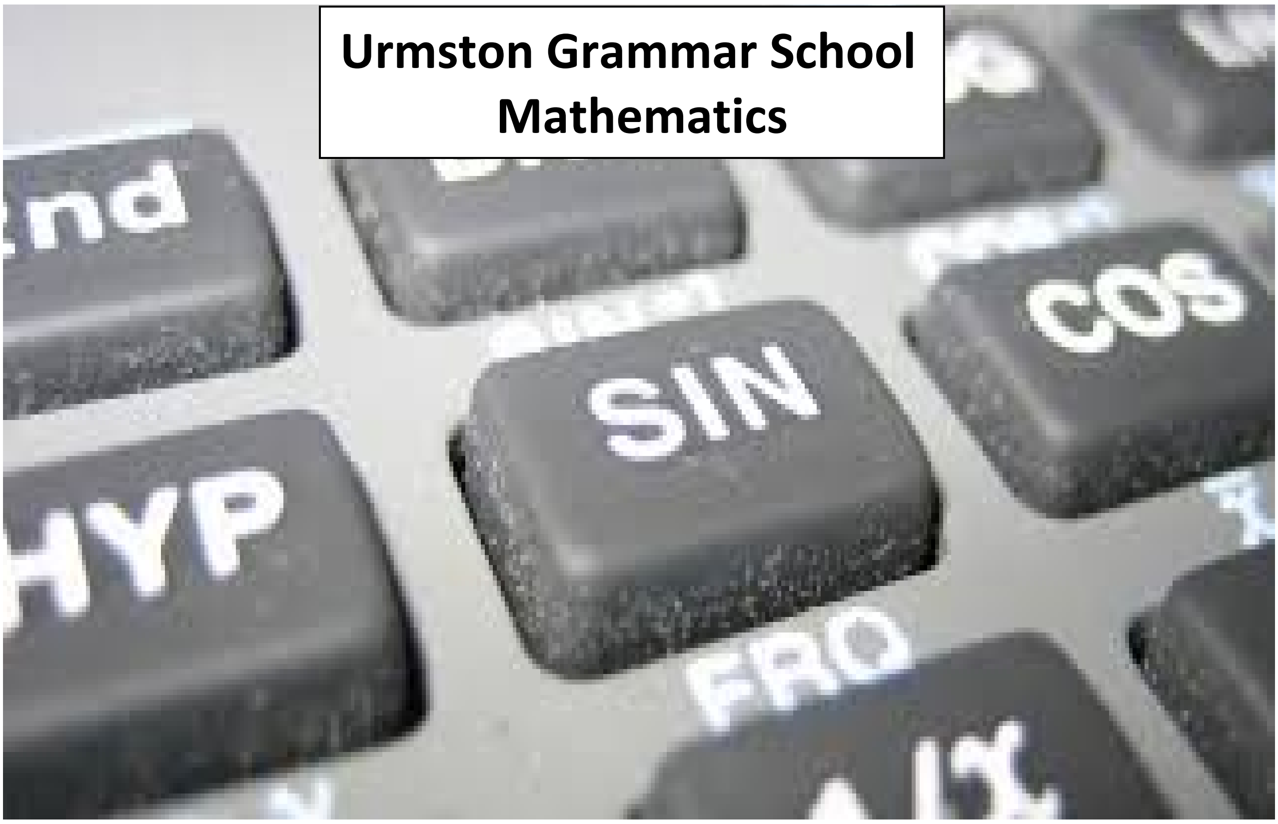
Name ____

Urmston Grammar School Mathematics



Induction Booklet

Please print off and work through this booklet and make sure that you are confident with the techniques for September, as they will make your A Level easier if you can use them all.

Please bring your solutions to this booklet with you to your first Maths lesson. Answers are at the end of the booklet; you need to check your work and tick or cross your solutions. If you have made a mistake try and correct it. If you are having any problems with the work please see your Mathematics teacher.

Welcome to Mathematics at Urmston Grammar School!

In Years 12 and 13, we offer Edexcel Modular 'A' Level Examination. The two year course comprises eight lessons per week and we are able to meet a range of student interests in Pure Mathematics, Statistics and Mechanics, by offering the subject on two lines.

Students will study six units of assessment during the course. Three will be examined during Year 12 and the remaining three during Year 13.

