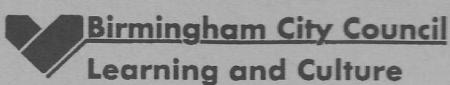


Birmingham
Resources for
Understanding
Mathematics

C if U can

Algebra



Course U can - these are the easy ones!

C een it B4

If $a = 3$ and $b = 5$, find the value of:-

1. $2a + b$
2. $2ab$

$$\begin{aligned} 1) \quad & (2 \times 3) + 5 \\ &= 6 + 5 \\ &= 11 \\ 2) \quad & 2ab = 2 \times a \times b \\ &= 2 \times 3 \times 5 \\ &= 30 \end{aligned}$$

When $n = 8$, evaluate the expression

$$\begin{aligned} & 3(2n - 2) \\ &= 3(2 \times 8 - 2) \\ &= 3(16 - 2) \\ &= 3 \times 14 \\ &= 42 \end{aligned}$$

$$T = 3x + 4y$$

Find the value of T
When $x = -5$ and $y = 3$

$$\begin{aligned} T &= (3 \times -5) + (4 \times 3) \\ &= -15 + 12 \\ &= -3 \end{aligned}$$

Careful - these questions don't use the word 'substitute' - but that's what you're doing!

Evaluate $A = 3(2b - 4)$ when

1. $b = -2$
2. $b = -5$

$$\begin{aligned} 1) \quad A &= 3((2 \times -2) - 4) \\ &= 3(-4 - 4) \\ &= 3 \times -8 \\ &= -24 \\ 2) \quad A &= 3((2 \times -5) - 4) \\ &= 3(-10 - 4) \\ &= 3 \times -14 \end{aligned}$$

$$= -42$$

Given that

$$P = Q^2 - 2Q$$

Find the value of P when $Q = -3$

$$\begin{aligned} P &= (-3)^2 - (2 \times -3) \\ &= 9 - (-6) \\ &= 9 + 6 \\ &= 15 \end{aligned}$$

Check out the
clues!

Now C if U can do these.....

6

$$P = 3a + 5b$$

$$a = 5.8$$

$$b = -3.4$$

Work out the value of P

$$\begin{aligned} P &= (3 \times a) + (5 \times b) \\ &= (3 \times 5.8) + (5 \times -3.4) \\ &= 17.4 + (-17.4) \\ &= 17.4 - 17.4 \\ &= 0 \end{aligned}$$

CLUE:-

Remember b has a negative value

$$P = x^2 - 7x$$

Work out the value of P when $x = -5$

$$\begin{aligned} P &= (-5)^2 - (7 \times -5) \\ &= 25 - (-35) \\ &= 25 + 35 \\ &= 60 \end{aligned}$$

CLUE:-

Remember x has a negative value - what happens when you square it?

7

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

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

A polygon has 20 sides.

Work out the number of diagonals of this polygon

$$\begin{aligned} D &= \frac{20^2 - 3}{2} \\ &= \frac{400 - 3}{2} = \frac{397}{2} = 198.5 \end{aligned}$$

CLUE:-

Where do you substitute the 20? Work out the top first!

Can you do these? Decide how good you think you are before you look at the examples - are you confident, close or clueless?

C if U can Expressions

Confident

Close

Clueless

How did you do with the examples?
Write any notes you need to remember.

Simplify expressions - (make them easier!)

Expand and simplify expressions with brackets

Write expressions from information

Turn expressions into formulae

Solve problems involving expressions and formulae

Couldn't be easier - but it's going to get harder soon!

