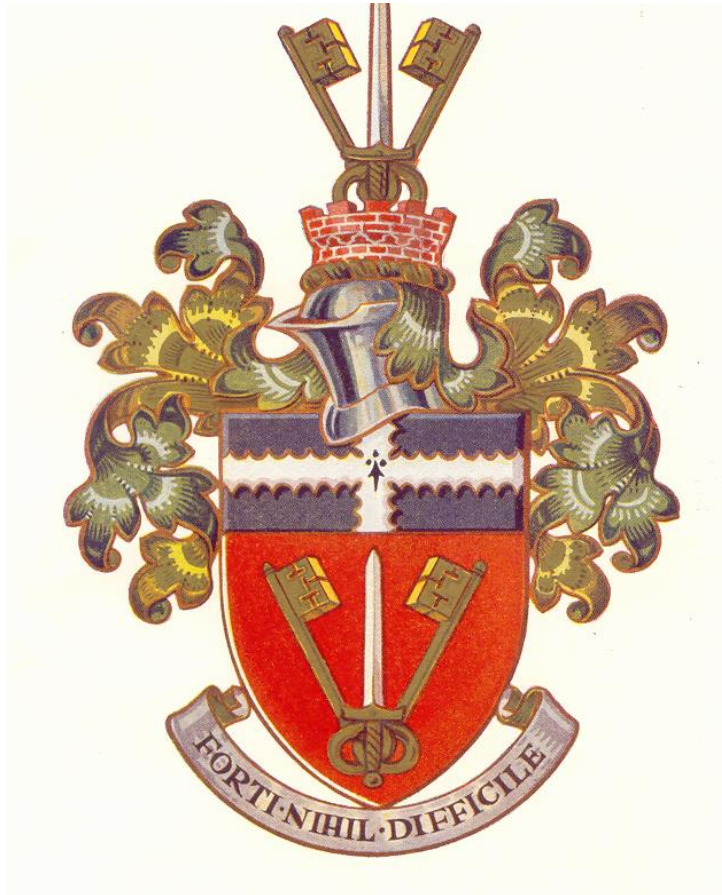


MATHEMATICS DEPARTMENT



**6th FORM
INDUCTION
June 2023**

Introduction

Mathematics at this level builds on the work of GCSE but also introduces new ideas and methods which will give you the mathematical skills and knowledge to solve increasingly complex problems.

The AS/A Level courses for Mathematics and Further Mathematics at SHSB consists of three elements -pure mathematics, statistics and mechanics. The course is linear, which means that if you go on to study for a full A Level, you can be tested on all the material you have covered in both years of study. Mathematics and Further Mathematics are two separate A levels.

Aims

If you are studying these subjects we would like you to be able to do the following:-

- a) apply mathematics to everyday situations.
- b) use your mathematical skills in other subject areas.
- c) communicate mathematically.
- d) investigate open-ended problems.
- e) develop spatial ability
- f) develop logical thought processes.
- g) acquire confidence in handling mathematical concepts.
- h) improve your mental facility with numbers.

Mathematics & Further Mathematics

AS & A level Mathematics

For Mathematics, in Year 12 you will study topics associated with pure maths, statistics and mechanics. This will enable you to undertake an AS Level in the subject, in May/June 2024. In Year 13 you will study further topics in pure maths, statistics and mechanics which, along with topics studied previously in Year 12, will enable you to undertake a full A Level in maths in June 2025.

The time allocation is 9 hours a fortnight; each class is taught by two members of staff. There is no coursework element on the maths course.

A Level Further Mathematics

In the summer of Year 12, students studying for both the maths and the further maths courses will take an AS in Maths, as described above, but also an AS in Further Mathematics. The time allocation is 16 hours a fortnight, and the class is taught by two members of staff.

The success in these examinations is a factor when you consider your options in Year 13. If your results are strong enough, you would go on to take both an A Level in Mathematics and one in Further Mathematics at the end of Year 13 (once again all

the topics covered over that two year period of study could be assessed). If your results at the end of Year 12 indicate that it is in your best interest to do so, you may go on to only sit the A Level in Maths at the end of Year 13. There is no coursework on either the Maths or the Further Maths course.

Course Content

Pure Mathematics This builds on the concepts of GCSE but extends them. Algebra, trigonometry, coordinate geometry and series are topics you are familiar with and which will be developed. You will study the ideas of calculus to a high level, initially looking at gradients of graphs and areas under graphs. You will find many of the ideas in pure mathematics are interesting in their own right and they form an important foundation for the other branches of mathematics studied.