We expect to be able to offer three alternative 'A' levels, each of which leads to an award entitled **"A level Mathematics":**

Line A: [Units in Pure Mathematics and Statistics]

Line C: 1- [Units in Pure Mathematics and 2 of Statistics, Mechanics and Decision Mathematics]

2- [Units in Pure Mathematics and Mechanics]

For each course about two thirds of the work consists of the traditional 'pure' topics of algebra, geometry, trigonometry and calculus and the remainder will comprise the applications of these to Statistics, Mechanics, or Decision Mathematics according to the units taken. The Pure Mathematics content of each course is identical and students should choose their balance of Statistics, Mechanics or Decision Mathematics according to their own preferences and the other 'A' level subjects they choose to study.

AS Level Mathematics

Students may opt to study AS as a discrete qualification. This comprises three units of assessment. The course will include two units of Pure Mathematics, together with a module of Statistics, Mechanics or Decision Mathematics according to the option chosen.

Students taking this option will be taught together with those intending to study the full 'A' level as <u>all</u> students will sit 3 units of assessment during Year 12. We hope that this will also afford a greater flexibility in the choice of units available to AS students, but students should discuss their requirements with the Head of Faculty as the various modules are taken on different occasions during the year.

AS & A Level Further Mathematics

For students taking A level Mathematics on Line C, it is possible to also opt for either AS or A level Further Mathematics on Line A. **To take Further Mathematics on Line A at any level, you must also take Mathematics on Line C.** For AS Further Mathematics, this will mean taking 3 more Mathematics Modules, one of which must be Further Pure 1. For A level Further Mathematics, there would be 6 more modules to take, of which 2 must be Further Pure 1 and Further Pure 2. The exact mixture of modules will be discussed with the Head of Faculty but can be assumed to include modules in Further Pure Mathematics, Statistics, Mechanics and Decision Mathematics. Some of the Further Mathematics lessons will be taken with the A level group on line A and the others will be arranged separately. It is especially important that prospective Further Mathematics candidates discuss their intentions with their Mathematics teacher and the Head of Faculty. This is an exciting course and it means that up to half of the total A level time will be Mathematics so applicants will need to really enjoy the subject to be able to cope with this!

Examinations

Students will sit modular examinations throughout the course and three modules will be taken in the summer of both Year 12 and Year 13. Further Mathematics students will take 6 modules in Year 12 and 6 in Year 13 in the June examination period.

General

Students who include Biology, the Arts subjects or the Social Sciences in their 'A' level choices will tend to find that an alternative which contains some Statistics is most suitable while those who choose Physics will find that some Mechanics Modules complement their studies best.

The above information provides guidelines only. Any student who requires further information on any aspect of these courses or who would like guidance in choosing the most appropriate units for them should consult a member of the Mathematics Faculty who will be happy to advise. Mathematics is equally suitable for girls and boys studying a wide range of other 'A' level subjects and successful former students have studied the arts, the sciences or a combination of bot

You may also find the following book useful:

AS-Level Maths Head Start Published by
CGP Workbooks ISBN: 978 1 84146
993 5
Cost: £4.95 (but currently £3.99 on Amazon)

Acknowledgements: We would like to thank Heckmondwike Grammar School, for the use of their induction material.

EXPANDING BRACKETS

To remove a single bracket, we multiply every term in the bracket by the number or the expression on the outside:

Examples

1) $3(x + 2y) = 3x + 6y$

2) $-2(2x - 3) = (-2)(2x) + (-2)(-3)$
$= -4x + 6$

To expand two brackets, we must multiply everything in the first bracket by everything in the second bracket. We can do this in a variety of ways, including

- the smiley face method
- FOIL (Fronts Outers Inners Lasts)
- using a grid.

Examples:

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

or

$(x + 1)(x + 2) = x^2 + 2 + 2x + x$
$= x^2 + 3x + 2$

or

	x	1
x	x^2	x
2	$2x$	2

$(x + 1)(x + 2) = x^2 + 2x + x + 2$
$= x^2 + 3x + 2$

2) $(x - 2)(2x + 3) = x(2x + 3) - 2(2x + 3)$
$= 2x^2 + 3x - 4x - 6$
$= 2x^2 - x - 6$

or

$(x - 2)(2x + 3) = 2x^2 - 6 + 3x - 4x = 2x^2 - x - 6$

or

	x	-2
$2x$	$2x^2$	$-4x$
3	$3x$	-6

$(2x + 3)(x - 2) = 2x^2 + 3x - 4x - 6$
$= 2x^2 - x - 6$

EXERCISE A Multiply out the following brackets and simplify.

