Birmingham City Council

Birmingham
Resources for
Understanding
Mathematics

C if U can

Algebra

Birmingham City Council

Inequalities/simple graphs			
I can solve inequalities			
I can show inequalities on a number line			
I can match shaded regions to their inequalities			

Graphs			
I can create tables of values and draw straight line graphs			
I can draw graphs of quadratic equations			
I can solve simultaneous equations using graphs			

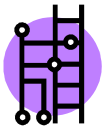
Substitution and formulae	I am **confident** I can do this	I am **close** to being able to do this	I am **clueless** and need more help
I can substitute numbers into expressions			
I can change the subject of a formula			
I can use substitution to solve problems			

Expressions			
I can write expressions and simplify them			
I can factorise expressions			
I can multiply out two pairs of brackets			

Equations			
I can solve equations including brackets with the unknown on one side			
I can solve equations using trial and improvement			
I can solve equations with unknowns on both sides			

How will this booklet help you to get a grade C in maths?

- This booklet is one of four covering number, algebra, shape, space and measures and handling data.
- Each booklet contains work on the topics you need to understand to get a grade C
- Each topic starts off with a 'warm up' with some easier grade E questions followed by a harder D grade questions where you get a bit of help
- There are then some (harder still) C grade questions, where you are given clues if you need them (try on your own first) and finally a C grade question for you to try on your own.

Look for  to indicate grade E/D questions,

to indicate harder D grade questions

and  to indicate C grade work

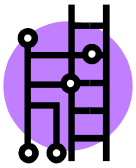
At the end of each topic, go to the back of the booklet and keep a record of your progress

Substitution and formulae

Easy E/D grade questions

1. If p = 4 and q = -9 find the value of
   a. 5p – 2q

   b. 3pq



2. Make x the subject of the formula

   y = 3 + x

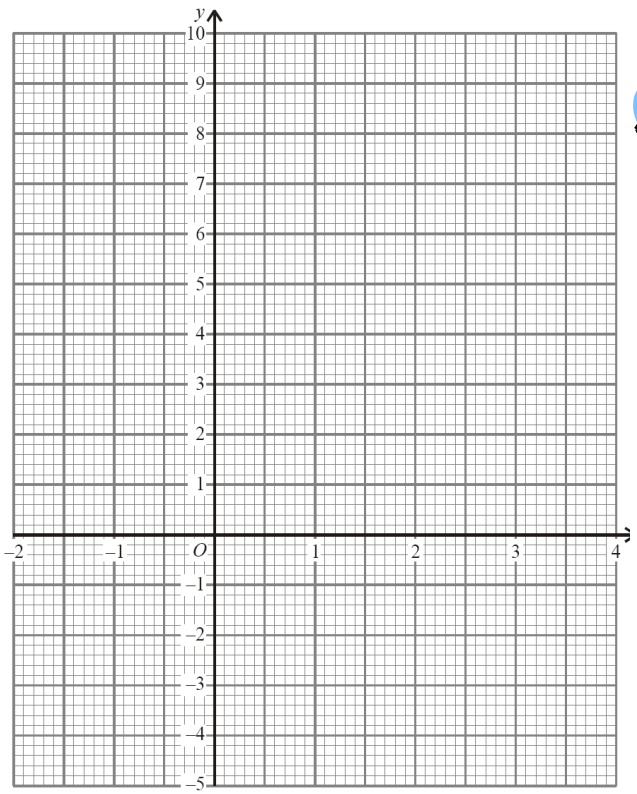
Are you feeling more **C**onfident?

C if you can ….. cope on your own!