C een it B4

Simplify the expression:-

$$4p + 9q + 5p - 3q$$

$$\begin{aligned} &= 4p + 5p + 9q - 3q \\ &= 9p + 6q \end{aligned}$$

Simplify the expression:-

$$5p^2 + 3q - p^2 + 2q$$

$$\begin{aligned} &= 5p^2 - p^2 + 3q + 2q \\ &= 4p^2 + 5q \end{aligned}$$

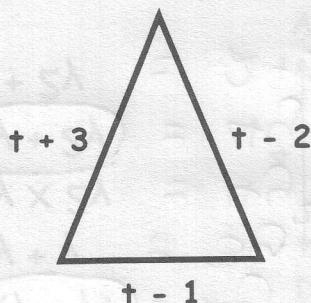
Multiply out

$$6(4x - 3)$$

$$\begin{aligned} &= (6 \times 4x) - (6 \times 3) \\ &= 24x - 18 \end{aligned}$$

In these two questions, you are finding expressions and trying to simplify them.

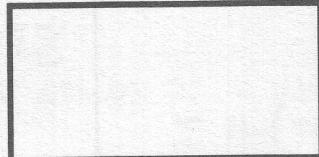
Find the perimeter of this shape:-



$$\begin{aligned} \text{Perimeter} &= t+3+t-2+t-1 \\ &= t+t+t+3-2-1 \\ &= 3t \end{aligned}$$

Find the perimeter of this shape:-

$$4(x - 2)$$



$$\begin{aligned} &4(x-2) + 3x + 4(x-2) + 3x \\ &= 4x - 8 + 3x + 4x - 8 + 3x \\ &= 4x + 3x + 4x + 3x - 8 - 8 \\ &= 14x - 16 \end{aligned}$$

Can't think why algebra
isn't considered fun!

Now C if U can do these.....

12

Here are some expressions. Two of the expressions always have the same value as $4y$.

Circle the ones always equal to $4y$

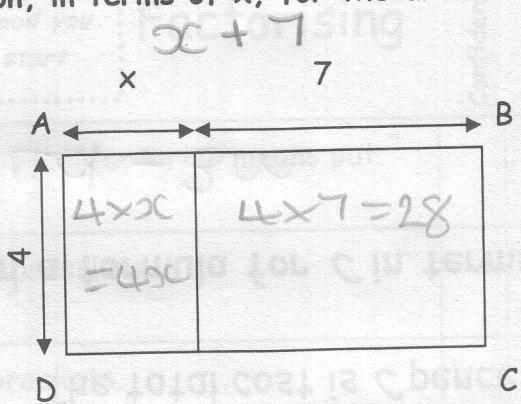
- $2(y + y) = 2y + 2y = 4y$
- $2y + y = 3y$
- $2y \times 2y = 4y^2$
- $2y + 2y = 4y$
- $2 + 2y = 2 + 2y$

CLUE:-

Some of these expressions will sometimes be equal to $4y$. The questions says always

The diagram shows a rectangle ABCD. The measurements are in centimetres.

Write an expression, in terms of x , for the area of the rectangle ABCD.



$$\text{Area} = \text{Length} \times \text{width}$$

$$= 4 \times (x+7)$$

$$= 4(x+7)$$

$$= 4x + 28$$

CLUE :-

The question doesn't ask what the area is, just for an expression (or formula) which will help find the area. Write an expression in each part of the rectangle.

13

A shop sells doughnuts and muffins. Doughnuts cost d pence each.

Muffins cost m pence each.

Daniel buys 4 doughnuts and 3 muffins.

The total cost is C pence.

Write down a formula for C in terms of d and m

$$C = 4d + 3m$$

CLUE:-

So C will be the subject of the formula. If it helps, write it in words first.

Can U crack these? Are you
confident, close

or clueless? Assess how good you
think you are before you start

C if U can Factorising

Confident

Close

Clueless

Could you do
them?
Write any notes
you need to
remember.

Factorise simple expressions. (factorise means put back into brackets!)

Simplify and factorise expressions.

Remove a single pair of brackets.

Expand and simplify two pairs of brackets.

Factorise quadratics (involving squares).

Make certain you can do these easy ones first.

