

MATHEMATICS DEPARTMENT



6th FORM INDUCTION

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 A Level course for Mathematics 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

When studying mathematics in Key Stage 5, 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

A Level Mathematics

For Mathematics, you will study topics associated with pure maths, statistics and mechanics. This will enable you to undertake an A Level in the subject at the end of Year 13. Every topic taught across Years 12 and 13 can be tested in that final A Level, but there will be many internal tests to help guide you, including Year 12 internal exams towards the end of Year 12.

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

A Level Further Mathematics

Students studying for both the maths and the further maths courses will cover the content for both A Level Maths and A Level Further maths across Years 12 and 13. The time allocation is 16 hours a fortnight, and the class is taught by two members of staff. In Year 12, you will have the opportunity to sit internal tests in both the maths topics and the further maths topics, which will help you when considering your options in Year 13. If your results are strong enough, you would likely go on to take both an A Level in Mathematics and one in Further Mathematics at the end of Year 13. 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 the Year 12 Pure and Applied A Level Maths course is given on page 6 of your booklet for information.

Tests and Examinations

In Year 12 you will have the opportunity to sit a number of internal tests that will help guide your future choices into Year 13 and beyond. The first test is a simple diagnostic test in week 3, to check that the work you do over the summer to prepare for the transition has been effective. Week 9 sees the first test based on new content learned, followed by further topic tests throughout the year. This culminates in your Year 12 exams in late April for both maths and further maths if taking the joint option. Exams in A Levels are sat at the end of Year 13 and consist of three 2 hour papers in Maths and four 1.5 hour papers in Further Maths.

Induction for Mathematics Students

Students can sometimes find the transition from Mathematics GCSE to Mathematics A level difficult at first. To help make the transition smoother, you should work over your break to ensure that you are confident with the following GCSE topics which are building blocks for the start of the A Level course:

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 Year 12 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 third week in September. This will help you with an early indication of any areas that you may be 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 required for A Level Maths

You would be required to:-

- **Continue your studies outside of lesson time.** This must include work on written homework which will be handed in to the teacher, but also on non-assessed work practising questions after each lesson. You should mark your work from the back of the textbook.
- **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 fx991CW CLASSWIZ).

Common Assessments

There will be regular testing across the year. These four class tests results will make up 50% of the UCAS prediction.

The End of Year 12 assessment will make up the other 50% of the assessment. All of this is detailed in another document that will be given to you at the start of Year 12.

The materials for these assessments are drawn from the AS content. Please see the next page for a full list of this content. Please be aware that we do not study Vectors in Year 12, so that will not be on any assessment taken in Year 12.

CONTENT OVERVIEW : YEAR 12 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 Year 12 Mathematics

The exercises in this booklet have been collated for you to practice basic algebraic skills. The questions indicated are the requirement for you to work through, and **bring in to your first maths lesson in September**. Please show full workings and do the work on A4 lined paper. The answers are at the end (but not the worked solutions!), so please use these to help you identify if a review of a topic is needed. If you struggle in any area then you should do review the topic using MyMaths or other GCSE resources you may have.

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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) $\frac{1}{3}(4a-1) + \frac{1}{2}(a-14) = 0$

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

(c) $x = 0$

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

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

2 (a) $d = vt$

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

(e) $v = u + gt$

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

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

Rearranging – Using factorising

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

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

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

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

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

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

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

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

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

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

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

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

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