Statistics This is a more formal and wide ranging development of the statistics studied at GCSE. It involves learning how to analyse and summarise numerical data in order to draw conclusions from it. Hypothesis testing, which is a valuable tool to analyse features of a data set is introduced. Many of the ideas you will meet in this part of the course have applications in a wide area of other fields.

Mechanics In this area you will learn how to describe mathematically the motion of objects and how they respond to forces acting upon them, from cars in the street to satellites revolving around a planet. Much of what you will do is based on simple mathematical models; i.e. turning a complicated physical problem into a simpler one that can be analysed and solved using mathematical methods. You will study two main areas:

Statics which looks at the mathematics of objects which are stationary and

Dynamics which deals with how objects move and why they move in particular ways.

A topic summary for AS Mathematics is given on page 6 of your booklet.

Examinations

An AS exam in Maths consists of a two hour pure paper and a 1 hour and 15 mins applied paper (statistics and mechanics). An A Level in Maths consists of two, two hour pure papers and one two hour applied paper. An AS in Further Maths will consist of two 1 hour and 40 min papers, these papers include additional pure and mechanics topics. An A Level in Further Maths consists of four 1 hour 30 minute papers, two pure and two applied.

Induction for Mathematics Students 2023

Students have often found the transition from Mathematics GCSE to Mathematics AS and A level work difficult. Students should feel confident with the following GCSE topics which are building blocks for AS level:

1. **Simplifying Brackets**
2. **Algebraic Fractions**
Multiplication & Division
Addition & Subtraction
3. **The rules of Indices**
4. **Factorisation**
Quadratics, including with coefficient of x^2 greater than one
Difference of Two Squares
5. **Completing the Square and Quadratic Equations**
Including the Quadratic Formula
6. **Simultaneous Equations**
Elimination (linear)
Substitution (linear and 'one linear, one quadratic')
7. **Equations with fractions**
8. **Rearranging Formulae**
Simple formulae, Roots, and Powers

The second half of this booklet contains, '**Preparing for AS level Mathematics**', which will give you the practice you need. ***This should be completed by your first maths lesson in September and the solutions brought in to your first lesson. To help you check whether your preparations have worked well, you will undertake a short test in the second week in September. This will help you with an early indication on any areas that you are still struggling with.***

We have access to the website MyMaths (see login and password below). They have dedicated bridging resources to help with the transition from GCSE to A Level. Please use MyMaths to help you with the questions below if you need to. The Bridging Resources can be found by entering MyMaths, selecting A Level resources and then the bridging units.

www.MyMaths.co.uk login: shsb password: focus

Expectations

We expect you to:-

- **Continue your studies outside of lesson time.** This must include work on written homework which will be handed in to the teacher to mark, but also on non-assessed work practising questions after each lesson. You should mark your work from the back of the textbook.
- **Complete the identified MyMaths homeworks in the unsupervised lesson.**
-
- **Complete written homework** to a high standard by the deadline.
- **Seek help when you need it.** It is essential that, from the start of the course, you ASK YOUR TEACHER for assistance whenever you have difficulty understanding any of the work. This also applies to written homework before it is handed in.
- **If you are absent** you must speak to your teacher and ensure you catch up on your work.
- **Use the resources available to you.** The MyMaths website covers most of the work for AS Maths very well; alternatively the textbooks are a rich source of information.
- **Be fully equipped for lessons**, specifically ensure you have a calculator with you. (A calculator satisfying the criteria for the new A level is the Casio fx991EX CLASSWIZ).

Common Assessments

There are tests for each section of each module and these take place at regular intervals once the work for them has been covered. These tests are important steps and must be passed before you move on. Retests will therefore be arranged during lunchtimes for this purpose.

Teachers mark the common assessment tests and test scripts must be returned to the teacher once the material has been discussed in class.

The tests are common across the year group and the results are used to produce grades for tracking purposes and reports.

CONTENT OVERVIEW : AS MATHEMATICS

Paper 1: Pure Mathematics (*Paper code: 8MA0/01)

Written examination: 2 hours

62.5% of the qualification

100 marks

Content overview

- Topic 1 – Proof
- Topic 2 – Algebra and functions
- Topic 3 – Coordinate geometry in the (x, y) plane
- Topic 4 – Sequences and series
- Topic 5 – Trigonometry
- Topic 6 – Exponentials and logarithms
- Topic 7 – Differentiation
- Topic 8 – Integration
- Topic 9 – Vectors

Assessment overview

- Students must answer all questions.
- Calculators can be used in the assessment.