C een it B4

16

Factorise

$$8xy + 12x$$

$$4x(2y + 3)$$

Factorise

$$6x^2 - 3xy$$

$$3x(2x - y)$$

- Multiply out each of these

$$8(2x - 3) = 16x - 24$$

$$3(4x + 1) = 12x + 3$$

- Now simplify this expression and factorise

$$8(2x - 3) + 3(4x + 1)$$

$$= 16x - 24 + 12x + 3$$

$$= 16x + 12x - 24 + 3$$

$$= 28x - 21$$

$$= 7(4x - 3)$$

Remember, 2 brackets with 2 values inside gives 4 values before you simplify them.

Expand these brackets:-

- $(x + 1)(x + 3)$

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

- $(x - 6)(x + 2)$

$$x^2 - 6x + 2x - 12 = x^2 - 4x - 12$$

- $(x - 4)(x + 7)$

$$x^2 - 4x + 7x - 28$$

$$x^2 + 3x - 28$$

Factorise:-

- $x^2 + 3x + 2$

$$(x+2)(x+1)$$

- $x^2 + 7x + 12$

$$(x+4)(x+3)$$

- $x^2 + 2x - 15$

$$(x+5)(x-3)$$

- $x^2 - 2x - 35$

$$(x-7)(x+5)$$

17

Sometimes, the questions worth more marks just have several parts

C if U can do these.....

18

Factorise

$$1. 9x + 12 = 3(3x + 4)$$

$$\therefore (3 - t)(x + 1)$$

$$2. x^2 + x = x(x + 1)$$

$$\therefore (x - 2)(x + 5)$$

$$\therefore (x + 1)(x + 3)$$

CLUE:-

In part 2, x is 1x. You are looking for what is common in both values.

Expand and simplify

$$(3x + 2)(4x + 1)$$

$$12x^2 + 8x + 3x + 2$$

$$= 12x^2 + 11x + 2$$

CLUE:-

Don't forget to simplify at the end

19

Factorise completely

$$3x^2 + 6xy$$

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

$$(3x + 5)(x - 1)$$

CLUE:-

Completely is the key word! Are you sure there's nothing else to do?

C if U can Equations

Are you confident, close or clueless? Assess how good you think you are before you start.

Confident	Close	Clueless
-----------	-------	----------

At the end of the section, go back and think about your self assessment. Was it a good judgement? Make any notes you need to here.

Solve simple equations including those with a letter on both sides.			
Solve problems where you have to use inverse operations. (Working something backwards)			
Write equations from information.			
Solve equations that have brackets.			
Solve equations with fractions in them.			

Simple ones first

C een it B4

22

Solve the equation:-

$$8x - 3 = 21$$

$$\begin{aligned} (+3) \quad 8x &= 24 \quad (-3) \\ (\div 8) \quad x &= \frac{24}{8} \quad (\div 8) \\ x &= 3 \end{aligned}$$

Solve the equation:-

$$4(3n + 7) = 18$$

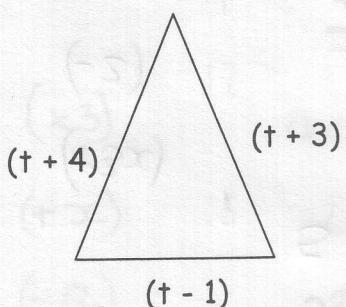
$$\begin{aligned} 12n + 28 &= 18 \\ 12n &= -10 \\ n &= \frac{-10}{12} \\ n &= \frac{-5}{6} \end{aligned}$$

Solve the equation:-

$$4(x + 2) = 6x + 4$$

$$\begin{aligned} 4x + 8 &= 6x + 4 \\ 8 &= 2x + 4 \\ 4 &= 2x \\ 2 &= x \\ x &= 2 \end{aligned}$$

Perimeter = 39 cm



Find the value of t.

$$\begin{aligned} t+4+t+3+t-1 &= 39 \\ t+t+t+4+3-1 &= 39 \\ 3t+6 &= 39 \end{aligned}$$

$$3t = 33$$

$$t = \frac{33}{3}$$

$$t = 11$$

Solve the following equations:-

$$\frac{(12+x)}{3} = 5$$

$$\begin{aligned} 12+x &= 5 \times 3 \\ 12+x &= 15 \\ x &= 15-12 \\ x &= 3 \end{aligned}$$

$$\frac{x-5}{3} = 3$$

$$\begin{aligned} x-15 &= 9 \\ x &= 9+15 \\ x &= 24 \end{aligned}$$

23

These just have more steps
than the ones you just did.