1. $7(4x + 5)$
2. $-3(5x - 7)$
3. $5a – 4(3a - 1)$
4. $4y + y(2 + 3y)$
5. $-3x – (x + 4)$
6. $5(2x - 1) – (3x - 4)$
7. $(x + 2)(x + 3)$
8. $(t - 5)(t - 2)$
9. $(2x + 3y)(3x – 4y)$
10. $4(x - 2)(x + 3)$
11. $(2y - 1)(2y + 1)$
12. $(3 + 5x)(4 – x)$

Two Special Cases

Perfect Square:	Difference of two squares:
$(x + a)^2 = (x + a)(x + a) = x^2 + 2ax + a^2$	$(x - a)(x + a) = x^2 – a^2$
$(2x - 3)^2 = (2x – 3)(2x – 3) = 4x^2 – 12x + 9$	$(x - 3)(x + 3) = x^2 – 3^2$
	$= x^2 – 9$

EXERCISE B Multiply out

1. $(x - 1)^2$
2. $(3x + 5)^2$
3. $(7x - 2)^2$
4. $(x + 2)(x - 2)$
5. $(3x + 1)(3x - 1)$
6. $(5y - 3)(5y + 3)$

LINEAR EQUATIONS

When solving an equation, you must remember that whatever you do to one side must also be done to the other. You are therefore allowed to

- add the same amount to both side
- subtract the same amount from each side
- multiply the whole of each side by the same amount
- divide the whole of each side by the same amount.

If the equation has unknowns on both sides, you should collect all the letters onto the same side of the equation.

If the equation contains brackets, you should start by expanding the brackets.

A linear equation is an equation that contains numbers and terms in x. A linear equation does not contain any x^2 or x^3 terms.

Example 1: Solve the equation $64 - 3x = 25$

Solution: There are various ways to solve this equation. One approach is as follows:

Step 1: Add $3x$ to both sides (so that the x term is positive): $64 = 3x + 25$

Step 2: Subtract 25 from both sides: $39 = 3x$

Step 3: Divide both sides by 3: $13 = x$

So the solution is $x = 13$.

Example 2: Solve the equation $6x + 7 = 5 - 2x$.

Solution:

Step 1: Begin by adding $2x$ to both sides (to ensure that the x terms are together on the same side) $8x + 7 = 5$

Step 2: Subtract 7 from each side: $8x = -2$

Step 3: Divide each side by 8: $x = -\frac{1}{4}$

Exercise A: Solve the following equations, showing each step in your working:

1) $2x + 5 = 19$

2) $5x - 2 = 13$

3) $11 - 4x = 5$

4) $5 - 7x = -9$

5) $11 + 3x = 8 - 2x$

6) $7x + 2 = 4x - 5$

Example 3: Solve the equation $2(3x - 2) = 20 - 3(x + 2)$

Step 1: Multiply out the brackets: $6x - 4 = 20 - 3x - 6$
(taking care of the negative signs)

Step 2: Simplify the right hand side: $6x - 4 = 14 - 3x$

Step 3: Add 3x to each side: $9x - 4 = 14$

Step 4: Add 4: $9x = 18$

Step 5: Divide by 9: $x = 2$

Exercise B: Solve the following equations.

1) $5(2x - 4) = 4$

2) $4(2 - x) = 3(x - 9)$

3) $8 - (x + 3) = 4$

4) $14 - 3(2x + 3) = 2$

EQUATIONS CONTAINING FRACTIONS

When an equation contains a fraction, the first step is usually to multiply through by the denominator of the fraction. This ensures that there are no fractions in the equation.

Example 4: Solve the equation $\frac{y}{2} + 5 = 11$

Solution:
Step 1: Multiply through by 2 (the denominator in the fraction): $y + 10 = 22$

Step 2: Subtract 10: $y = 12$

Example 5: Solve the equation $\frac{1}{3}(2x + 1) = 5$

Solution:
Step 1: Multiply by 3 (to remove the fraction) $2x + 1 = 15$

Step 2: Subtract 1 from each side $2x = 14$

Step 3: Divide by 2 $x = 7$

When an equation contains two fractions, you need to multiply by the lowest common denominator. This will then remove both fractions.

