Pearson Edexcel

Pearson Edexcel GCE Mathematics and Further Mathematics

Qualification and Assessment Guide

Qualification and Assessment Guide

This Guide provides an overview of the Pearson Edexcel AS and A level Mathematics and Further Mathematics qualifications and assessments and outlines the high-quality support and resources you can expect from the Pearson Mathematics qualifications team.

Key features of our qualifications:

- Our AS and A level Mathematics specifications are unique in that they assess **Pure and Applied mathematics in separate papers** to help students focus on the different skills required for each.
- **Statistics and mechanics appear in separate sections** of the applied paper to help students focus and apply their learning appropriately.
- We also offer flexibility within the full range of options for AS and A level Further Mathematics, so you can choose to specialise or diversify your maths study as appropriate for you and your students.
- We've designed our assessments to be **accessible** to the **full range** of your learners, yet challenge your most **able students**. Our papers gradually build in demand and are designed to help your students approach the exams with confidence.

We're here to support you every step of the way to help you plan and teach our new qualifications, track and assess students' progress, and develop your own professional knowledge and skills.

Qualification structure and features

AS and A level Mathematics

Qualification	Component	Overview	Assessment
A level Mathematics	**Paper 1: Pure Mathematics** 33.3% weighting	Any Pure Mathematics content can be assessed on either paper	2 hours 100 marks
	Paper 2: Pure Mathematics 33.3% weighting		2 hours 100 marks
	Paper 3: Statistics and Mechanics 33.3% weighting	**Section A:** Statistics (50 marks) **Section B:** Mechanics (50 marks)	2 hours 100 marks
AS level Mathematics	**Paper 1: Pure Mathematics** 33.3% weighting	AS level Pure Mathematics content can be assessed on either paper	2 hours 100 marks
	Paper 2: Statistics and Mechanics 33.3% weighting	**Section A:** Statistics (30 marks) **Section B:** Mechanics (30 marks)	1 hour 15 mins 60 marks

AS and A level Further Mathematics

Qualification	Component	Overview	Assessment
A level Further Mathematics	**Paper 1: Core Pure Mathematics 1** 25% weighting	Compulsory content – any Pure Mathematics content can be assessed on either paper	1.5 hours 75 marks
	Paper 2: Core Pure Mathematics 2 25% weighting		1.5 hours 75 marks
	Paper 3: Further Mathematics Option 1 25% weighting	Students take two optional papers with options available in: • Further Pure Mathematics 1 and 2 • Further Statistics 1 and 2 • Further Mechanics 1 and 2 • Decision Mathematics 1 and 2 See below for details of how these options can be arranged	1.5 hours 75 marks
	Paper 4: Further Mathematics Option 2 25% weighting		1.5 hours 75 marks
AS level Further Mathematics	**Paper 1: Core Pure Mathematics** 50% weighting	Compulsory content – AS level Pure Mathematics	1 hour 40 mins 80 marks
	Paper 2: Further Mathematics Options 50% weighting	Students take two options assessed in one paper. Options available in: • Further Pure Mathematics 1 and 2 • Further Statistics 1 and 2 • Further Mechanics 1 and 2 • Decision Mathematics 1 and 2 See below for details of how these options can be arranged	1 hour 40 mins 80 marks

AS and A level Further Mathematics options

For the A level Further Mathematics Papers 3 and 4 and AS Further Mathematics Paper 2, students choose a pair of options, either:

- any two options from column A, or
- a matching pair of options from columns A and B.

This makes a total of ten different option pairs.

Column A	Column B
Further Pure Mathematics 1	Further Pure Mathematics 2
Further Statistics 1	Further Statistics 2
Further Mechanics 1	Further Mechanics 2
Decision Mathematics 1	Decision Mathematics 2

For A level Further Mathematics Paper 3 and Paper 4, students will take one paper in each of their options. Students are permitted to take more than the two optional papers if they want to extend their course of study. Where students take more than two optional papers, the combination of papers that result in the best grade will be used.

For AS Further Mathematics paper 2, students will take a paper which contains two equally sized sections, with each section covering one of their option pair. The AS version of each option is made up of half of the content of the A level version.

Students taking AS Further Mathematics followed by A level Further Mathematics should select the same option pair for both. Otherwise they will need to learn extra content.