24

Now C if U can do these.....

Solve this equation

$$5 - 3x = 2(x + 1)$$

$$\underline{5 - 3x} = \underline{2x + 2}$$

(+3x)

$$5 = 5x + 2$$

(+3x)

(-2)

$$3 = 5x$$

(IS - (-2))

$$5x = 3$$

(÷5)

$$x = \frac{3}{5}$$

(÷5)

CLUE:-

Brackets first.

Solve this equation

$$\frac{40 - x}{3} = 4 + x$$

(x3)

$$40 - \underline{x} = \underline{12 + 3x}$$

(x3)

(+x)

$$40 = 12 + 4x$$

(+x)

(-12)

$$28 = 4x$$

(-12)

$$4x = 28$$

CLUE:-

(÷4)

$$x = \frac{28}{4}$$

(÷4)

Deal with the 3 first.

$$x = 7$$

25

Solve this equation

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

$$7x + 14 = \frac{5x + 1}{2}$$

$$14x + 28 = 5x + 1$$

$$(5x) \quad 9x + 28 = 1 \quad (-5x)$$

$$(-28) \quad 9x = -27 \quad (-28)$$

$$\text{CLUE:- } (\div 9) \quad x = \frac{-27}{9} \quad (\div 9)$$

Brackets first, then the 2

$$x = -3$$

If you don't know
what these
statements mean,
turn the page.

C if U can

Trial and improvement and inequalities

Confident

Close

Clueless

Could you do them?
Do you need to make
any notes?

Solve simple inequalities (greater or less than)			
Solve harder inequalities			
Solve problems where you have to work backwards (inverse)			
Write inequalities from information			
Use trial and improvement to solve equations			

These shouldn't be too challenging.

C een it B4

28

Solve the inequality

$$3n < 6$$

$$n < \frac{6}{3}$$

$$n < 2.$$

Solve the inequality

$$5n > -15$$

$$n > -\frac{15}{5}$$

$$n > -3$$

Solve the inequality

$$6n \leq -3$$

$$n \leq -\frac{3}{6}$$

$$n \leq -\frac{1}{2}$$

Use trial and improvement to solve

$$x^3 + 2x = 50$$

where x lies between 3 and 4

trial x	$x^3 + 2x$	comment
3.5	49.875	too low
3.6	53.856	too high
3.55	51.8388...	too high
$\therefore x = 3.5$ to 1dp		

Use trial and improvement to solve

$$\frac{1}{2}x^3 - x = 90$$

where x lies between 5 and 6

trial x	$\frac{1}{2}x^3 - x$	comment
5.5	77.6875	too low
5.7	86.8965	too low
5.8	91.756	too high
5.75	89.3045...	too low
$\therefore x = 5.8$ to 1dp		

29

These are very similar,
just a bit harder!

30

Now C if U can do these.....

Solve the inequality

$$4x - 3 < 7$$

(+3)

$$4x < 7 + 3 \quad (+3)$$

$$4x < 10$$

(÷4)

$$x < \frac{10}{4} \quad (\div 4)$$

$$x < \frac{5}{2}$$

$$x < 2.5$$

CLUE:-

Start by adding 3 to both sides

X is an integer, such that
 $-3 < x \leq 2$
list all the possible values of x

$$-2, -1, 0, 1, 2$$

CLUE:-

Don't forget the difference between the two signs here. Integers are whole numbers

31

The equation

$$x^3 - 15x = 31$$

Has a solution between 4 and 5.