Paper 2: Statistics and Mechanics (*Paper code: 8MA0/02)

Written examination: 1 hour 15 minutes

37.5% of the qualification

60 marks

Content overview

Section A: Statistics

- Topic 1 – Statistical sampling
- Topic 2 – Data presentation and interpretation
- Topic 3 – Probability
- Topic 4 – Statistical distributions
- Topic 5 – Statistical hypothesis testing

Section B: Mechanics

- Topic 6 – Quantities and units in mechanics
- Topic 7 – Kinematics
- Topic 8 – Forces and Newton's laws

Assessment overview

- The assessment comprises two sections: Section A – Statistics and Section B – Mechanics.
- Students must answer all questions.
- Calculators can be used in the assessment.



MATHEMATICS DEPARTMENT

Preparing for AS level Mathematics

The exercises in this booklet have been collated for you to practise basic algebraic skills. The questions indicated are the requirement for you to work through and bring in to your first maths lesson in September. If you struggle in any area then you should do further practice using MyMaths or other GCSE resources you may have.

Contents

Simplifying Brackets	Left hand column8
Multiplying Fractions	Q1aceg, Q2aceg, Q3aceg.....8
Dividing Fractions	Q1aceg, Q2aceg9
Addition & Subtraction of Fractions	Q1aceg, Q2aceg, Q3aceg9
Indices 1	Q1acegikmo.....10
Indices 2	Q1acegi, Q2acegik, Q3acegi10
Negative and Fractional Indices	All questions11
Quadratic Factorisation	All questions11
Difference of Two Squares	All questions.....11
Quadratic Equations	Q1ace, Q2acegik, Q3ace, Q4ace12
Completing the Square and Quadratic Equations	All questions.....12
Equations with Fractions	Q1aceg, Q2ace, Q3aceg13
Simultaneous equations	All questions13
Rearranging - One Operation	Q1aceg, Q2acegh13
Rearranging - Two Operations	Q1aceg, Q2acegh14
Rearranging - Using Factorising	Q1acegikmo, Q2.....14
Rearranging - Squares and square roots	All questions.....14