Example 6: Solve the equation $\frac{x+1}{4}+\frac{x+2}{5}=2$

Solution:

Step 1: Find the lowest common denominator: The smallest number that both 4 and 5 divide into is 20.

Step 2: Multiply both sides by the lowest common denominator $\frac{20(x+1)}{4}+\frac{20(x+2)}{5}=40$

Step 3: Simplify the left hand side: $\frac{\overset{5}{\cancel{20}}(x+1)}{\cancel{4}}+\frac{\overset{4}{\cancel{20}}(x+2)}{\cancel{5}}=40$

$5(x + 1) + 4(x + 2) = 40$

Step 4: Multiply out the brackets: $5x + 5 + 4x + 8 = 40$

Step 5: Simplify the equation: $9x + 13 = 40$

Step 6: Subtract 13 $9x = 27$

Step 7: Divide by 9: $x = 3$

Example 7: Solve the equation $x+\frac{x-2}{4}=2-\frac{3-5x}{6}$

Solution: The lowest number that 4 and 6 go into is 12. So we multiply every term by 12:

$$12x+\frac{12(x-2)}{4}=24-\frac{12(3-5x)}{6}$$

Simplify	$12x+3(x-2)=24-2(3-5x)$
Expand brackets	$12x+3x-6=24-6+10x$
Simplify	$15x-6=18+10x$
Subtract 10x	$5x-6=18$
Add 6	$5x = 24$
Divide by 5	$x = 4.8$

Exercise C: Solve these equations

1) $\frac{1}{2}(x+3)=5$

2) $\frac{2x}{3}-1=\frac{x}{3}+4$

3) $\frac{y}{4}+3=5-\frac{y}{3}$

4) $\frac{x-2}{7}=2+\frac{3-x}{14}$

Exercise C (continued)

5) $\dfrac{7x-1}{2} = 13 - x$

6) $\dfrac{y-1}{2} + \dfrac{y+1}{3} = \dfrac{2y+5}{6}$

7) $2x + \dfrac{x-1}{2} = \dfrac{5x+3}{3}$

8) $2 - \dfrac{5}{x} = \dfrac{10}{x} - 1$

FORMING EQUATIONS

Example 8: Find three consecutive numbers so that their sum is 96.

Solution: Let the first number be n, then the second is $n + 1$ and the third is $n + 2$.

Therefore $n + (n + 1) + (n + 2) = 96$

$3n + 3 = 96$

$3n = 93$

$n = 31$

So the numbers are 31, 32 and 33.

Exercise D:

1) Find 3 consecutive even numbers so that their sum is 108.

2) The perimeter of a rectangle is 79 cm. One side is three times the length of the other. Form an equation and hence find the length of each side.

3) Two girls have 72 photographs of celebrities between them. One gives 11 to the other and finds that she now has half the number her friend has.
Form an equation, letting n be the number of photographs one girl had at the **beginning**.
Hence find how many each has **now**.

SIMULTANEOUS EQUATIONS

An example of a pair of simultaneous equations is $3x + 2y = 8$ ①
$5x + y = 11$ ②

In these equations, x and y stand for two numbers. We can solve these equations in order to find the values of x and y by eliminating one of the letters from the equations.

In these equations it is simplest to eliminate y. We do this by making the coefficients of y the same in both equations. This can be achieved by multiplying equation ② by 2, so that both equations contain $2y$:

$3x + 2y = 8$ ①
$10x + 2y = 22$ 2×② = ③

To eliminate the y terms, we subtract equation ③ from equation ①. We get: $7x = 14$
i.e. $x = 2$

To find y, we substitute $x = 2$ into one of the original equations. For example if we put it into ②:

$10 + y = 11$
$y = 1$

Therefore the solution is $x = 2$, $y = 1$.

Remember: You can check your solutions by substituting both x and y into the original equations.