Formulae

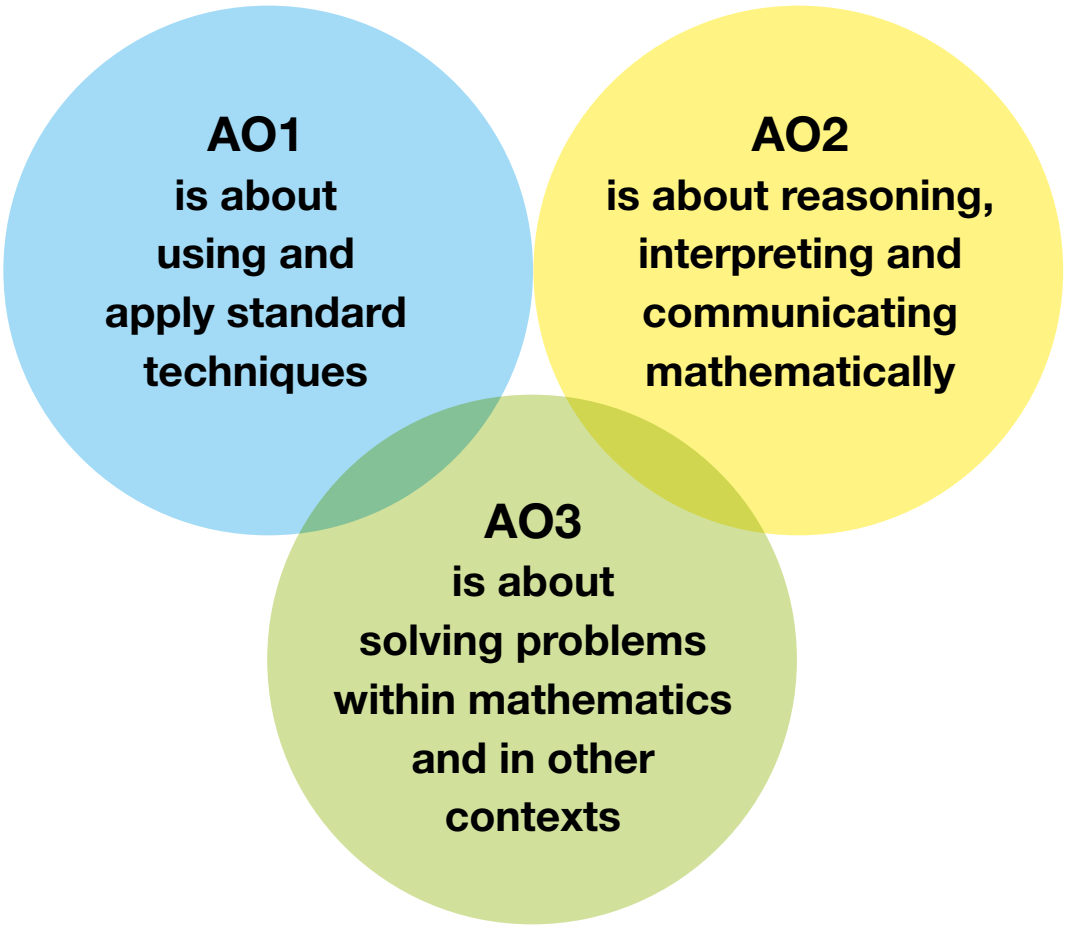
Formulae which students can be given during an exam are provided in the booklet 'Mathematical Formulae and Statistical Tables' which will be provided for use with every paper.

There is one version of the formulae booklet which is for use in all exams for AS and A levels in both Mathematics and Further Mathematics.

AS and A level Mathematics and Further Mathematics Specifications and Sample Assessment materials

Assessment Objectives

The diagram below gives an overview of the three Assessment Objectives assigned to the AS and A level Mathematics and Further Mathematics qualification. Each of the qualifications have different weightings of these Assessment Objectives which are outlined in the specifications.



The strands and elements that further define each Assessment Objective are detailed below and incorporate the overarching themes for the qualifications:

- mathematical argument, language and proof
- mathematical problem solving
- mathematical modelling.

Every strand and element must be assessed in every examination series.

