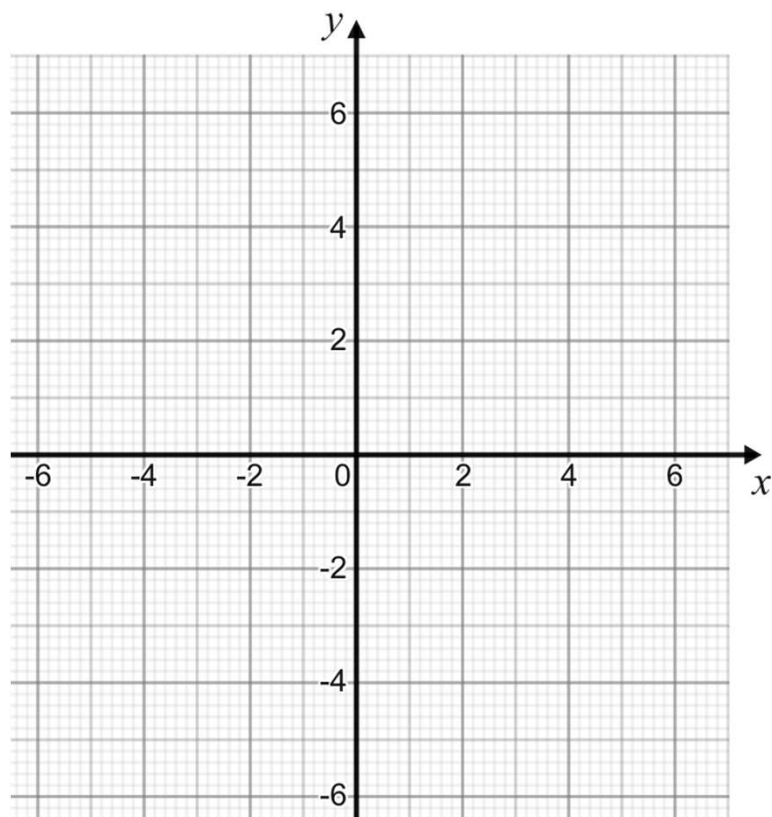


Use your diagram to solve the simultaneous equations

$$\text{equations } \begin{cases} y = \frac{1}{3}x - 4 \\ y = x - 2 \end{cases}$$

Worked Example

On the grid, draw the graphs of $y = 2x + 3$ and $y = -\frac{1}{3}x - 4$



Use your diagram to solve the simultaneous equations

$$\text{equations } \begin{cases} y = 2x + 3 \\ y = -\frac{1}{3}x - 4 \end{cases}$$

Fluency Practice

Question 1: Shown below are the graphs of $y = -x + 4$ and $y = x - 2$

- (a) Write down the coordinates of the point where the graphs of $y = -x + 4$ and $y = x - 2$ intersect.

- (b) Use your answer to (a) to solve the simultaneous equations.

$$\begin{aligned}y &= -x + 4 \\y &= x - 2\end{aligned}$$

Question 2: Shown below are the graphs of $y = 2x + 2$ and $y = -x - 4$

- (a) Write down the coordinates of the point where the graphs of $y = 2x + 2$ and $y = -x - 4$ intersect.

- (b) Use your answer to (a) to solve the simultaneous equations.

$$\begin{aligned}y &= -x - 4 \\y &= 2x + 2\end{aligned}$$

Question 3: Shown below are the graphs of $y = x$ and $x - 2y + 4 = 0$

- (a) Write down the coordinates of the point where the graphs of $y = x$ and $x - 2y + 4 = 0$ intersect.

- (b) Use your answer to (a) to solve the simultaneous equations.

$$\begin{aligned}y &= x \\x - 2y + 4 &= 0\end{aligned}$$

Fluency Practice

Question 4: Shown below are the graphs of $6x + 2y - 9 = 0$ and $y = 2x - 3$

Use the graphs to solve the simultaneous equations

$$\begin{aligned}6x + 2y - 9 &= 0 \\ y &= 2x - 3.\end{aligned}$$

Question 5: The straight line $y + 2x = 4$ has been drawn on the grid.

(a) On the same grid, draw the graph of $y = x + 1$

(b) Use the graphs to solve the simultaneous equations

$$\begin{aligned}y + 2x &= 4 \\ y &= x + 1.\end{aligned}$$

Question 6: The straight line $y = 2x + 3$ has been drawn on the grid.

(a) On the same grid, draw the graph of $y = -3x + 8$

(b) Use the graphs to solve the simultaneous equations

$$\begin{aligned}y &= 2x + 3 \\ y &= -3x + 8\end{aligned}$$

Fluency Practice

Question 7: The straight line $3x + y = 8$ has been drawn on the grid.

(a) On the same grid, draw the graph of $x + y = 9$

(b) Use the graphs to solve the simultaneous equations

$$\begin{aligned} 3x + y &= 8 \\ x + y &= 9 \end{aligned}$$

Question 8: By drawing the graphs of $y = 3x + 1$ and $x + y = 7$

Solve the simultaneous equations

$$\begin{aligned} y &= 3x + 1 \\ x + y &= 7 \end{aligned}$$

Question 9: By drawing the graphs of $y = 3x + 5$ and $x - 2y + 6 = 0$

Solve the simultaneous equations

$$\begin{aligned} y &= 3x + 5 \\ x - 2y + 6 &= 0 \end{aligned}$$

Apply

Question 1: Jesse has been asked to graphically solve the simultaneous equations

$$\begin{aligned} y &= x + 3 \\ y &= 2x - 4 \end{aligned}$$

He has drawn the graph shown.

Jesse says that there is no answer to the simultaneous equations.

Explain why Jesse is incorrect.