Complete the table of values for $y = x^2 - 3x - 1$

x	–2	–1	0	1	2	3	4
y		3	–1	–3			3

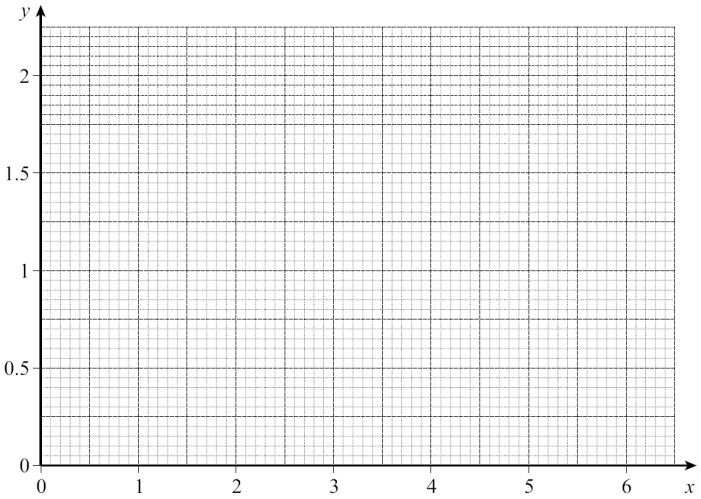
Draw the graph of the equation and use it to find an estimate for the minimum value of y



(a) Complete the table of values for $y = \frac{1}{x}$

x	0.5	1	2	3	4	5	6
y		1	0.5	0.33	0.25	0.2	0.17

(b) On the grid draw the graph of $y = \frac{1}{x}$ for values of x from 0·5 to 6



(c) Describe what happens to the graph for larger values of x.

You can tell this from the table – use this as a check

Definitely D grade questions

Find the value of $p^2 + 3q$ when p = 7 and q = -4

Watch out for adding a negative number

C if U can……. answer the rest! (With a few **C**lues)

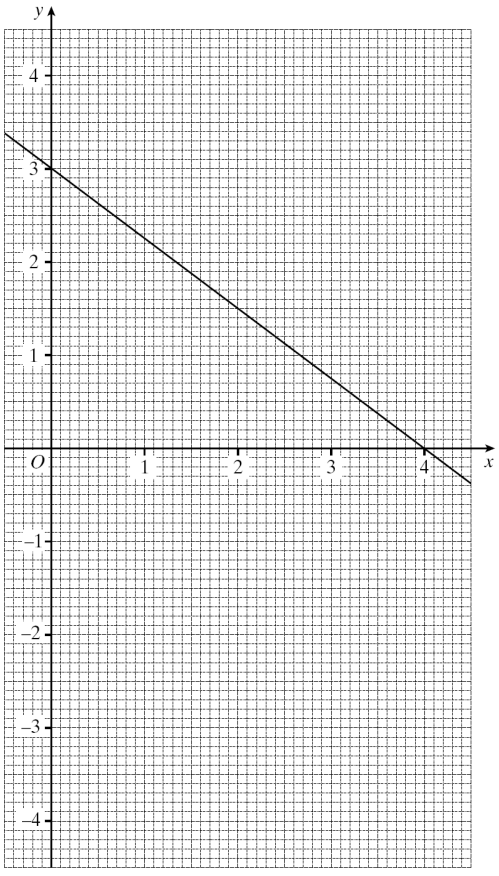
Make x the subject of the formula

$r = \frac{1}{2}x - 5$

First, make $\frac{1}{2}x$ the subject, then decide what to do to make x the subject

The graph of $4y + 3x = 12$ has been drawn on the grid.
Draw another line on the grid to solve the simultaneous equations
$4y + 3x = 12$
$y = 2x - 4$

You could start with a table of values



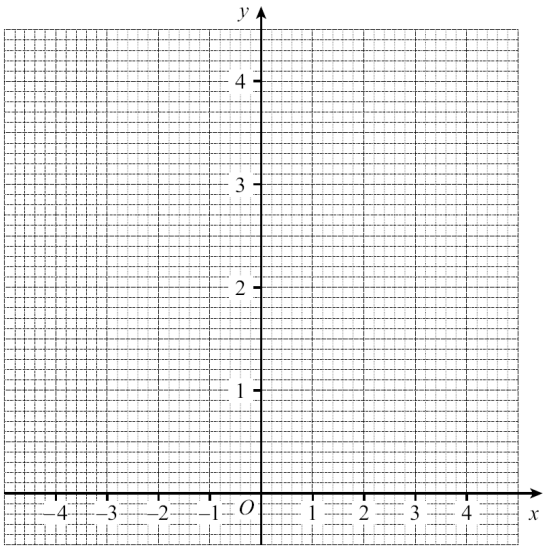
The solution will be where the two lines cross

C if U can……. answer the rest! (With a few **C**lues)

This is a table of values for $y = 4 - \frac{1}{5}x^2$

x	−4	−3	−2	−1	0	1	2
y	0.8	2.2	3.2	3.8	4	3.8	3.2

(a) Use the table to draw the graph of this equation for values of x from -4 to +2



What shape will this graph be? What pattern do you find in the numbers in the table?