AO	Strands and elements	Description
AO1	1.1a	Select routine procedures
	1.1b	Correctly carry out routine procedures
	1.2	accurately recall facts, terminology and definitions
AO2	2.1	construct rigorous mathematical arguments (including proofs)
	2.2a	make deductions
	2.2b	make inferences
	2.3	assess the validity of mathematical arguments
	2.4	explain their reasoning
	2.5	use mathematical language and notation correctly
AO3	3.1a	Translate problems in mathematical contexts into mathematical processes
	3.1b	Translate problems in non-mathematical contexts into mathematical processes
	3.2a	interpret solutions to problems in their original context, and,
	3.2b	Where appropriate evaluate their accuracy and limitations
	3.3	translate situations in context into mathematical models
	3.4	use mathematical models
	3.5a	Evaluate the outcomes of modelling in context,
	3.5b	recognise the limitations of models
	3.5c	where appropriate, explain how to refine them

Each mark in the mark schemes for our questions papers is allocated to an Assessment Objective's strand and element.

Assessments for a GCE Qualification must also ensure that, taken together, include questions or tasks which allow Learners to:

- provide extended responses, and
- demonstrate their ability to draw together different areas of knowledge and understanding from across.

When setting question papers, these conditions and Assessment Object requirements have to be considered in combination.

Assessment style

Our papers are well designed and easy to read with clear diagrams so your students have every opportunity to understand the question.

Easy to follow mark scheme

Accessible language

Clear diagrams

3.

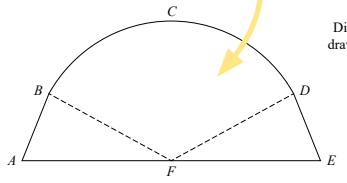


Diagram not drawn to scale

Figure 1

Figure 1 shows the plan view of a design for a stage at a concert.

The stage is modelled as a sector $BCDF$, of a circle centre F, joined to two congruent triangles ABF and EDF.

Given that

AFE is a straight line

$AF = FE = 10.7\,\text{m}$

$BF = FD = 9.2\,\text{m}$

angle $BFD = 1.82$ radians

find

(a) the perimeter of the stage, in metres, to one decimal place,

(5)

(b) the area of the stage, in m^2, to one decimal place.

(4)

Question	Scheme	Marks	AOs
3 (a)	Uses $s = r\theta = 9.2\times1.82 = 16.744$	M1	1.1b
	Correct method of finding angle AFB or DFE $\frac{\pi-1.82}{2}$	M1	1.1b
	Correct method for AB or DE using a correctly found angle $(c^2) = 9.2^2 + 10.7^2 - 2\times9.2\times10.7\cos"0.66"$	dM1	2.1
	Finds arc length BCD + two $\times AB$ +21.4 oe	M1	3.1a
	= 51.4 metres	A1	1.1b
		(5)	
(b)	Uses $A = \frac{1}{2}r^2\theta = \frac{1}{2}\times9.2^2\times1.82 = 77.0224$	M1	1.1b
	Correct method for area of triangle AFB or DEF $\frac{1}{2}\times10.7\times9.2\times\sin\left(\frac{\pi-1.82}{2}\right)$	M1	1.1b
	Finds area of sector $BFDC$ + two triangles	dM1	3.1a
	= 137.4 m^2	A1	1.1b
		(4)	
			(9 marks)

Notes:
(a)
M1: Uses $s = r\theta = 9.2\times1.82$ This is implied by awrt 16.7
M1: Uses a correct method to find angle AFB or DFE This is implied by awrt 0.66 radians
dM1: Uses a correct method for AB or DE using a correctly found angle.
$(c^2) = 9.2^2 + 10.7^2 - 2\times9.2\times10.7\cos"0.66"$
M1: Finds arc length BCD + two $\times AB$ +21.4 oe
A1: awrt 51.4 metres
(b)
M1: Uses $A = \frac{1}{2}r^2\theta = \frac{1}{2}\times9.2^2\times1.82$ This is implied by awrt 77
M1: Uses a correct method for area of triangle AFB or DEF $\frac{1}{2}\times10.7\times9.2\times\sin\left(\frac{\pi-1.82}{2}\right)$
dM1: Finds area of sector $BFDC$ + two triangles
A1: awrt 137.4 m^2

Clear expectations

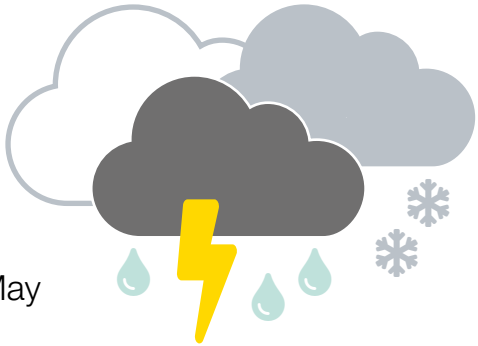
Familiar layout of questions

We are routinely analysing students' performance in the exams and gathering feedback from teachers, parents and students. We are building on this and refining our papers to improve the exam experience for all students.