Simplifying Brackets

1 Expand the brackets and simplify the following expressions.

(a) $2(3(1-a) + 2(2+a))$

(c) $-(2(1-x) - (1-2x))$

(e) $2(x(3-y) + 3x(1+y))$

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

(i) $p(2(a-b) + 2(b-a))$

(k) $x(-(a-b) + b(x+a))$

2 Expand the brackets and simplify the following expressions.

(a) $x(3(b-a) + 2(b+a))$

(c) $x(2y(x+y) - x(y^2 - y))$

(e) $2a(b(c-b-2) + 3b(a-c))$

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

(i) $x(2x(y-z) + zy(x-y))$

(k) $x^2(x - 2(3-y)) - x(x^2 + 2y)$

3 Expand the brackets and simplify the following expressions.

(a) $(4x)^2 - (3x)^2$

(c) $4z^2 - (-2z)^2$

Multiplying Fractions

1 Carry out each of the following multiplications.

(a) $\frac{x}{2z} \times \frac{3y}{x}$

(c) $\frac{4x}{3} \times \frac{y}{2x}$

(e) $\frac{a}{bc} \times \frac{b}{ac}$

(g) $\frac{4x}{3y} \times \frac{6xy}{5}$

2 Simplify the following fractions.

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

(c) $\frac{pq}{r^3} \times \frac{pr}{q^3}$

(e) $\frac{q^3}{r^2} \times \frac{p}{q^2} \times \frac{q}{p}$

(g) $\frac{a}{b} \times \frac{b}{c} \times \frac{c}{a}$

3 Multiply each of the following.

(a) $\frac{x}{2y^2} \times \frac{1}{2}x$

(c) $\frac{3}{x^2} \times \frac{1}{9}x \times \frac{xy^2}{3x^2}$

(e) $\frac{3x^2}{4y} \times \frac{y^2}{6x}$

(g) $\frac{2}{5}x^3 \times \frac{y}{4x}$

Dividing Fractions

1 Express each of the following fractions in its lowest terms.

(a) $\frac{x}{y} + \frac{1}{y}$

(c) $\frac{p^2}{q^2} + \frac{p^2}{q}$

(e) $\frac{p}{qr} + \frac{q}{pr}$

(g) $\frac{5xy^2}{2y} + \frac{10x}{y}$

2 Carry out the following divisions giving your answers in their lowest terms.

(a) $\frac{3c}{d} \div c$

(c) $\frac{1}{2}l^3 \div l$

(e) $\frac{2}{3}a \div \frac{3}{4}ab$

(g) $\frac{1}{4}x^3 \div 6x^2$

Addition & Subtraction of Fractions

1 Carry out the following additions and subtractions, giving your answers as fractions.

(a) $\frac{x}{3} + \frac{x}{5}$

(c) $\frac{2}{3}z - \frac{1}{2}z$

(e) $x + \frac{1}{2}y$

(g) $\frac{3x}{5} - \frac{2x}{15}$

2 Carry out the following additions and subtractions, giving your answers as fractions.

(a) $\frac{2}{x} + \frac{3}{x}$

(c) $\frac{1}{2p} + \frac{2}{3p}$

(e) $\frac{5x}{2y} - \frac{3x}{4y}$

(g) $\frac{a}{5b} - \frac{3a}{10b}$

3 Carry out the following additions and subtractions, giving your answers as fractions.

(a) $\frac{1}{2}a - \frac{1}{2}b$

(c) $\frac{u}{v} + \frac{v}{u}$

(e) $\frac{3}{x} + \frac{2}{x^2}$

(g) $\frac{3x}{y} + \frac{4y}{z}$

Indices 1

1 Simplify each of the following, leaving your answer in index form.

(a) $(2^2)^9$

(c) $(5^5)^5$

(e) $(q^3)^6$

(g) $\frac{1}{(s^2)^7}$

(i) $\frac{1}{(u^4)^8}$

(k) $\frac{(y^6)^2}{(y^2)^5}$

(m) $\frac{x^3 \times (x^2)^4}{(x^4)^2 \times x^2}$

(o) $\frac{z \times z^2 \times (z^5)^4}{(z^2)^5 \times z \times z^2}$

Indices 2

1 Simplify each of the following.

(a) $2pq \times 4p^2q^3$

(c) $8x^2yz \times 3xy^2z^3$

(e) $\frac{24m^2n^4}{32m^3n^7}$

(g) $(6a^3b^2) \div (2ab)$

(i) $(14ef^2) \div (21f^3e)$

(j) $(2x^2y^3)^3$

(k) $(4p + q^3)^3$

2 Simplify the following expressions.

(a) $\frac{4x^2y}{3xy^4} \times \frac{6x^2y^3}{2x^4y}$

(c) $\left(\frac{2a}{b}\right)^2 + \frac{a^2}{b^3}$

(e) $\left(\frac{3r^2s}{2rs^3}\right)^2 \times \frac{r}{6s}$

(f) $\frac{2u}{3v^2} + \frac{4v^2}{3u^2v^3}$

(g) $\frac{2m^2}{3l} + \left(\frac{2l}{3m}\right)^2$

3 Expand the brackets and simplify the following expressions.

(a) $(4x)^2 - (3x)^2$

(b) $(-3y)^2 - 3y^2$

(c) $4z^2 - (-2z)^2$

(d) $4z^3 - (-2z)^3$

(e) $-(2x)^3 - (-2x)^3$

(f) $(3x^2)^2 + (-x)^4$

Negative and Fractional Indices

1. Rewrite the following expressions in the form $\sqrt[m]{a}$ or $(\sqrt[m]{a})^n$.

- a) $a^{\frac{1}{5}}$ b) $a^{\frac{1}{8}}$ c) $a^{\frac{3}{5}}$ d) $a^{\frac{2}{5}}$ e) $a^{\frac{5}{2}}$.

Evaluate the expressions given in the following questions without using a calculator, showing the stages of your working:

2. a) $64^{\frac{3}{2}}$ b) $144^{\frac{1}{2}}$ c) $64^{\frac{1}{3}}$ d) $16^{\frac{3}{4}}$ e) $1\,000\,000^{\frac{1}{6}}$

3. a) $4^{-\frac{3}{2}}$ b) $32^{-\frac{2}{5}}$ c) $125^{-\frac{2}{3}}$ d) $64^{-\frac{2}{3}}$ e) $1024^{-\frac{3}{5}}$.

4. a) $\left(\frac{64}{27}\right)^{\frac{2}{3}}$ b) $\left(\frac{8}{125}\right)^{\frac{4}{3}}$ c) $\left(\frac{49}{81}\right)^{-\frac{3}{2}}$ d) $\left(\frac{8}{125}\right)^{-\frac{4}{3}}$ e) $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$

Quadratic Factorisation

1. Factorise each of the following quadratics.

- (a) $x^2 + 7x + 10$ (b) $y^2 - 3y - 10$ (c) $z^2 + 4z - 21$ (d) $t^2 - 26t + 165$
(e) $2x^2 + 3x + 1$ (f) $3x^2 + 5x + 2$ (g) $4x^2 - 12x + 5$
(h) $2x^2 - x - 1$ (i) $12x^2 + x - 1$ (j) $8x^2 - 15x - 2$

2.

Factorise the following quadratics completely by first taking out the common factor.