Fluency Practice

Question 2: Harry and Trevor are trying to solve the simultaneous equations

$$y = 3x + 1$$

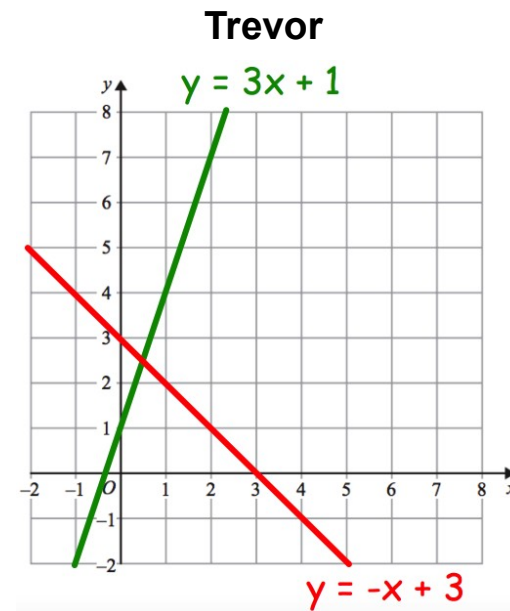
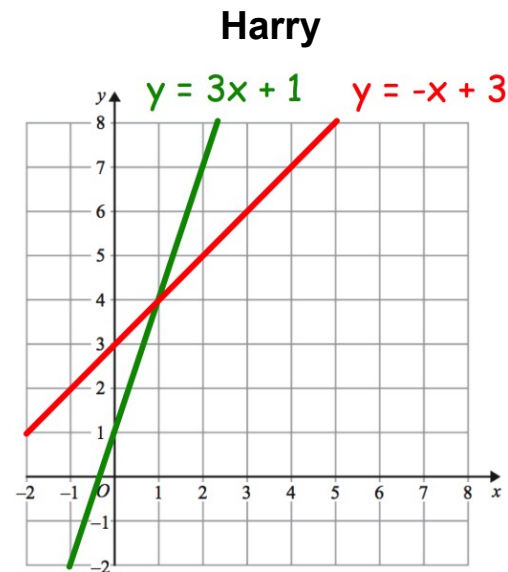
$$y = -x + 3$$

Harry's answer is $x = 1$ and $y = 4$

Trevor's answer is $x = 0.5$ and $y = 2.5$

(a) By looking at the graphs below, decide who is correct

(b) What mistake was made by the other boy?



Templates

Question 6

Question 5

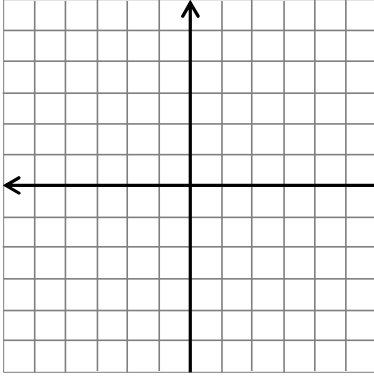
Question 7

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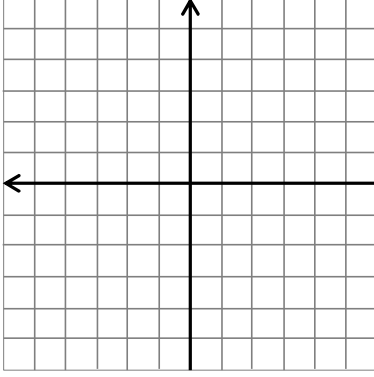
Fluency Practice

For each pair of equations draw the lines for each, the point of intersection represents the solution.

1. $y = 3x - 1$
 $y = 2x$

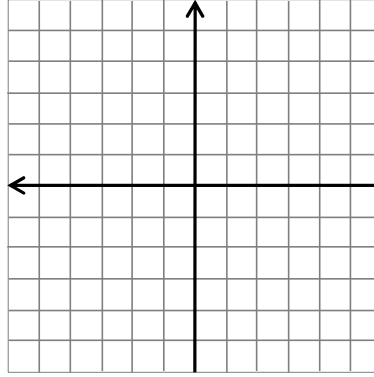


2. $y = 2x - 1$
 $y = x$



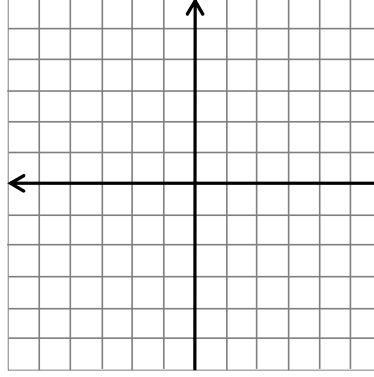
Point of intersection (____, ____) so x= ____ & y= ____

3. $y = 3x - 2$
 $y = x - 2$



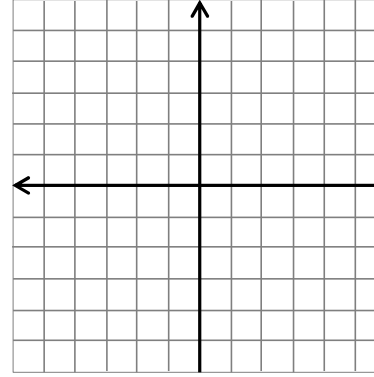
Point of intersection (____, ____) so x= ____ & y= ____

4. $y = 3 - 2x$
 $y = x$



Point of intersection (____, ____) so x= ____ & y= ____

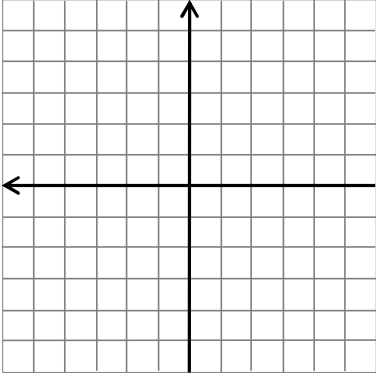
5. $x + y = 5$
 $y = 2x - 1$



Point of intersection (____, ____) so x= ____ & y= ____

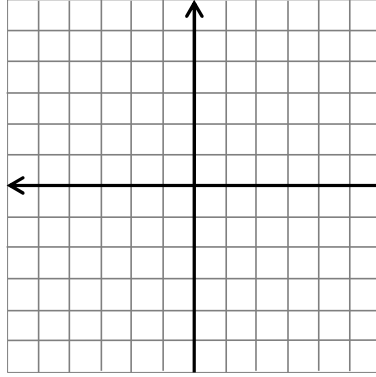
Fluency Practice

7. $x - y = 3$
 $x + y = 5$



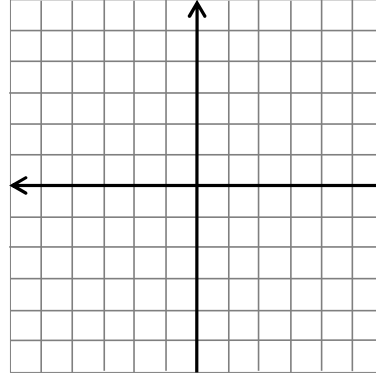
Point of intersection (____, ____) so $x =$ ____ & $y =$ ____