Recent improvements have focused on:

- **ensuring early questions are accessible to all** and then steadily ramp in demand to encourage engagement and help build students' confidence through the papers
- **dividing questions into parts** so students are clear where marks can be achieved and can attempt the question in smaller parts
- **using clear, concise language** to better enable all students to access the questions and understand the type of response expected.

Use of data in statistics



The Pearson Large Data Set which supports the AS and A level Mathematics qualifications consists of weather data samples provided by the Met Office for five UK weather stations and three overseas weather stations in the time periods May to October 1987 and May to October 2015. The weather stations locations are:

- Camborne, Heathrow, Hurn, Leeming and Leuchars in the UK
- Beijing, Jacksonville and Perth overseas

The data set can be downloaded from our website and should be appropriate for the lifetime of the qualification. Further information around our data source can be accessed at

http://www.metoffice.gov.uk/

To support the use of the large data set in the teaching of the statistics content, tasks such as:

- selecting a sample
- cleaning the data
- creating diagrams from the data
- calculating summary statistics such as mean, standard deviation
- calculating regression equations and correlation coefficients where applicable
- hypothesis testing,

should be carried out by students during their course of study.

We have a range of resources available to support the teaching of the Large Data Set.

Supporting you every step of the way

We have a full package of support to help you **plan** and **teach** our qualifications, **track and assess** students' progress, and **develop** your own professional knowledge and skills.

Planning

Course planners and **schemes of work** for both AS and A level Mathematics and parallel delivery with AS and A level Further Mathematics for different models of delivery.

Digital interactive schemes of work which are designed to be totally flexible and tailored to the way you want to deliver the qualification.

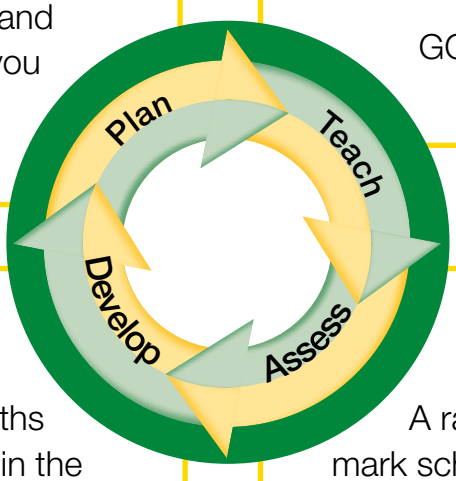
Teaching

Content and assessment guidance and exemplification to give you clarity and a better understanding of what to expect in the exams.

Guidance and resources for teaching the **Large Data Set**.

Guidance on teaching **Mechanics and Statistics**.

GCSE to A level **transition materials**.



Developing

Maths Emporium
A rich source of maths resources available in the **Maths Emporium** to support you in teaching mathematics.

Online and face-to-face **Continuous Professional Development**.

Strong **Pearson Mathematics community** on Twitter @EmporiumMaths

Tracking and Assessing

A range of **past papers** and mark schemes available with grade boundaries and examiner reports.

Exemplar student responses to exam questions with examiner commentary to help you gain a deeper understanding of what's expected from your students in the examination.

Secure mock papers, specimen papers, practice tests and **topic tests**.

Baseline diagnostic tests at the start of the course.

ResultsPlus

ResultsPlus is a free online results analysis tool for teachers that gives you a detailed breakdown of your students' performance in Pearson Edexcel exams.

Widely used by teachers across the country, ResultsPlus provides the most detailed analysis available of your students' performance and helps you to identify topics and skills where your students could benefit from further learning, helping them gain a deeper understanding of maths.

Contextualises performance through 'skills map' reports, to show how students fared on topics, skills and types of question.

Visit **quals.pearson.com/resultsplusgcsemaths**

examWizard

- examWizard is a free online resource for teachers containing a huge bank of past paper questions and support materials to help you create your own mock exams and tests.
- examWizard helps you search for past papers, mark schemes and examiners' reports.
- Create topic-based tests with the easy-to-use, intuitive question search.
- Build your own paper with the latest past paper questions as they become available after each exam series.
- Sample Assessment Materials and Specimen Papers are already included in the bank of questions.

Visit **quals.pearson.com/examwizardgcsemaths**

Access to Scripts

This online post-results service allows teachers to access their candidates' exam papers free of charge for all scripts that have been marked online.