(b) Use symmetry to write down the values of y when x = 3 and x = 4

x	3	4
y		

Tom is investigating the two expressions ***ab + c*** and ***a(b + c)***

(a) He finds that both expressions have the same value when a = 1, b = 3 and c = 4
Show that this is true

Do this by substituting in the values to show the answer

(b) Tom says this means that a(b + c) = ab + c
Explain why Tom is wrong

You could do this by showing an example when it wouldn't work

The number of diagonals, D, of a polygon with n sides is given by the formula

$$D = \frac{n^2 - 3n}{2}$$

Where do you substitute the 20?

A polygon has 20 sides.
Work out the number of diagonals of this polygon

Definitely D grade questions

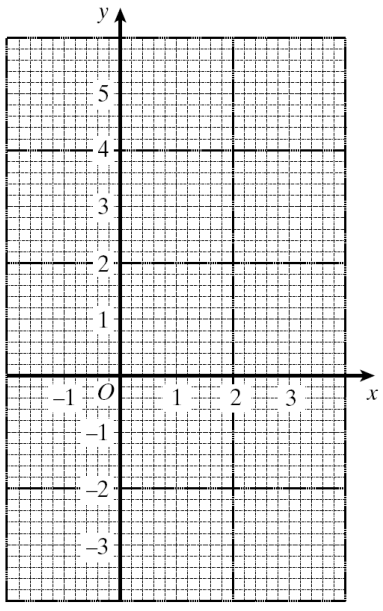
(a) Complete this table of values for y = 2x – 1

What kind of pattern are you expecting in the numbers?

x	–1	0	1	2	3
y	–3		1		5

(b) On the grid, draw the graph of y = 2x – 1 for values of x from -1 to +3

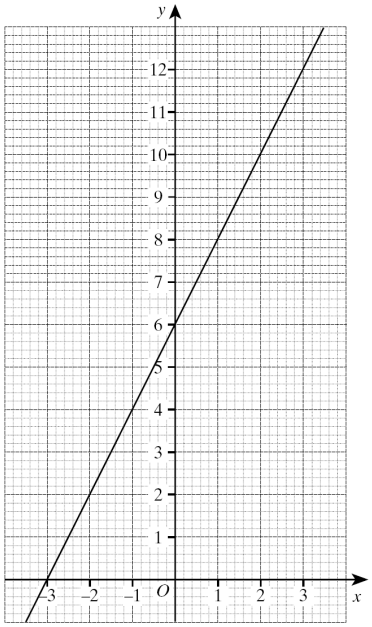
Think what the graph will look like



Graphs

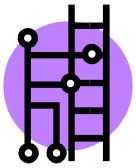
Easy E/D grade questions

1. The graph shows the line y = 2x + 6

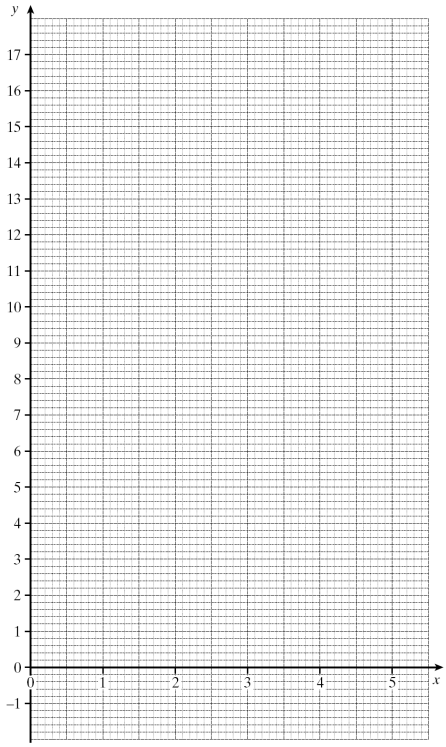


a. Use the graph to find x when y = 10

b. Use the graph to find x when y = 1



2. On the grid below draw the graph of
y + 3x – 1 for values of x from 0 to 5



Are you feeling more **C**onfident?