Example: Solve $2x + 5y = 16$ ①
$3x - 4y = 1$ ②

Solution: We begin by getting the same number of x or y appearing in both equation. We can get $20y$ in both equations if we multiply the top equation by 4 and the bottom equation by 5:

$8x + 20y = 64$ ③
$15x - 20y = 5$ ④

As the SIGNS in front of $20y$ are DIFFERENT, we can eliminate the y terms from the equations by ADDING:

$23x = 69$ ③+④
i.e. $x = 3$

Substituting this into equation ① gives:

$6 + 5y = 16$
$5y = 10$
So… $y = 2$

The solution is $x = 3$, $y = 2$.

Exercise:

Solve the pairs of simultaneous equations in the following questions:

1) $x + 2y = 7$
$3x + 2y = 9$

2) $x + 3y = 0$
$3x + 2y = -7$

3) $3x - 2y = 4$
$2x + 3y = -6$

4) $9x - 2y = 25$
$4x - 5y = 7$

5) $4a + 3b = 22$
$5a - 4b = 43$

6) $3p + 3q = 15$
$2p + 5q = 14$

FACTORISING

Common factors

We can factorise some expressions by taking out a common factor.

Example 1: Factorise $12x - 30$

Solution: 6 is a common factor to both 12 and 30. We can therefore factorise by taking 6 outside a bracket:

$$12x - 30 = 6(2x - 5)$$

Example 2: Factorise $6x^2 - 2xy$

Solution: 2 is a common factor to both 6 and 2. Both terms also contain an x.
So we factorise by taking $2x$ outside a bracket.

$$6x^2 - 2xy = 2x(3x - y)$$

Example 3: Factorise $9x^3y^2 - 18x^2y$

Solution: 9 is a common factor to both 9 and 18.
The highest power of x that is present in both expressions is x^2.
There is also a y present in both parts.
So we factorise by taking $9x^2y$ outside a bracket:

$$9x^3y^2 - 18x^2y = 9x^2y(xy - 2)$$

Example 4: Factorise $3x(2x - 1) - 4(2x - 1)$

Solution: There is a common bracket as a factor.
So we factorise by taking $(2x - 1)$ out as a factor.
The expression factorises to $(2x - 1)(3x - 4)$

Exercise A

Factorise each of the following

1) $3x + xy$

2) $4x^2 - 2xy$

3) $pq^2 - p^2q$

4) $3pq - 9q^2$

5) $2x^3 - 6x^2$

6) $8a^5b^2 - 12a^3b^4$

7) $5y(y - 1) + 3(y - 1)$

Factorising quadratics

Simple quadratics: Factorising quadratics of the form $x^2 + bx + c$
The method is:
Step 1: Form two brackets $(x \ \dots \ )(x \ \dots \ )$
Step 2: Find two numbers that multiply to give c and add to make b. These two numbers get written at the other end of the brackets.

Example 1: Factorise $x^2 - 9x - 10$.

Solution: We need to find two numbers that multiply to make -10 and add to make -9. These numbers are -10 and 1.
Therefore $x^2 - 9x - 10 = (x - 10)(x + 1)$.

General quadratics: Factorising quadratics of the form $ax^2 + bx + c$
The method is:
Step 1: Find two numbers that multiply together to make ac and add to make b.
Step 2: Split up the bx term using the numbers found in step 1.
Step 3: Factorise the front and back pair of expressions as fully as possible.
Step 4: There should be a common bracket. Take this out as a common factor.

Example 2: Factorise $6x^2 + x - 12$.

Solution: We need to find two numbers that multiply to make $6 \times -12 = -72$ and add to make 1. These two numbers are -8 and 9.

Therefore,
$$6x^2 + x - 12 = \underbrace{6x^2 - 8x} + \underbrace{9x - 12}$$
$$= 2x(3x - 4) + 3(3x - 4) \qquad \text{(the two brackets must be identical)}$$
$$= (3x - 4)(2x + 3)$$

Difference of two squares: Factorising quadratics of the form $x^2 - a^2$

Remember that $x^2 - a^2 = (x + a)(x - a)$.