- (a) $2x^2 + 2x - 4$ (b) $4x^2 + 16x + 16$ (c) $9x^2 - 30x + 9$
(d) $4x^2 + 8x - 12$ (e) $6x^2 + 36x + 54$ (f) $8x^2 - 24x + 10$

Difference of Two Squares

1 Find the factors of each of the following quadratics.

- (a) $x^2 - 1$ (b) $x^2 - 81$ (c) $4x^2 - 9$
(d) $9x^2 - 1$ (e) $4 - 25d^2$ (f) $8z^2 - 32$

2 Find the factors of each of the following quadratics.

- (a) $3x^2 - 27$ (b) $50 - 2y^2$ (c) $100 - 4z^2$

Quadratic Equations

1 Rearrange the following quadratic equations into the form $ax^2 + bx + c = 0$, where a is positive. You do not need to solve the equations.

- (a) $x^2 + 2x = 5$ (b) $2x^2 - 10 = x$ (c) $3 + 4x = x^2$
 (d) $x(x - 4) = 3$ (e) $x(2 - 3x) = -1$ (f) $2x + 5 = 7x(x - 1)$

2 Solve the following quadratic equations.

- (a) $x^2 + 3x + 2 = 0$ (b) $x^2 - 4x + 3 = 0$ (c) $x^2 - 4x + 4 = 0$
 (d) $c^2 - 3c - 4 = 0$ (e) $x^2 + 9x + 20 = 0$ (f) $t^2 - 12t + 35 = 0$
 (g) $d^2 = 15 - 2d$ (h) $x^2 + 11x + 30 = 0$ (i) $56 = x^2 + 10x$
 (j) $x^2 - 12x + 32 = 0$ (k) $y^2 + 10y + 25 = 0$ (l) $12 + x = x^2$

3 Find the roots of the following equations.

- (a) $x^2 + 3x = 0$ (b) $x^2 - 4x = 0$ (c) $4 - x^2 = 0$
 (d) $x^2 - 25 = 0$ (e) $4x^2 + 25x = 0$ (f) $4x^2 - 25 = 0$

4 Find the roots of the following equations.

- (a) $2x^2 - x - 1 = 0$ (b) $6 + x - 12x^2 = 0$ (c) $6x^2 - 5x - 4 = 0$
 (d) $4x^2 - 7x - 2 = 0$ (e) $6x^2 = 11x + 10$ (f) $8x^2 - 24x + 10 = 0$

Completing the Square and Quadratic Equations

1. Write an equivalent expression in the form $(x \pm a)^2 + b$:

- a) $x^2 + 4x$ b) $x^2 - 6x$ c) $x^2 + 3x$ d) $x^2 - 5x$

2. Write an equivalent expression in the form $(x \pm a)^2 + b$:

- a) $x^2 + 4x - 1$ b) $x^2 - 6x + 3$ c) $x^2 + 3x + 3$

3. Write these quadratics in the form $a(x \pm b)^2 + c$:

- a) $2x^2 - 12x + 7$ b) $3x^2 + 15x - 1$

4. What needs to be added to the following expressions to make them perfect squares?

- a) $x^2 + 8x$ b) $x^2 + 3x$ c) $x^2 - 7x$ d) $4x^2 - 12x$

Solve the following equations by completing the square, giving your solutions to 3 s.f.

5. $x^2 + 8x = 1$ 6. $x^2 + x - 1 = 0$ 7. $x^2 - 3x + 1 = 0$

Use the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to solve the following equations giving your answers to 3 significant figures.:

9. $2x^2 - 5x - 8 = 0$ 10. $5x^2 + x - 2 = 0$ 11. $4x^2 + 9x + 3 = 0$

Equations with Fractions

1 Solve the following equations, checking your solutions.

(a) $\frac{x}{4} = \frac{5}{3}$ (b) $\frac{y}{3} = 2$ (c) $4z = \frac{3}{2}$ (d) $\frac{1}{3}t = \frac{5}{3}$
(e) $\frac{x}{3} = \frac{x}{4} + 1$ (f) $\frac{1}{2}y = 3 - 2y$ (g) $\frac{3}{2}z = \frac{4}{3} - \frac{5}{4}z$ (h) $t = \frac{3}{2} + \frac{2}{3}t$

2 Solve the following equations, checking your solutions.

(a) $\frac{x-1}{2} = \frac{3}{4}$ (b) $\frac{2y-3}{9} = \frac{1}{3}$ (c) $\frac{3z-1}{4} = \frac{z}{2}$
(d) $\frac{t}{2} - \frac{t+2}{3} = 0$ (e) $\frac{1}{3}(2x-3) = x$ (f) $5 - \frac{1}{4}(7p-1) = 0$