C if you can ….. cope on your own!

(a) Find the value of 3p + 2q when p = 7 and q = -4

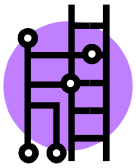
(b) Find the value of $x^2 + y^2$ when x = -5 and y = 3

(c) Use the formula $R = 5e - 3f$
to find the value of e when $R = 6{\cdot}4$ and $f = 4{\cdot}2$

Expressions

Easy E/D grade questions

1. Simplify 2x + 8 + 4x - 3



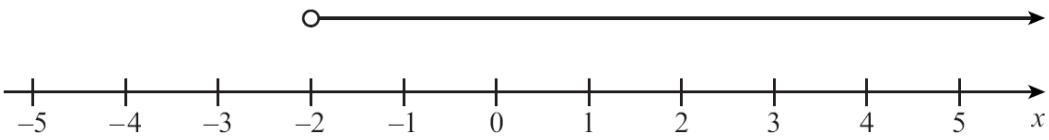
2. Expand and simplify
   (a) 6(3p + q)

   (b) 6(3p + q) – 2(2p + 3q)

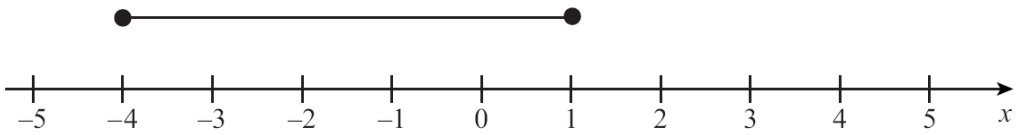
Are you feeling more **C**onfident?

C if you can ….. cope on your own!

(a) Write down the inequality shown by the following diagram



(b) Write down the inequality shown by the following diagram



(c) Write down **all** the integers that satisfy both inequalities shown in parts (a) and (b)

Match each of the shaded regions to one of these inequalities

A $y \leqslant -\frac{1}{2}x + 2$

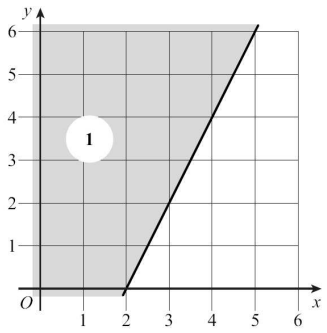
B $y \leqslant \frac{1}{2}x + 2$

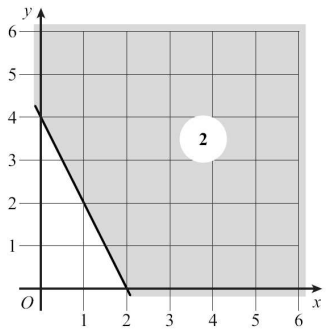
C $y \geqslant -2x + 4$

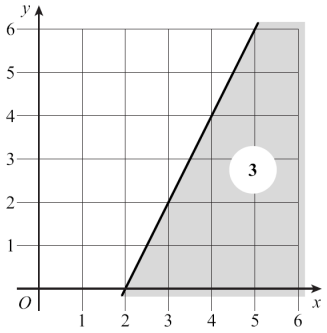
D $y \geqslant 2x - 4$

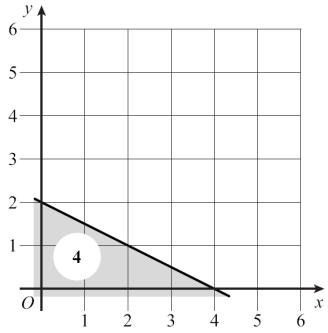
E $y \leqslant 2x - 4$

Here you need to use what you know about straight line graphs
Try to work out the equation of the line first









Definitely D grade questions

(a) Factorise 5x – 10

Remember to look for what both parts of the expression have in common to take outside the brackets and take out as much as possible

(b) Factorise $y^2 + 3y$

C if U can……. answer the rest! (With a few **C**lues)

What does 'in terms of y' mean?