Therefore:
$$x^2 - 9 = x^2 - 3^2 = (x+3)(x-3)$$
$$16x^2 - 25 = (2x)^2 - 5^2 = (2x+5)(2x-5)$$

Also notice that: $2x^2 - 8 = 2(x^2 - 4) = 2(x+4)(x-4)$
and $3x^3 - 48xy^2 = 3x(x^2 - 16y^2) = 3x(x+4y)(x-4y)$

Factorising by pairing
We can factorise expressions like $2x^2 + xy - 2x - y$ using the method of factorising by pairing:

$$2x^2 + xy - 2x - y = x(2x + y) - 1(2x + y)$$
(factorise front and back pairs, ensuring both brackets are identical)
$$= (2x + y)(x - 1)$$

Exercise B

Factorise

1) $x^2 - x - 6$

2) $x^2 + 6x - 16$

3) $2x^2 + 5x + 2$

4) $2x^2 - 3x$ (factorise by taking out a common factor)

5) $3x^2 + 5x - 2$

6) $2y^2 + 17y + 21$

7) $7y^2 - 10y + 3$

8) $10x^2 + 5x - 30$

9) $4x^2 - 25$

10) $x^2 - 3x - xy + 3y$

11) $4x^2 - 12x + 8$

12) $16m^2 - 81n^2$

13) $4y^3 - 9a^2 y$

14) $8(x+1)^2 - 2(x+1) - 10$

CHANGING THE SUBJECT OF A FORMULA

We can use algebra to change the subject of a formula. Rearranging a formula is similar to solving an equation – we must do the same to both sides in order to keep the equation balanced.

Example 1: Make x the subject of the formula $y = 4x + 3$.

Solution: $y = 4x + 3$

Subtract 3 from both sides: $y - 3 = 4x$

Divide both sides by 4; $\frac{y-3}{4} = x$

So $x = \frac{y-3}{4}$ is the same equation but with x the subject.

Example 2: Make x the subject of $y = 2 - 5x$

Solution: Notice that in this formula the x term is negative.

$y = 2 - 5x$

Add $5x$ to both sides $y + 5x = 2$ (the x term is now positive)

Subtract y from both sides $5x = 2 - y$

Divide both sides by 5 $x = \frac{2-y}{5}$

Example 3: The formula $C = \frac{5(F-32)}{9}$ is used to convert between ° Fahrenheit and ° Celsius.

We can rearrange to make F the subject.

$C = \frac{5(F-32)}{9}$

Multiply by 9 $9C = 5(F-32)$ (this removes the fraction)

Expand the brackets $9C = 5F - 160$

Add 160 to both sides $9C + 160 = 5F$

Divide both sides by 5 $\frac{9C+160}{5} = F$

Therefore the required rearrangement is $F = \frac{9C+160}{5}$.

Exercise A

Make x the subject of each of these formulae:

1) $y = 7x - 1$

2) $y = \frac{x+5}{4}$

3) $4y = \frac{x}{3} - 2$

4) $y = \frac{4(3x-5)}{9}$

Rearranging equations involving squares and square roots

Example 4: Make x the subject of $x^2 + y^2 = w^2$

Solution: $x^2 + y^2 = w^2$

Subtract y^2 from both sides: $x^2 = w^2 - y^2$ (this isolates the term involving x)

Square root both sides: $x = \pm\sqrt{w^2 - y^2}$

Remember that you can have a positive or a negative square root. We cannot simplify the answer any more.

Example 5: Make a the subject of the formula $t = \frac{1}{4}\sqrt{\frac{5a}{h}}$

Solution: $t = \frac{1}{4}\sqrt{\frac{5a}{h}}$

Multiply by 4 $4t = \sqrt{\frac{5a}{h}}$

Square both sides $16t^2 = \frac{5a}{h}$

Multiply by h: $16t^2 h = 5a$

Divide by 5: $\frac{16t^2 h}{5} = a$

Exercise B:

Make t the subject of each of the following

1) $P = \frac{wt}{32r}$

2) $P = \frac{wt^2}{32r}$

3) $V = \frac{1}{3}\pi t^2 h$

4) $P = \sqrt{\frac{2t}{g}}$

5) $Pa = \frac{w(v-t)}{g}$

6) $r = a + bt^2$

More difficult examples

Sometimes the variable that we wish to make the subject occurs in more than one place in the formula. In these questions, we collect the terms involving this variable on one side of the equation, and we put the other terms on the opposite side.