Use a trial and improvement method to find this solution.

Give your answer to 1 decimal place.

You must show all your working.

trial x

4.5

4.7

4.6

4.65

$x^3 - 15x$

23.625

33.323

28.336

30.794625

comment

too low

too high

too low

too low

CLUE:-

Make sure you go through enough steps.

$\therefore x = 4.7$ to 1dp

Can you cope with these questions? Decide how good you think you are before you look at the examples - are you confident, close or clueless?

C if U can Graphs

Confident

Close

Clueless

Were they easier or harder than you had thought? What do you need to remember?

Complete a table of values.

Plot co-ordinates from a set of values and draw a straight line.

Recognise that an equation like $y = 3x + 2$ is a straight line on a graph.

Use a line on a graph to find the value on one axis when you are given the value on the other axis.

Plot co-ordinates and draw a curve on a graph.

Remember substitution? That's how to find the missing values in the tables.

C een it B4

34

Complete this table of values for the function
 $y = 3x + 1$

x	-3	-2	-1	0	1	2	3
y	-8	-5	-2	1	4	7	10

Complete this table of values for the function
 $y = 2x - 5$

x	-3	-2	-1	0	1	2	3
y	-11	-9	-7	-5	-3	-1	1

Use the table of values you have completed in the previous question to plot and draw the graph of

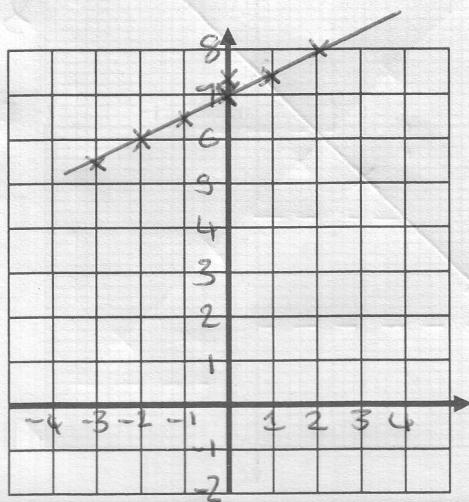
$$y = 2x - 5$$

Straight line,
 Sloping up,
 crossing y-axis
 at -5.

Complete the table of values for the function
 $y = \frac{1}{2}x + 7$

x	-3	-2	-1	0	1	2	3
y	5.5	6	6.5	7	7.5	8	8.5

Plot the function
 $y = \frac{1}{2}x + 7$
 on the grid



35

Very similar, just
harder numbers!

Now C if U can do these.....

36

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

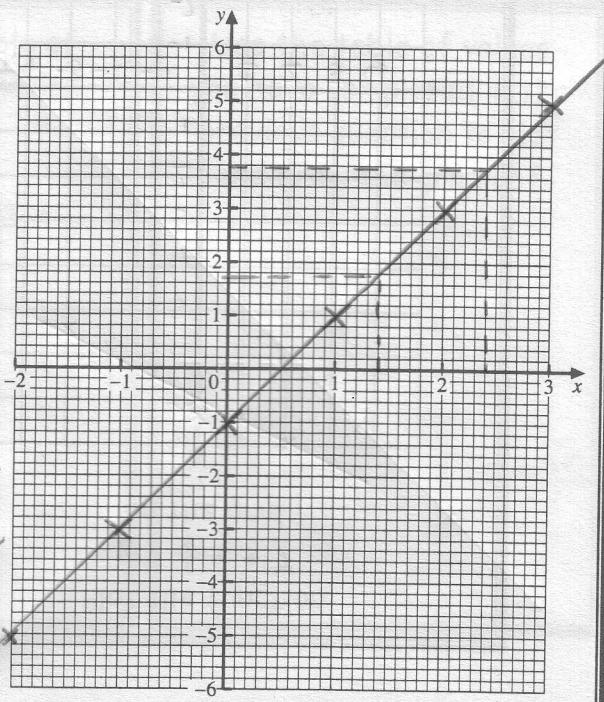
x	-2	-1	0	1	2	3
y	-5	-3	-1	1	3	5

Then draw the graph and use the
graph to find

- the value of y when $x = -1.4$ $y = 1.8$
- the value of x when $y = 3.8$ $x = 2.4$