9. $y = 3x - 2$
 $x + y = 2$



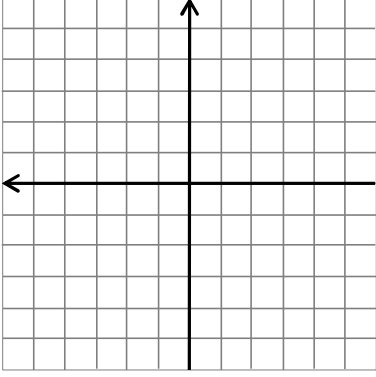
Point of intersection (____, ____) so $x =$ ____ & $y =$ ____

11. $x + 4y = 4$
 $x - 2y = 4$



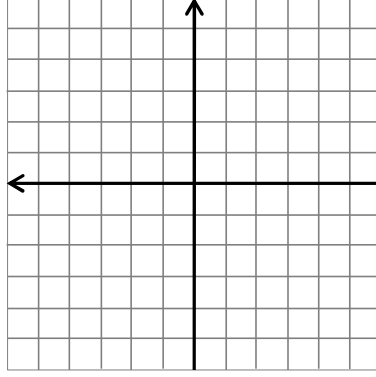
Point of intersection (____, ____) so $x =$ ____ & $y =$ ____

8. $x + y = -5$
 $y = 4x$



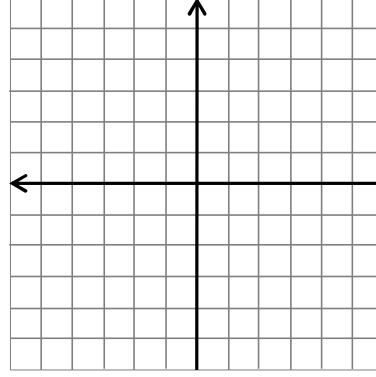
Point of intersection (____, ____) so $x =$ ____ & $y =$ ____

10. $2x - 3y = 6$
 $x + 3y = 3$



Point of intersection (____, ____) so $x =$ ____ & $y =$ ____

12. $x + 3y = 6$
 $x + 2y = 5$



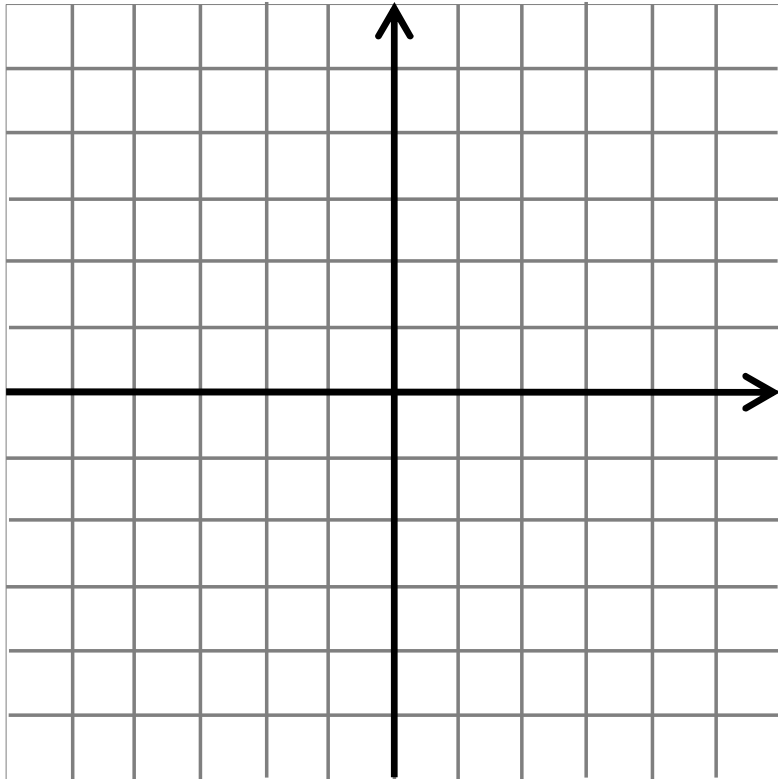
Point of intersection (____, ____) so $x =$ ____ & $y =$ ____

Worked Example

Solve graphically:

$$y = x - 1$$

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

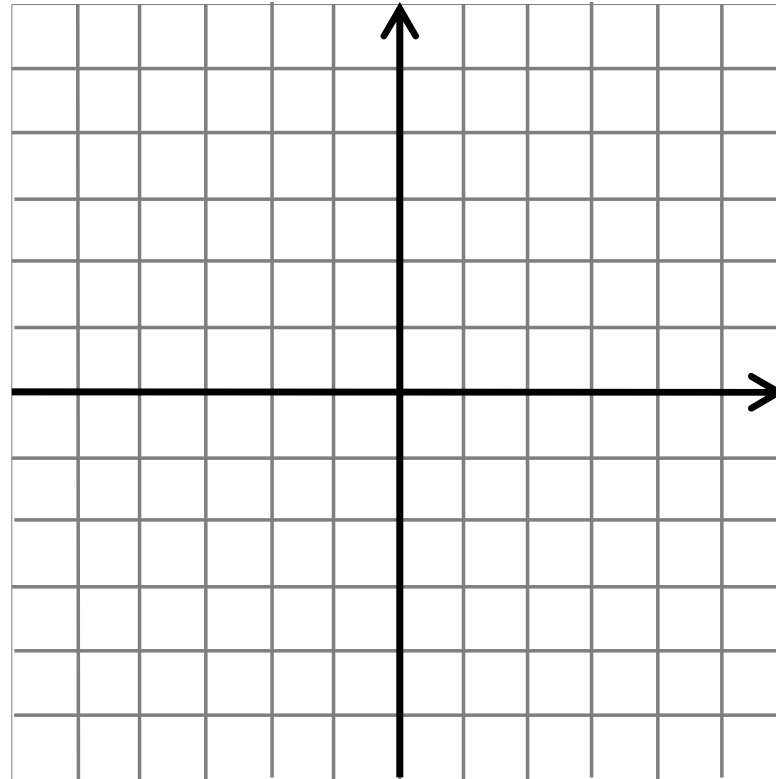


Worked Example

Solve graphically:

$$y = 3 - x$$

$$y = x^2 + 2x + 5$$

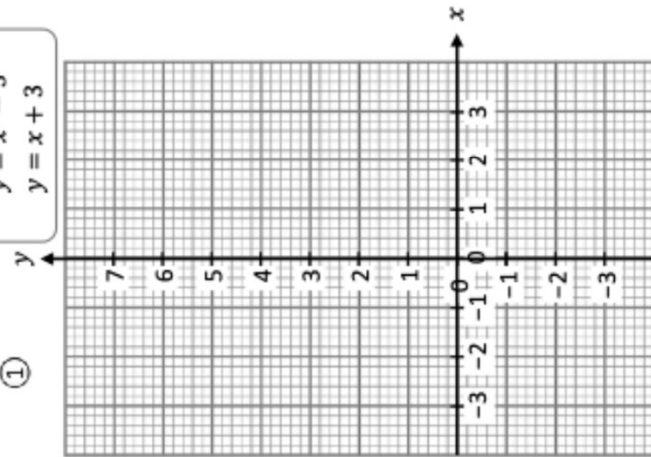


Fluency Practice

Solving Quadratic & Linear Simultaneous Equations by Plotting

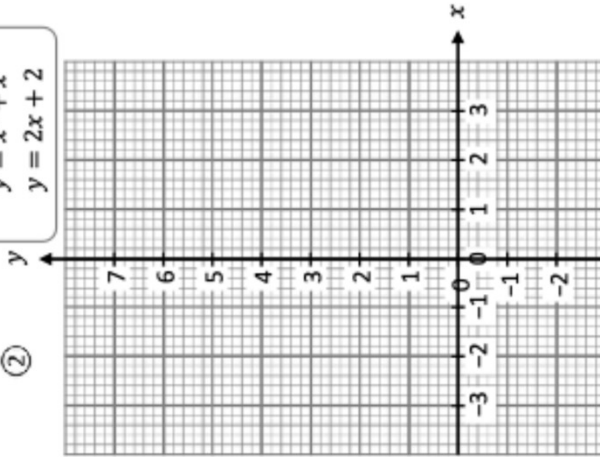
①

$$\begin{aligned} y &= x^2 - 3 \\ y &= x + 3 \end{aligned}$$



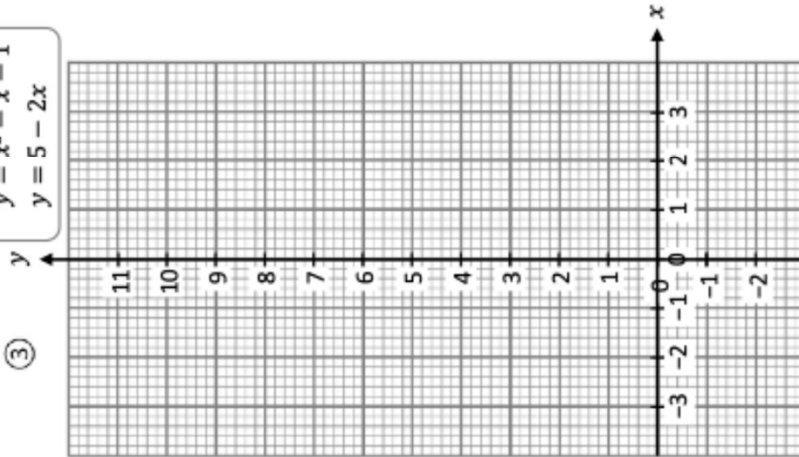
②

$$\begin{aligned} y &= x^2 + x \\ y &= 2x + 2 \end{aligned}$$



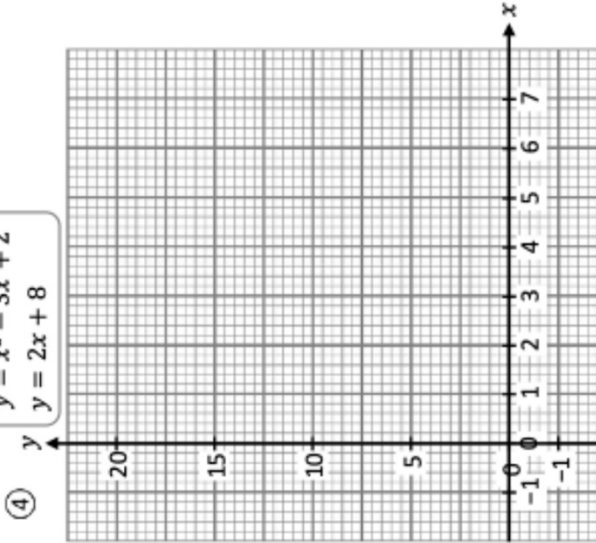
③

$$\begin{aligned} y &= x^2 - x - 1 \\ y &= 5 - 2x \end{aligned}$$



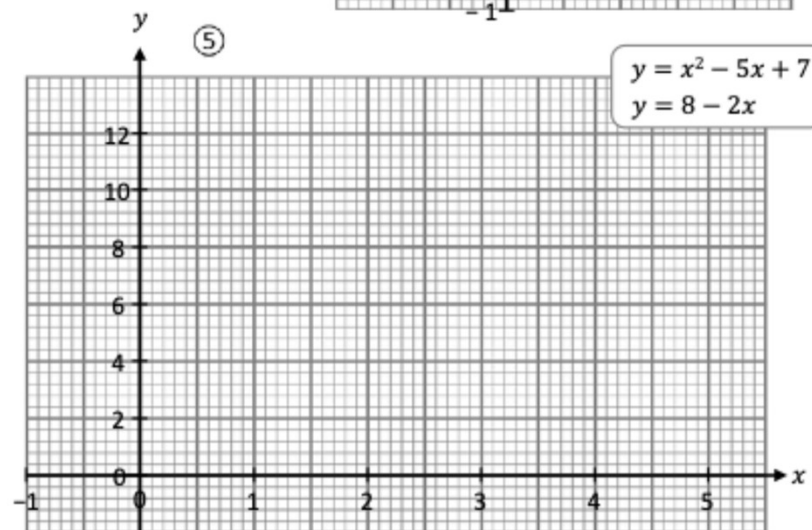
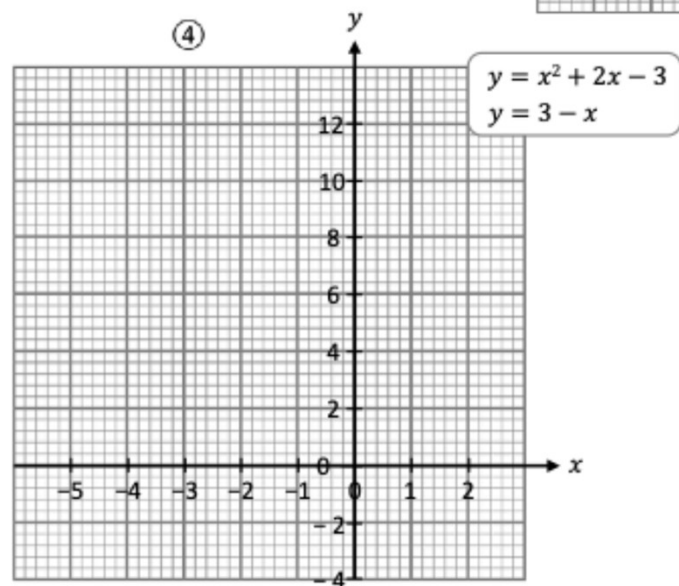
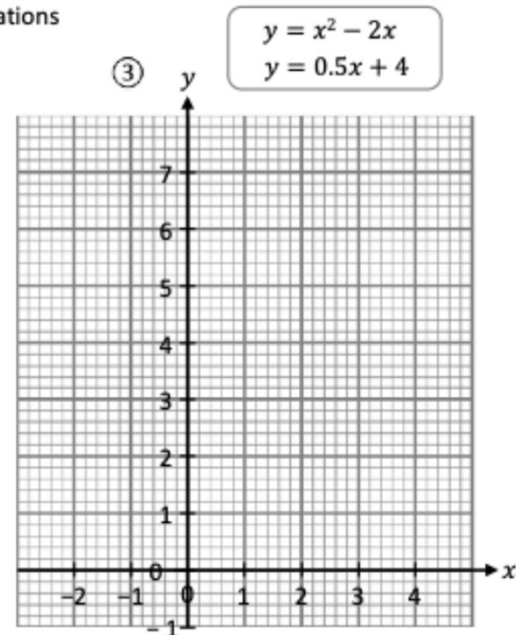
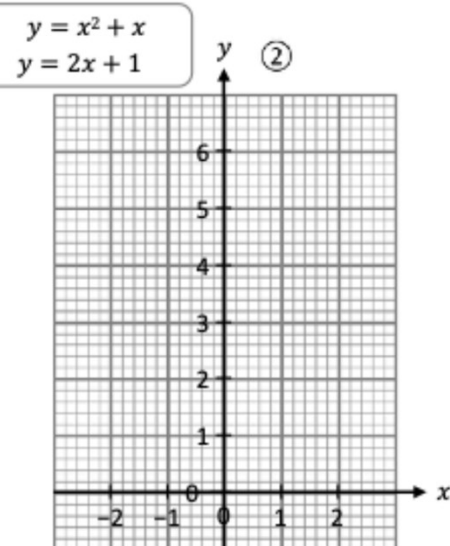
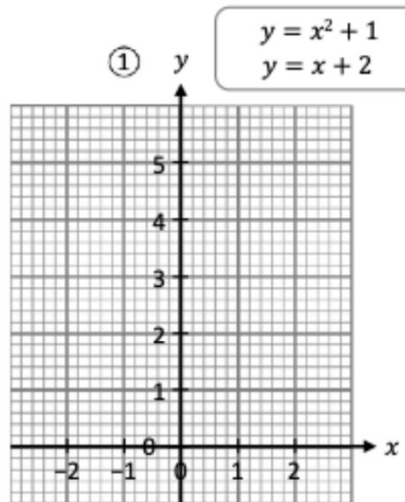
④

$$\begin{aligned} y &= x^2 - 3x + 2 \\ y &= 2x + 8 \end{aligned}$$



Fluency Practice

Estimating Solutions to Linear & Non-Linear Simultaneous Equations



Extra Notes

2 Linear Simultaneous Equations

Worked Example	Your Turn