Example 6: Make t the subject of the formula $a - xt = b + yt$

Solution: $a - xt = b + yt$

Start by collecting all the t terms on the right hand side:

Add xt to both sides: $a = b + yt + xt$

Now put the terms without a t on the left hand side:

Subtract b from both sides: $a - b = yt + xt$

Factorise the RHS: $a - b = t(y + x)$

Divide by $(y + x)$: $\dfrac{a-b}{y+x} = t$

So the required equation is $t = \dfrac{a-b}{y+x}$

Example 7: Make W the subject of the formula $T - W = \dfrac{Wa}{2b}$

Solution: This formula is complicated by the fractional term. We begin by removing the fraction:

Multiply by $2b$: $2bT - 2bW = Wa$

Add $2bW$ to both sides: $2bT = Wa + 2bW$ (this collects the W's together)

Factorise the RHS: $2bT = W(a + 2b)$

Divide both sides by $a + 2b$: $W = \dfrac{2bT}{a+2b}$

Exercise C

Make x the subject of these formulae:

1) $ax + 3 = bx + c$

2) $3(x + a) = k(x - 2)$

3) $y = \dfrac{2x+3}{5x-2}$

4) $\dfrac{x}{a} = 1 + \dfrac{x}{b}$

SOLVING QUADRATIC EQUATIONS

A quadratic equation has the form $ax^2 + bx + c = 0$.

There are two methods that are commonly used for solving quadratic equations:
* factorising
* the quadratic formula

Note that not all quadratic equations can be solved by factorising. The quadratic formula can always be used however.

Method : Factorising

Make sure that the equation is rearranged so that the right hand side is 0. It usually makes it easier if the coefficient of x^2 is positive.

Example 1 : Solve $x^2 - 3x + 2 = 0$

Factorise $(x - 1)(x - 2) = 0$
Either $(x - 1) = 0$ or $(x - 2) = 0$
So the solutions are $x = 1$ or $x = 2$

Note: The individual values $x = 1$ and $x = 2$ are called the **roots** of the equation.

Example 2: Solve $x^2 - 2x = 0$

Factorise: $x(x - 2) = 0$
Either $x = 0$ or $(x - 2) = 0$
So $x = 0$ or $x = 2$

EXERCISE

1) Use factorisation to solve the following equations:

a) $x^2 + 3x + 2 = 0$

b) $x^2 - 3x - 4 = 0$

c) $x^2 = 15 - 2x$

2) Find the roots of the following equations:

a) $x^2 + 3x = 0$

b) $x^2 - 4x = 0$

c) $4 - x^2 = 0$

3) Solve the following equations by factorising.

a) $6x^2 - 5x - 4 = 0$

b) $8x^2 - 24x + 10 = 0$

Indices

The rules for indices are:

- a^x x a^y = a^{x+y} Rule 1
- $a^x \div a^y$ = a^{x-y} Rule 2
- $(a^x)^y$ = a^{xy} Rule 3

Example 1:

Simplify $3a^2$ x $2a^4$
This means 3 x a^2 x 2 x a^4 , so multiply the numbers and use Rule 1.
So the answer is $6a^6$

Example 2:
Simplify 3s x $(2s)^2$
This means 3s x 2s x 2s, so multiply the numbers and use Rule 1.
So the answer is $12s^3$

Meanings can also be found for powers when x and y are any numbers, positive, negative or fractions.

- $a^{\frac{1}{n}} = \sqrt[n]{a}$ Rule 4
- $a^0 = 1$ Rule 5
- $a^{-n} = \frac{1}{a^n}$ Rule 6
- $a^{\frac{x}{y}}$ = $\sqrt[y]{a^x}$ or $(\sqrt[y]{a})^x$ Rule 7

Example 3:

Simplify $25^{\frac{1}{2}}$
Using Rule 4, this means $\sqrt{25}$ = 5

Example 4:
Simplify $16^{\frac{3}{2}}$
Using Rule 7, this means $(\sqrt{16})^3$ = 4^3 = 64

Example 5:

Simplify $9^{\frac{-3}{2}}$
Using Rule 6, this means $\frac{1}{9^{\frac{3}{2}}}$, Then use Rule 7. So we have $\frac{1}{3^3}$ = $\frac{1}{27}$

Example 6:

Simplify $3x^0$
This means 3 x x^0. Then use Rule 5. So we have 3 x 1 = 3

EXERCISE

1) Simplify the following:

a) $2a \times 3a^{2}$

b) $(2a)^{2} \times 3a$

c) $4^{\frac{1}{2}}$

d) 3^{-3}

e) $9^{\frac{-1}{2}}$

f) $(25a^{2})^{\frac{1}{2}}$

g) $3a^{-2}$

h) $(\frac{1}{27})^{\frac{-2}{3}}$

i) $3^{\frac{1}{2}}$ x $3^{\frac{-3}{2}}$

j) $16^{\frac{-3}{4}}$

k) 2 x 2^{-3}

SOLUTIONS TO THE EXERCISES

EXPANDING BRACKETS

Ex A

1) $28x + 35$ 2) $-15x + 21$ 3) $-7a + 4$ 4) $6y + 3y^2$ 5) $-4x – 4$
6) $7x – 1$ 7) $x^2 + 5x + 6$ 8) $t^2 – 7t + 10$ 9) $6x^2 + xy – 12y^2$
10) $4x^2 + 4x – 24$ 11) $4y^2 – 1$ 12) $12 + 17x – 5x^2$

Ex B

1) $x^2 – 2x + 1$ 2) $9x^2 + 30x + 25$ 3) $49x^2 – 28x + 4$ 4) $x^2 – 4$
5) $9x^2 - 1$ 6) $25y^2 – 9$

LINEAR EQUATIONS

Ex A

1) 7 2) 3 3) 1½ 4) 2 5) -3/5 6) -7/3

Ex B

1) 2.4 2) 5 3) 1 4) ½

Ex C

1) 7 2) 15 3) 24/7 4) 35/3 5) 3 6) 2 7) 9/5 8) 5

Ex D

1) 34, 36, 38 2) 9.875, 29.625 3) 24, 48

SIMULTANEOUS EQUATIONS

1) $x = 1, y = 3$ 2) $x = -3, y = 1$ 3) $x = 0, y = -2$ 4) $x = 3, y = 1$
5) $a = 7,\ b = -2$ 6) $p = 11/3,\ q = 4/3$

FACTORISING

Ex A

1) $x(3 + y)$ 2) $2x(2x – y)$ 3) $pq(q – p)$ 4) $3q(p – 3q)$ 5) $2x^2(x - 3)$ 6) $4a^3b^2(2a^2 – 3b^2)$
7) $(y – 1)(5y + 3)$

Ex B

1) $(x – 3)(x + 2)$ 2) $(x + 8)(x – 2)$ 3) $(2x + 1)(x + 2)$ 4) $x(2x – 3)$ 5) $(3x -1)(x + 2)$
6) $(2y + 3)(y + 7)$ 7) $(7y – 3)(y – 1)$ 8) $5(2x – 3)(x + 2)$ 9) $(2x + 5)(2x – 5)$ 10) $(x – 3)(x – y)$
11) $4(x – 2)(x – 1)$ 12) $(4m – 9n)(4m + 9n)$ 13) $y(2y – 3a)(2y + 3a)$ 14) $2(4x - 1)(x + 2)$

CHANGING SUBJECT OF A FORMULA

Ex A

1) $x = \frac{y+1}{7}$ 2) $x = 4y - 5$ 3) $x = 3(4y + 2)$ 4) $x = \frac{9y + 20}{12}$

Ex B

1) $t = \frac{32rP}{w}$ 2) $t = \pm\sqrt{\frac{32rP}{w}}$ 3) $t = \pm\sqrt{\frac{3V}{\pi h}}$ 4) $t = \frac{P^2 g}{2}$ 5) $t = v - \frac{Pag}{w}$ 6) $t = \pm\sqrt{\frac{r-a}{b}}$

Ex C

1) $x = \frac{c-3}{a-b}$ 2) $x = \frac{3a+2k}{k-3}$ 3) $x = \frac{2y+3}{5y-2}$ 4) $x = \frac{ab}{b-a}$

QUADRATICS

1) a) -1, -2 b) -1, 4 c) -5, 3 2) a) 0, -3 b) 0, 4 c) 2, -2
3) a) -1/2, 4/3 b) 0.5, 2.5

INDICIES

a) $6a^3$ b) $12a^3$ c) 2 d) $\frac{1}{27}$ e) $\frac{1}{3}$ f) 5a g) $\frac{3}{a^2}$

h) 9 i) $\frac{1}{3}$ j) $\frac{1}{8}$ k) $\frac{1}{4}$