Jessica is paid £7 for each hour that she works.
She works for y hours.

(a) Write down an expression, in terms of y, for the amount, in pounds (£) that Jessica is paid

Lucy is also paid £7 for each hour that she works.
She works for three times as many hours as Jessica.

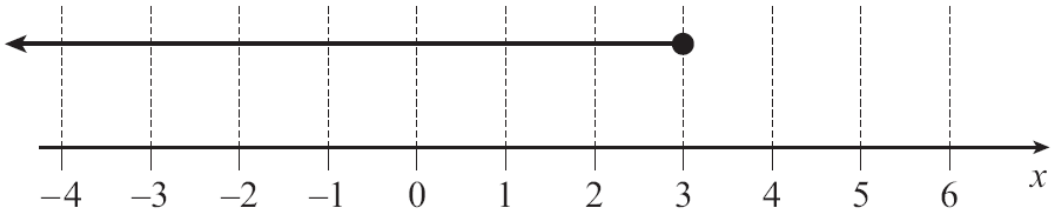
(b) Write down an expression, in terms of y, for the amount in pounds (£) that Lucy is paid. Give your answer as simply as possible

(a) Solve the inequality
$3(x - 2) \leq 9$

Again, use the same method as for solving equations

(b) The inequality $x \leq 3$ is shown on the number line below

A full circle means the 3 is included, an empty circle means it isn't



Draw another inequality on the number line so that only the following integers satisfy both inequalities
{-2, -1, 0, 1, 2, 3}

Write this as an inequality in symbols first

C if U can……. answer the rest! (With a few **C**lues)

(a) Solve the inequality $5x + 3 < 18$

You can solve this as you would an equation but remember the inequality sign NOT =

(b) y is an integer
Write down all the solutions of the inequality $-6 \leq 2y < 0$

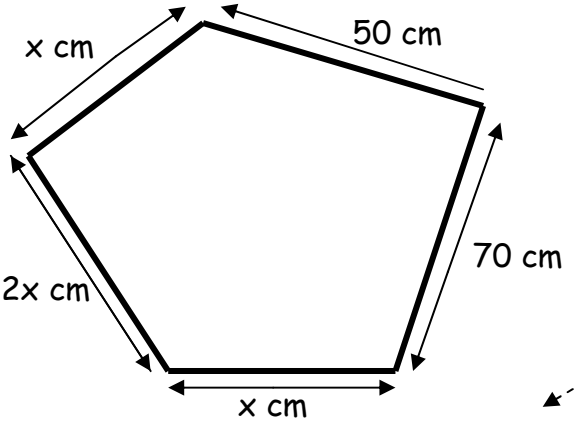
If you are stuck, think what this means in words first

(a) Expand and simplify $(2p + 7)(p + 2)$

Expand means multiply out everything in the second bracket by everything in the first bracket. Do it one step at a time to make sure you don't miss anything
Don't forget to simplify at the end

(b) Expand and simplify $(p + 5)(p - 5)$

The perimeter of the pentagon is 200cm



Remember, the perimeter is found by adding the lengths of all the sides

(a) Write down an expression for the perimeter of the pentagon

This will involve using the information given, making an equation and solving it

(b) Work out the value of x

Definitely D grade questions

What is an integer?