Solve: $4x + 3y = 23$ $2x + 3y = 19$	Solve: $8x + 3y = 31$ $2x + 3y = 19$

Worked Example

Solve:

$$4x - 3y = 23$$

$$2x + 3y = 19$$

Your Turn

Solve:

$$8x + 3y = 31$$

$$2x - 3y = 19$$

Fill in the Gaps

Question	Add or subtract?	Carry out addition or subtraction	Work out x	Substitute x into one equation	Work out y	Check using other equation	State both answers
$3x + y = 17$ $x + y = 7$	Subtract	$\begin{array}{r} 3x + y = 17 \\ - \quad x + y = 7 \\ \hline 2x \quad \quad = 10 \end{array}$	$x = 5$	$3x + y = 17$ $15 + y = 17$	$y = 2$	$x + y = 7$ $5 + 2 = 7$ $\checkmark$	$x = 5$ $y = 2$
$5x + 2y = 12$ $3x - 2y = 4$	Add	$\begin{array}{r} 5x + 2y = 12 \\ + \quad 3x - 2y = 4 \\ \hline 8x \quad \quad = 16 \end{array}$	$x = 2$	$5x + 2y = 12$ $10 + 2y = 12$ $2y = 2$			
$x - 2y = 2$ $4x + 2y = 18$	Add	$\begin{array}{r} x - 2y = 2 \\ + \quad 4x + 2y = 18 \\ \hline \end{array}$					
$4x - 3y = 18$ $x - 3y = 9$							
$x + 4y = 19$ $3x + 4y = 17$							
$2x + y = 3$ $6x - y = 17$							