3 Solve the following equations, checking your solutions.

(a) $\frac{1}{3}(4a-1) + \frac{1}{2}(a-14) = 8$ (b) $\frac{1}{3}(4a-1) - \frac{1}{2}(a-4) = 0$
(c) $\frac{x-1}{2} + \frac{x+1}{2} = 3$ (d) $\frac{3x-1}{2} - \frac{x+1}{2} = 3$
(e) $\frac{1}{6}(5a-7) + \frac{1}{9}(5a+2) = 6$ (f) $\frac{1}{2}(1-s) - \frac{1}{3}(2s-1) = 2$
(g) $\frac{x+2}{3} + \frac{x+3}{4} = \frac{2(x+4)}{5}$ (h) $\frac{1}{2}y - \frac{1}{3}(2y+5) = -2$

Simultaneous equations

Solve the following pairs of equations simultaneously:

1. $3x + 2y = 16$ 2. $3a - 5b = 17$ 3. $3m + 5n = 14$ 4. $x + y = 7$
 $2x + y = 9$ $9a + 2b = -17$ $7m + 2n = 23$ $x^2 - xy = 4$.

Rearranging - One Operation

1 Solve each of the following equations for x .

(a) $x + a = b$ (c) $a - x = b$
(e) $ax = 2b$ (g) $ax + c = b + c$

2 In each case, make the letter given at the end the subject of the formula.

(a) $y = mx + c$, c (b) $y = mx + c$, m (c) $s = vt$, t
(d) $V = IR$, R (e) $v^2 = u^2 + 2as$, s (f) $v = u + gt$, g
(g) $v = u + gt$, u (h) $2s = 2u + at^2$, a (i) $y = a^2x + b^2$, x

Rearranging - Two Operations

1 Solve each of the following equations for x .

(a) $2(x + a) = b$

(c) $a(x + b) = ab$

(e) $\frac{x}{a} = \frac{a+b}{b}$

(g) $a(x + c) = c(a + b)$

2 In each case, make the letter given at the end the subject of the formula.

(a) $v = \frac{d}{t}$, d

(c) $s = ut + \frac{1}{2}at^2$, u

(e) $\frac{v-u}{g} = t$, v

(g) $s = \frac{1}{2}t(u + v)$, u

(i) $y = a^2x + b^2$, x

Rearranging - Using Factorising

1 Solve each of the following equations for x .

(a) $x + xy = y$

(c) $x + y = xy$

(e) $rx + sx - tx = u$

(g) $hx = k - kx$

(i) $ax + b(x - a) = 0$

(k) $y = \frac{x+1}{x}$

(m) $\frac{x}{a} = \frac{x}{b} - 1$

(o) $y = 1 - \frac{1}{x-1}$

2 In each case, make the letter given at the end the subject of the formula.

(a) $A = P + \frac{1}{100}PRT$, T

(b) $A = P + \frac{1}{100}PRT$, P

(c) $s = \frac{1}{2}d(a + l)$, a

(d) $s = \frac{1}{2}d(a + l)$, d

(e) $s = \frac{1}{2}n(2a + d(n-1))$, d

(f) $s = \frac{1}{2}(u + v)t$, t

(g) $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$, u

(h) $E = \frac{1}{2}mv^2 + mgh$, m

Rearranging - Squares and square roots

1 Solve each of the following equations for x .

(a) $\sqrt{x+1} = a$

(c) $x^2 - y^2 = a^2$

(e) $\sqrt[3]{x-a} = 1$

2 In each case, make the letter given at the end the subject of the formula.

(a) $A = 4\pi r^2$, r

(b) $V = \frac{4}{3}\pi r^3$, r

(c) $\frac{x^3}{a^3} - \frac{y^2}{b^2} = 1$, x

(d) $ay^2 = x^3$, y

(e) $E = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$, u

(f) $V = \pi r^2 h$, r

Simplifying Brackets

- 1 (a) $14 - 2a$
(c) -1
(e) $12x + 4xy$
(g) $-6x + 6y$
(i) 0
(k) $-ax + bx + abx + bx^2$
- 2 (a) $5bx - ax$
(c) $3x^2y + 2xy^2 - x^2y^2$
(e) $-4ab + 6a^2b - 2ab^2 - 4abc$
(g) $-3x + 6y - 2xy$
(h) $4y - 4yz$
(i) $-xy^2z + 2x^2y - 2x^2z + x^2yz$
(k) $-6x^2 + 2x^2y - 2xy$
- 3 (a) $7x^2$
(c) 0