Visit **quals.pearson.com/mathsgcseats**

Resources, matched to the Edexcel AS and A level specifications, with free online content

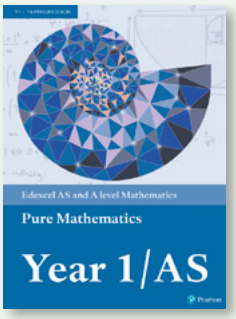
Textbooks

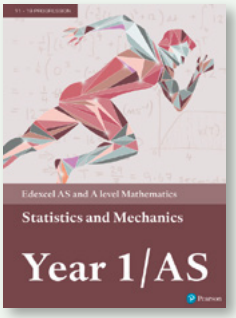
With over 900,000 copies sold (plus 1.3 million copies sold of the previous edition), Pearson Edexcel AS and A level Mathematics textbooks retain the familiar style, layout and features you know and trust.

- Separate pure and applied textbooks for AS and A level Mathematics and a textbook per option for AS and A level Further Mathematics.
- A focus on problem-solving and modelling, as well as supporting the large data set and calculator requirements.
- Include free online student-facing content to support independent learning.
- Packed with worked examples with guidance, lots of exam-style questions, practice papers, and plenty of mixed and review exercises.

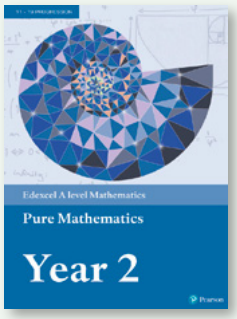
AS and A level Mathematics

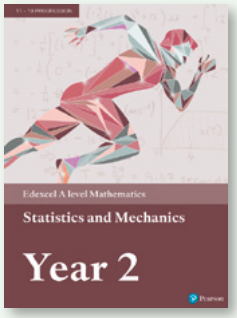
Year 1/AS





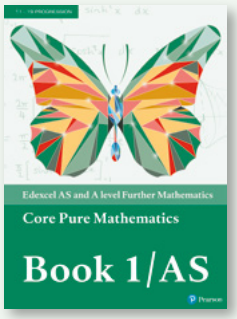
Year 2

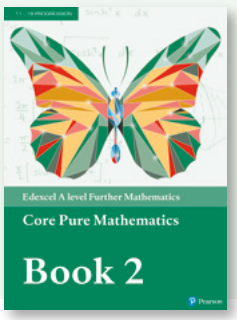




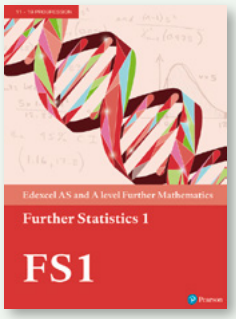
AS and A level Further Mathematics

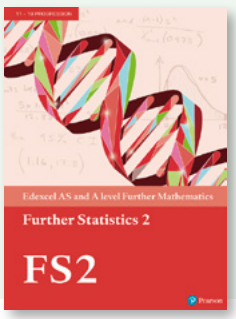
Compulsory

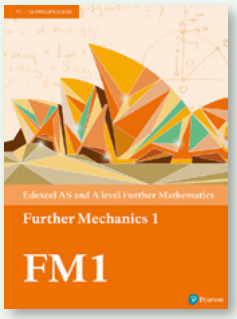


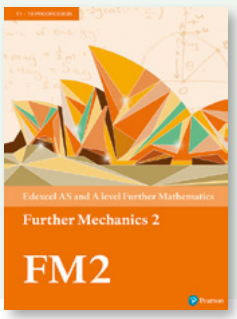


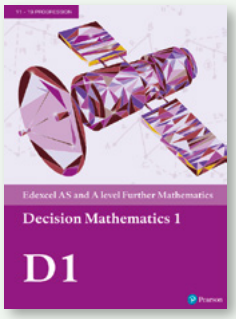
Options

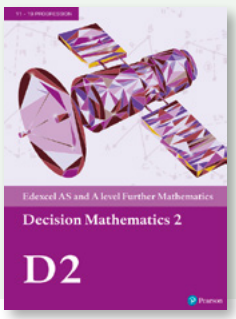


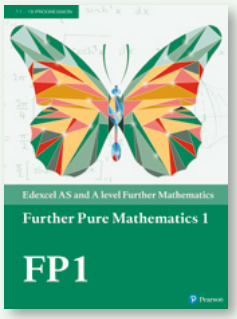


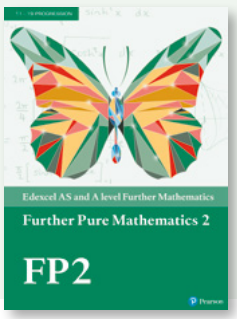












Our resources have been updated to match the Edexcel AS and A level exam structure and work seamlessly with the free qualification support including the interactive scheme of work.