Worked Example

Solve:

$$2x - 5y = 16$$

$$2x + 3y = 0$$

Your Turn

Solve:

$$3x + 5y = 2$$

$$3x - 2y = -5$$

Fill in the Gaps

Question	Add or subtract?	Carry out addition or subtraction	Work out y	Substitute y into one equation	Work out x	Check using other equation	State both answers
$x + 3y = 13$ $x + y = 7$	Subtract	$\begin{array}{r} x + 3y = 13 \\ - x + y = 7 \\ \hline 2y = 6 \end{array}$	$y = 3$	$x + 3y = 13$ $x + 9 = 13$	$x = 4$	$x + y = 7$ $4 + 3 = 7$ $\checkmark$	$x = 4$ $y = 3$
$3x + y = 19$ $3x - 4y = 14$	Subtract	$\begin{array}{r} 3x + y = 19 \\ - 3x - 4y = 14 \\ \hline 5y = 5 \end{array}$	$y = 1$	$3x + y = 19$ $3x + 1 = 19$ $3x = 18$			
$x + 5y = 22$ $-x + 2y = 6$	Add	$\begin{array}{r} x + 5y = 22 \\ + -x + 2y = 6 \\ \hline \end{array}$					
$2x - 5y = 25$ $2x + 3y = 1$	Subtract						
$-3x + y = 10$ $3x + 2y = 11$							
$x + 2y = -7$ $x - 6y = 5$							

Worked Example

Solve:

$$2x + 3y = 11$$

$$3x + y = 13$$

Your Turn

Solve:

$$4x + 3y = 5$$

$$2x - 5y = 9$$

Worked Example

Solve:

$$3x + 2y = 9$$

$$5x + 7y = 4$$

Your Turn

Solve:

$$2x + 3y = 9$$

$$5x + 7y = 23$$

Fill in the Gaps

Question	Multiply one or both equations	Add or subtract?	Carry out addition or subtraction	Work out x	Substitute x into one equation	Work out y	State both answers
$2x + y = 9$ $x + 2y = 6$	$4x + 2y = 18$ $x + 2y = 6$	Subtract	$\begin{array}{r} 4x + 2y = 18 \\ - x + 2y = 6 \\ \hline 3x = 12 \end{array}$	$x = 4$	$2x + y = 9$ $8 + y = 9$	$y = 1$	$x = 4$ $y = 1$
$3x + y = 17$ $2x - 3y = 4$	$9x + 3y = 51$ $2x - 3y = 4$	Add	$\begin{array}{r} 9x + 3y = 51 \\ + 2x - 3y = 4 \\ \hline 11x = 55 \end{array}$				
$x - 5y = 9$ $4x + y = 15$	$x - 5y = 9$ $20x + 5y = 75$						
$4x + 3y = 1$ $x - 2y = -8$							
$2x - 5y = 13$ $4x - 2y = 10$							
$x + 6y = 3$ $2x + 9y = 4$							

Fill in the Gaps

Question	Multiply one or both equations	Add or subtract?	Carry out addition or subtraction	Work out y	Substitute y into one equation	Work out x	State both answers
$x + 2y = 5$ $3x + y = 10$	$3x + 6y = 15$ $3x + y = 10$	Subtract	$\begin{array}{r} 3x + 6y = 15 \\ - 3x + y = 10 \\ \hline 5y = 5 \end{array}$	$y = 1$	$x + 2y = 5$ $x + 2 = 5$	$x = 3$	$x = 3$ $y = 1$
$4x - y = 3$ $x + 3y = 17$	$4x - y = 3$ $4x + 12y = 68$	Subtract	$\begin{array}{r} 4x - y = 3 \\ - 4x + 12y = 68 \\ \hline \end{array}$				
$x - 5y = 14$ $-2x - y = -6$	$2x - 10y = 28$ $-2x - y = -6$	Add					
$2x + 2y = 11$ $3x - 4y = 13$							
$5x + 7y = 6$ $-3x - 2y = 3$							
$4x + 3y = -3$ $6x + 5y = -6$							

Worked Example

Solve:

$$5x = -4y + 22$$

$$3x - 7y + 15 = 0$$

Your Turn

Solve:

$$5x + 7y - 12 = 0$$

$$8x = -4y + 3$$

Worked Example

Solve the following simultaneous equations:

$$2x + 5y = 25$$

$$y = 5x - 22$$

Your Turn

Solve the following simultaneous equations:

$$5x + 4y = 30$$

$$y = 3x - 1$$

Worked Example

Solve the following simultaneous equations:

$$b = (5 - a)^2 + 4$$

$$b = (a - 3)^2 - 5$$

Your Turn

Solve the following simultaneous equations:

$$y = (x - 3)^2 - 8$$

$$y = (5 - x)^2 - 2$$

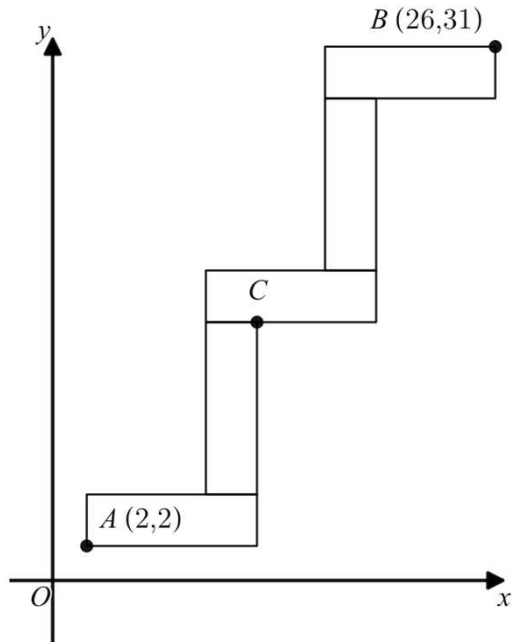
Worked Example	Your Turn
Two numbers have a sum of 45 and a difference of 13. Find the numbers.	Two numbers have a sum of 49 and a difference of 19. Find the numbers.

Worked Example	Your Turn
An aquarium specialises in octopuses and sea stars. Each octopus has 3 hearts and 8 limbs and each sea star has 1 heart and 5 limbs. At the aquarium, there are 165 limbs and 54 hearts from the octopuses and sea stars. Work out how many octopuses and sea stars there are.	On a nature walk Lucy looks for dragonflies and birds. Each dragonfly has 6 legs and 4 wings and each bird has 2 legs and 2 wings. In total, Lucy spots animals with a combined 76 legs and 60 wings. Work out how many dragonflies and birds there are.

Worked Example	Your Turn
Lucas is a pilot and in June he flew two different routes. During June, he flew on route A 3 times and route B 5 times and flew a total of 12850 km. Route A is 150 km longer than route B. Work out the length of route A and the length of route B.	Fatoumata is training for a marathon and has two routes she trains on. During July, she uses route A 5 times and route B 3 times and jogged a total of 84 km. Route A is 4 km longer than route B. Work out the length of route A and the length of route B.