Multiplying Fractions

- 1 (a) $\frac{3y}{2z}$ (c) $\frac{2}{3}y$ (e) $\frac{1}{c^2}$ (g) $\frac{8}{5}x^2$
2 (a) ab^2 (c) $\frac{p^2}{q^2r^2}$ (e) $\frac{q^2}{r^2}$ (g) 1
3 (a) $\frac{x^2}{4y^2}$ (c) $\frac{y^2}{9x^2}$ (e) $\frac{1}{8}xy$ (g) $\frac{1}{10}x^2y$

Dividing Fractions

- 1 (a) x (c) $\frac{1}{q}$ (e) $\frac{p^2}{q^2}$ (g) $\frac{1}{4}y^2$
2 (a) $\frac{3}{d}$ (c) $\frac{1}{2}l^2$ (e) $\frac{8}{9b}$ (g) $\frac{1}{24}x$

Addition & Subtraction of Fractions

- 1 (a) $\frac{8}{15}x$ (c) $\frac{1}{6}z$ (e) $\frac{2x+y}{2}$ (g) $\frac{7}{15}x$
2 (a) $\frac{5}{x}$ (c) $\frac{7}{6p}$ (e) $\frac{7x}{4y}$ (g) $\frac{-a}{10b}$
3 (a) $\frac{1}{2}(a - b)$ (c) $\frac{u^2+v^2}{uv}$ (e) $\frac{3x+2}{x^2}$ (g) $\frac{3xz+4y^2}{yz}$

Indices 1

1. (a) 2^{18} (c) 5^5 (e) q^{18}
(g) $\frac{1}{s^{14}}$ (i) $\frac{1}{u^{32}}$ (k) y^2
(m) x (o) z^{10}

Indices 2

- 1 (a) $8p^3q^4$
(c) $24x^3y^3z^4$
(e) $\frac{3}{4mn^3}$
(g) $3a^2b$
(i) $\frac{2}{3f}$ (j) $8x^6y^9$
(k) $\frac{64p^3}{q^9}$
- 2 (a) $\frac{4}{xy}$
(c) $4b$
(e) $\frac{3r^3}{8s^5}$ (f) $\frac{u^3}{2v}$
(g) $\frac{3m^4}{2l^3}$
- 3 (a) $7x^2$ (b) $6y^2$ (c) 0
(d) $12z^3$ (e) 0 (f) $10x^4$

Negative and Fractional Indices

1. (a) $\sqrt[5]{a}$ (b) $\sqrt[8]{a}$ (c) $(\sqrt[5]{a})^3$ (d) $(\sqrt[5]{a})^2$ (e) $(\sqrt{a})^5$
2. (a) 512 (b) 12 (c) 4 (d) 8 (e) 10
3. (a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{1}{25}$ (d) $\frac{1}{16}$ (e) $\frac{1}{64}$
4. (a) $\frac{16}{9}$ (b) $\frac{16}{625}$ (c) $\frac{729}{343}$ (d) $\frac{625}{16}$ (e) $\frac{27}{8}$.

Quadratic Factorisation

1. (a) $(x+2)(x+5)$ (b) $(x+3)(x+12)$
(c) $(z+7)(z-3)$ (d) $(p-12)(p+9)$
(e) $(2x+1)(x+1)$ (f) $(3x+2)(x+1)$
(g) $(2x-5)(2x-1)$ (h) $(2x+1)(x-1)$
(i) $(4x-1)((3x+1)$ (j) $(8x+1)(x-2)$.
2.
(a) $2(x-1)(x+2)$ (b) $4(x+2)^2$
(c) $3(3x-1)(x-3)$ (d) $4(x-1)(x+3)$
(e) $6(x+3)^2$ (f) $2(2x-5)(2x-1)$

Difference of two squares

- 1 (a) $(x+1)(x-1)$ (b) $(x+9)(x-9)$
(c) $(2x+3)(2x-3)$ (d) $(3x+1)(3x-1)$
(e) $(2+5d)(2-5d)$ (f) $8(z+2)(z-2)$
- 2 (a) $3(x+3)(x-3)$ (b) $2(5+y)(5-y)$
(c) $4(5+z)(5-z)$

Quadratic Equations

- 1 (a) $x^2 + 2x - 5 = 0$
(b) $2x^2 - x - 10 = 0$
(c) $x^2 - 4x - 3 = 0$
(d) $x^2 - 4x - 3 = 0$
(e) $3x^2 - 2x - 1 = 0$
(f) $7x^2 - 9x - 5 = 0$
- 2 (a) $-1, -2$ (b) $1, 3$ (c) 2
(d) $-1, 4$ (e) $-4, -5$ (f) $5, 7$
(g) $-5, 3$ (h) $-5, -6$ (i) $-14, 4$
(j) $4, 8$ (k) -5 (l) $-3, 4$
- 3 (a) $-3, 0$ (b) $0, 4$ (c) $-2, 2$
(d) $-5, 5$ (e) $-\frac{25}{4}, 0$ (f) $-\frac{5}{2}, \frac{5}{2}$
- 4 (a) $-\frac{1}{2}, 1$ (b) $-\frac{2}{3}, \frac{3}{4}$ (c) $-\frac{1}{2}, \frac{4}{3}$
(d) $-\frac{1}{4}, 2$ (e) $-\frac{2}{3}, \frac{5}{2}$ (f) $\frac{1}{2}, \frac{5}{2}$