x is an integer such that

Make sure you know what this means in words

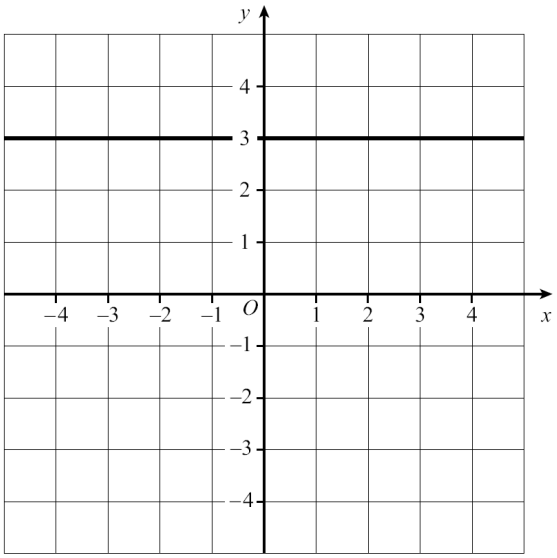
$-3 < x \leq 2$

List all the possible values of x

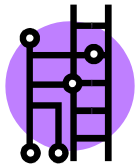
Inequalities and simple graphs

Easy E/D grade questions

1. (a) Pam says the graph shows the line x = 3.
Explain why Pam is wrong



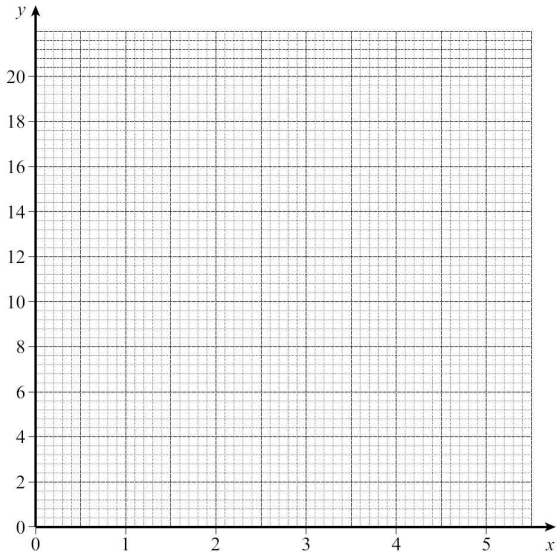
(b) Find the equation of the line that goes through the points (2, 0) and (2, 3)



2. (a) Complete the table of values for
y = 3x + 4

x	0	1	2	3	4	5
y	4		10		16	19

(b) On the grid draw the graph of y = 3x + 4 for values of x from 0 to 5



Are you feeling more **C**onfident?

C if you can ….. cope on your own!

(a) Expand and simplify (3x + 2)(4x + 1)

(b) Expand and simplify (x − 6)(x + 4)

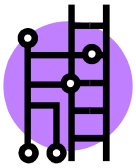
Equations

Easy E/D grade questions

1. Solve the equations

a. $4y - 1 + 9$

b. $\frac{x}{2} = 12$



2. I think of a number.
I multiply my number by 3 and add 1
My answer is 22

(a) Write down an equation to describe this

(b) What number am I thinking of?

Are you feeling more **C**onfident?

C if you can ….. cope on your own!

A solution of the equation $2x^3 + x = 40$ lies between $x = 2$ and $x = 3$

Use trial and improvement to find this solution.

Give your answer to one decimal place

x	x^3	$2x^3$	$2x^3 + x$	Comment
2	8	16	18	too small

Solve these equations

(a) $7(x + 2) = \frac{5x + 1}{2}$

If you are stuck with these, look back at the previous examples and use what you did there

(b) $5(x + 8) = \frac{7x - 4}{2}$

Definitely D grade questions

You could multiply out the bracket first

Solve the equations

(a) $4(z + 3) = 8$

(b) $3t + 4 = 19 - 2t$

There are a number of different ways to solve this. You could add or subtract from both sides, or you could collect the letters on one side and the numbers on the other

C if U can……. answer the rest! (With a few **C**lues)

Brackets first

Solve these equations

(a) $4(y + 3) = 9(y - 2)$

(b) $\frac{2t + 5}{3} = 7$

Do something with the 3 first

(c) $\frac{1}{2}(y - 4) = 5$

If you are stuck, try to make this look more like the equation in part (b)

Liam is using trial and improvement to find a solution to the equation

$x^3 + 4x = 72$

The table shows his first two trials

x	$x^3 + 4x$	Comment
3	39	Too small
4	80	Too large

Make sure you know how Liam got his first two answers

Continue the table to find a solution to the equation.

Give your answer to one decimal place

Don't forget this