Worked Example

A pattern is made from 5 identical rectangles arranged parallel to the axes.



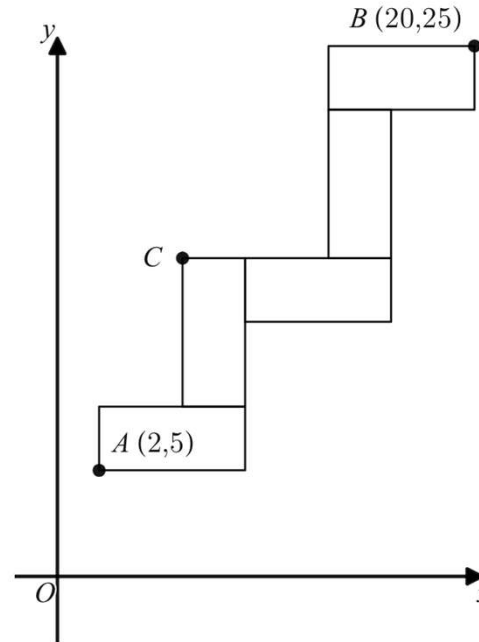
Point A has coordinates $(2, 2)$

Point B has coordinates $(26, 31)$

Work out the coordinates of point C .

Your Turn

A pattern is made from 5 identical rectangles arranged parallel to the axes.



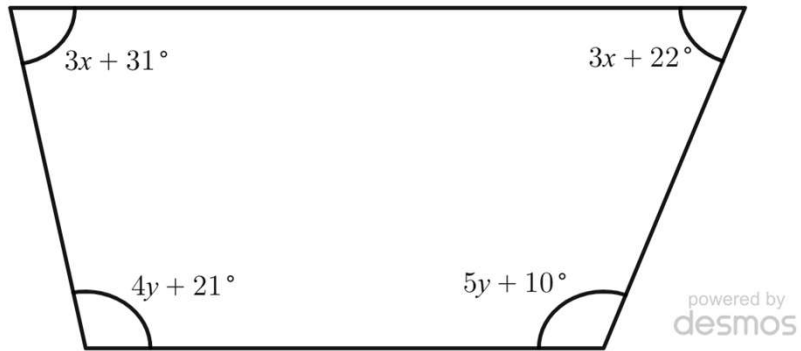
Point A has coordinates $(2, 5)$

Point B has coordinates $(20, 25)$

Work out the coordinates of point C .

Worked Example

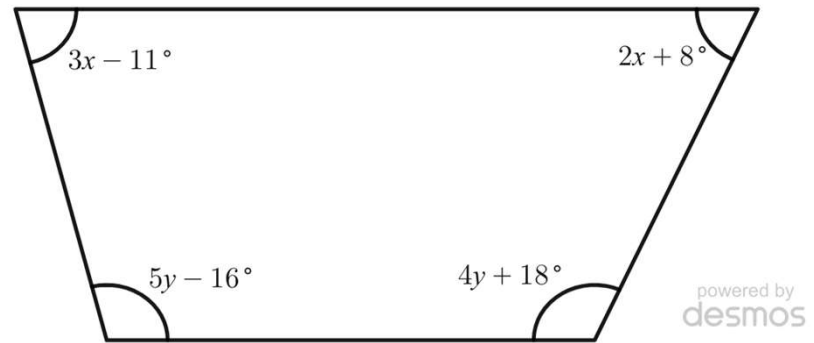
This diagram shows a trapezium.



Work out the values of x and y .

Your Turn

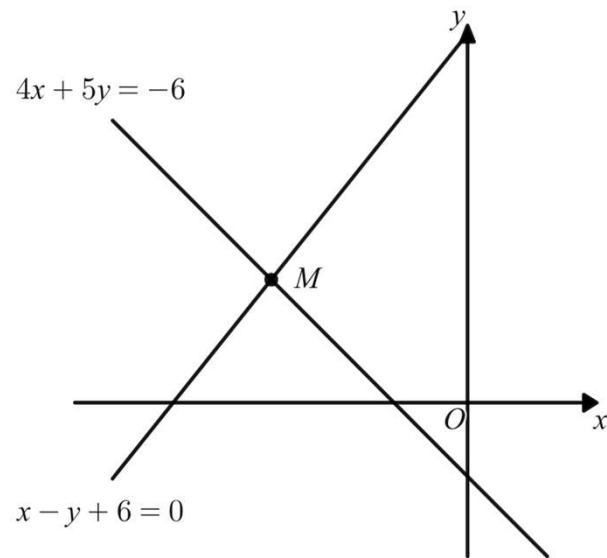
This diagram shows a trapezium.



Work out the values of x and y .

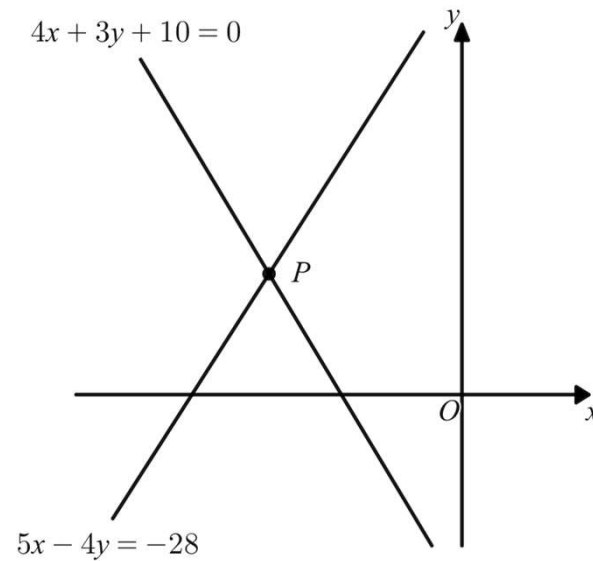
Worked Example

M is the point of intersection of the lines with equations $x - y + 6 = 0$ and $4x + 5y = -6$.
Write down the coordinates of M .



Your Turn

P is the point of intersection of the lines with equations $4x + 3y + 10 = 0$ and $5x - 4y = -28$.
Write down the coordinates of P .