CLUE:-

This graph may be a bit small. If so, re-draw it

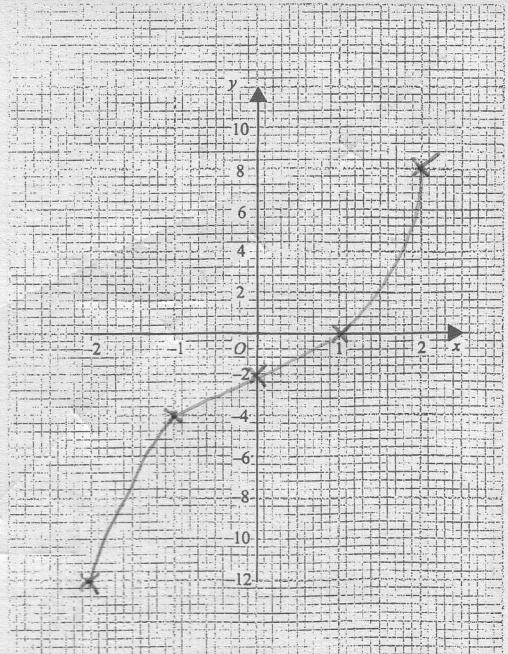


Complete the table of values for
 $y = x^3 + x - 2$
 then draw the graph on the grid

x	-2	-1	0	1	2
y	-12	-4	-2	0	8

CLUE:-

Take care with the negative numbers. This will make
a curve because of the x^3 .



37

x	-2	-1	0	1	2	3
y	10	8	6	4	2	0

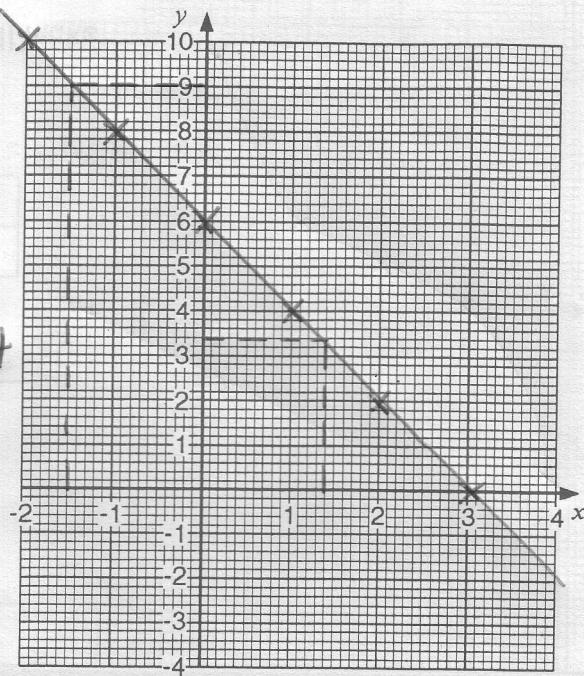
Make a table of values for

$$Y = 6 - 2x$$

Then draw the graph.

Use your graph to find

1. the value of y when $x = -1.5$ $y=9$
2. the value of x when $y = 3.4$ $x=1.4$



CLUE:-

Think about the numbers in the table of values.
Look at the graph for a hint.

- Which topics from this book do you think you could improve in?
- Are there any topics that you found were so difficult that you should not spend any more time working on them but concentrate on those where you really can make progress?
- This booklet didn't cover all of the algebra on the intermediate paper. Some things, eg simultaneous equations were left out. The things left out were the harder B grade questions, so don't be surprised if you can't do them in the exam.
- If you could do everything in this book, you should try some B grade questions.