Completing the Square and Quadratic Equations

1. (a) $(x+2)^2 - 4$ (b) $(x-3)^2 - 9$
(c) $(x+\frac{3}{2})^2 - \frac{9}{4}$ (d) $(x-\frac{5}{2})^2 - \frac{25}{4}$
2. (a) $(x+2)^2 - 5$ (b) $(x-3)^2 - 6$
(c) $(x+\frac{3}{2})^2 + \frac{3}{4}$
3. (a) $2(x-3)^2 - 11$ (b) $3(x+\frac{5}{2})^2 - \frac{79}{4}$
4. (a) 16 (b) 1 (c) 49/4 (d) 9
5. 0.123, -8.12 6. 2.73, -0.73
7. 0.618, -1.62 8. 0.382, 2.62
9. 3.61, -1.11 10. 0.540, -0.740
11. -0.407, -1.84

Equations with Fractions

- 1 (a) $\frac{20}{3}$ (c) $\frac{3}{8}$
(e) 12 (g) $\frac{16}{33}$
- 2 (a) $\frac{5}{2}$ (c) 1
(e) -3
- 3 (a) 4 (c) 3
(e) 5 (g) 1

Simultaneous Equations

1. $x=2, y=5$ 2. $a=-1, b=-4$
3. $m=3, n=1$ 4. $x=-0.5, y=7.5$

Rearranging One Operation

- 1 (a) $x=b-a$
(c) $x=a-b$
(e) $x=\frac{2b}{a}$
(g) $x=\frac{b}{a}$
- 2 (a) $c=y-mx$ (b) $m=\frac{y-c}{x}$
(c) $t=\frac{s}{v}$ (d) $R=\frac{V}{I}$
(e) $s=\frac{v^2-u^2}{2a}$ (f) $g=\frac{v-u}{t}$
(g) $u=v-gt$ (h) $a=\frac{2s-2u}{t^2}$
(i) $x=\frac{y-b^2}{a^2}$

Rearranging with squares and square roots

- 1 (a) $x=(a-1)^2$
(c) $x=\pm\sqrt{a^2+y^2}$
(e) $x=(1+a)^3$
- 2 (a) $r=\pm\sqrt{\frac{A}{4\pi}}$
(c) $x=\sqrt[3]{\frac{a^3b^2+a^3y^2}{b^2}}$
(d) $y=\pm\sqrt{\frac{x^3}{a}}$
(e) $u=\pm\sqrt{\frac{mv^2-2E}{m}}$
(f) $r=\pm\sqrt{\frac{V}{\pi h}}$

$$1 \text{ (a)} \quad x = \frac{1}{2}(b - 2a)$$

$$(c) \quad x = 0$$

$$(e) \quad x = \frac{a(a+b)}{b}$$

$$(g) \quad x = \frac{bc}{a}$$

$$2 \text{ (a)} \quad d = vt$$

$$(c) \quad u = \frac{2s - at^2}{2t}$$

$$(e) \quad v = u + gt$$

$$(g) \quad u = \frac{2s - vt}{t}$$

$$(i) \quad x = \frac{y - b^2}{a^2}$$

Rearranging – Using factorising

$$1 \text{ (a)} \quad x = \frac{y}{1+y}$$

$$(c) \quad x = \frac{y}{y-1}$$

$$(e) \quad x = \frac{u}{r+s-t}$$

$$(g) \quad x = \frac{k}{h+k}$$

$$(i) \quad x = \frac{ab}{a+b}$$

$$(k) \quad x = \frac{1}{y-1}$$

$$(m) \quad x = \frac{ab}{a-b}$$

$$(o) \quad x = \frac{y-2}{y-1}$$

$$2 \text{ (a)} \quad T = \frac{100A - 100P}{PR}$$

$$(b) \quad P = \frac{100A}{100 + RT}$$

$$(c) \quad a = \frac{2s - dl}{d}$$

$$(e) \quad d = \frac{2s - 2an}{n^2 - n}$$

$$(g) \quad u = \frac{fv}{v-f}$$