Worked Example

Given that:

$$a \begin{pmatrix} -5 \\ 1 \end{pmatrix} + b \begin{pmatrix} 6 \\ -4 \end{pmatrix} = \begin{pmatrix} 10 \\ -16 \end{pmatrix}$$

Find the value of a and the value of b .

Your Turn

Given that:

$$m \begin{pmatrix} -1 \\ 7 \end{pmatrix} + n \begin{pmatrix} 4 \\ -2 \end{pmatrix} = \begin{pmatrix} -21 \\ 43 \end{pmatrix}$$

Find the value of m and the value of n .

Extra Notes

3 Advanced Ratio

Worked Example



- a) Find the ratio of Green to Blue
- b) Write green as a fraction of the whole bar
- c) Write blue as a fraction of the whole bar
- d) Write green as a fraction of blue
- e) Write blue as a fraction of green
- f) Form a linear equation linking green and blue

Green =

Blue =

Your Turn

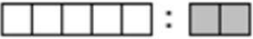


- a) Find the ratio of Green to Blue
- b) Write green as a fraction of the whole bar
- c) Write blue as a fraction of the whole bar
- d) Write green as a fraction of blue
- e) Write blue as a fraction of green
- f) Form a linear equation linking green and blue

Green =

Blue =

Fill in the Gaps

$x : y$	Visual representation	x as a fraction of whole	y as a fraction of a whole	x as a fraction of y	y as a fraction of x	Linear equation	$x = \dots$	$y = \dots$
								
								
$1 : 7$								
		$\frac{3}{8}$						
				$\frac{3}{2}$				
						$3x = 7y$		
							$x = \frac{10}{3}$	
								$y = \frac{2}{9}$

Worked Example	Your Turn
Given that $3y = 7x$, work out the ratio $x : y$	Given that $9q = 4p$, work out the ratio $p : q$

Worked Example	Your Turn
The ratio of x to y is 4 : 5 Write a linear function involving x and y	The ratio of p to q is 5 : 3 Write a linear function involving p and q

Worked Example	Your Turn
The ratio $5x + 3 : 2y - 1$ is equal to $5 : 4$ Express x in terms of y	The ratio $a + 1 : 2b + 5$ is equal to $5 : 7$ Express a in terms of b

Worked Example

Given that $3x - 10 : 9x - 51 = 2 : 3$
Find the value of x

Your Turn

Given that $9a - 4 : 7a + 21 = 7 : 2$
Find the value of a

Worked Example	Your Turn
Given that $7x - 6 : 4x + 12 = 5x - 2 : 5x + 10$ Find the possible values of x.	Given that $6a + 11 : 3a + 3 = 5a + 8 : 2a + 4$ Find the possible values of a.

Worked Example	Your Turn
$2a^2 - 5ab = 12b^2$, where $a > 0$ and $b > 0$ Find the ratio $a : b$ in its simplest form.	$5q^2 - 16pq = 16p^2$, where $p > 0$ and $q > 0$ Find the ratio $p : q$ in its simplest form.

Worked Example	Your Turn
There are blue counters and white counters in a bag in the ratio 4 : 3 10 blue counters are added, and the ratio becomes 2 : 1 Work out how many white counters there are in the bag.	There are black counters and red counters in a bag in the ratio 3 : 4 20 black counters are removed, and the ratio becomes 1 : 3 Work out how many red counters there are in the bag.

Worked Example	Your Turn
There are black counters and red counters in a bag in the ratio 3 : 7 5 black counters are removed, and 10 red counters are added to the bag, and the ratio becomes 2 : 5 Work out the original number of red counters in the bag.	There are white counters and red counters in a bag in the ratio 3 : 4 10 white counters are removed, and 1 red counter is added to the bag, and the ratio becomes 2 : 3 Work out the original number of red counters in the bag.

Worked Example	Your Turn
a, b, c and d are integers with no common factors. $a : b = 4 : 3$ $c : d = 1 : 6$ $2a = 3d$ Find $a : b : c : d$	a, b, c and d are integers with no common factors. $4a = 7b$ $c : d = 3 : 2$ $a : d = 4 : 7$ Find $a : b : c : d$

Worked Example	Your Turn
Green shapes and purple shapes are used in a game. Some of the shapes are triangles. All the other shapes are hexagons. The ratio of triangles to hexagons is 5 : 2 The ratio of green triangles to purple triangles is 3 : 5 Work out the fraction of shapes that are green triangles.	Blue shapes and red shapes are used in a game. Some of the shapes are circles. All the other shapes are squares. The ratio of circles to squares is 4 : 5 The ratio of blue circles to red circles is 3 : 2 Work out the fraction of shapes that are red circles.

Worked Example	Your Turn
White shapes and black shapes are used in a game. Some of the shapes are circles. All of the other shapes are squares. The ratio of the number of white shapes to the number of black shapes is 4 : 5 The ratio of the number of white circles to the number of white squares is 3 : 4 The ratio of the number of black circles to the number of black squares is 2 : 1 Work out what fraction of all the shapes are circles.	Blue shapes and red shapes are used in a game. Some of the shapes are circles. All of the other shapes are squares. The ratio of the number of blue shapes to the number of red shapes is 4 : 1 The ratio of the number of blue circles to the number of blue squares is 3 : 4 The ratio of the number of red circles to the number of red squares is 3 : 2 Work out what fraction of all the shapes are circles.

Worked Example	Your Turn
A drink seller has two types of drink mix in stock. Drink A is made from apple juice and orange juice in the ratio 8 : 3 Drink B is made from apple juice and orange juice in the ratio 2 : 9 Both drinks come in the same size cartons. Drink <i>A</i> and Drink <i>B</i> can be combined to produce Drink <i>C</i>. The vendor wants Drink <i>C</i> to contain apple juice and orange juice in the ratio 7 : 6 If the seller is to use whole cartons only, find the least number of cartons that she needs of each type.	A drink seller has two types of drink mix in stock. Drink A is made from apple juice and orange juice in the ratio 9 : 5 Drink B is made from apple juice and orange juice in the ratio 6 : 1 Both drinks come in the same size cartons. Drink <i>A</i> and Drink <i>B</i> can be combined to produce Drink <i>C</i>. The vendor wants Drink <i>C</i> to contain apple juice and orange juice in the ratio 7 : 2 If the seller is to use whole cartons only, find the least number of cartons that she needs of each type.

Extra Notes