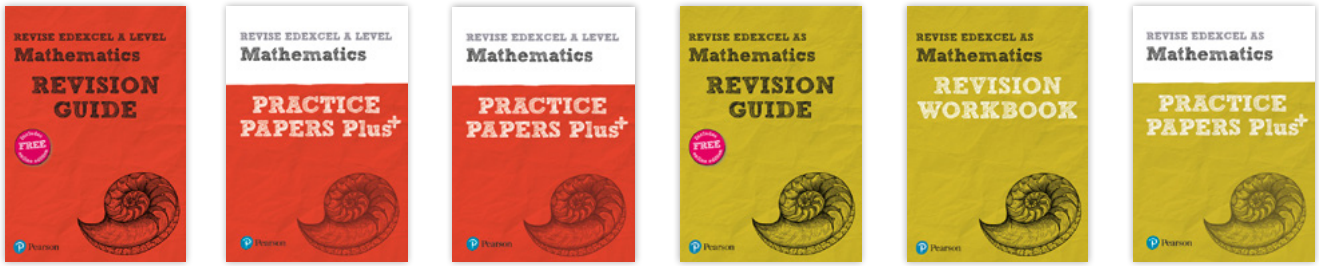
- 14 textbooks, with e-books and free online content.
- Practice books, Revision Guides, Workbooks and Practice Papers Plus+ books.
- ActiveLearn including teaching, planning and progression resources.

ActiveLearn

Our ActiveLearn service brings together front-of-class teaching resources, teacher planning resources and Progress and Assess materials into one easy-to-use package.

Revise Edexcel

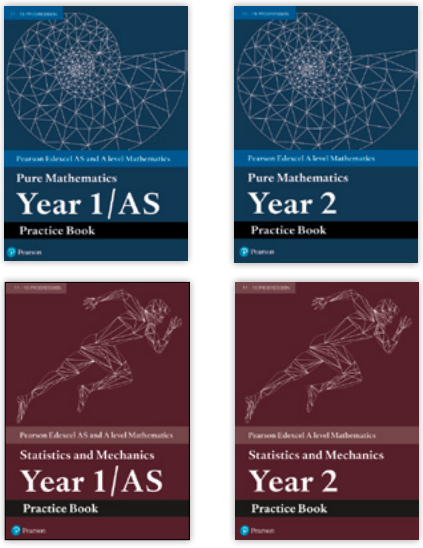
Our Revise Edexcel books for AS and A level Mathematics include Revision Guides, Workbooks and Practice Papers Plus+ books. They provide exam guidance, hints and tips for students plus plenty of exam practice.



Practice Books

Practice Books help your students get exam-ready and practise at the right pace.

- The most A level question practice available, with over 2000 extra questions.
- Designed to be used flexibly, the practice books are fully mapped to the scheme of work and textbooks so you and your students can use them seamlessly in and out of the classroom.
- Practice books are included as e-books as part of ActiveLearn.



You do not need to buy resources to teach the specification.

Pearson Edexcel AS and A level Mathematics textbooks with free online content

Clear and accessible design, with features that you and your students tell us you like, and content to match the Edexcel AS and A level exams, make ours the UK's most trusted A level Mathematics resources.

Packed with exam-style questions to ensure that your students are ready for the assessments.

4 Use the binomial expansion to find the first four terms, in ascending powers of x, of:

a $(1 + x)^8$ **b** $(1 - 2x)^6$ **c** $\left(1 + \frac{x}{2}\right)^{10}$

d $(1 - 3x)^5$ **e** $(2 + x)^7$ **f** $(3 - 2x)^3$

g $(2 - 3x)^6$ **h** $(4 + x)^4$ **i** $(2 + 5x)^7$

Hint Your answers should be in the form $a + bx + cx^2 + dx^3$ where a, b, c and d are numbers.

E **5** Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(2 - x)^6$ and simplify each term. **(4 marks)**

E **6** Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(3 - 2x)^5$ giving each term in its simplest form. **(4 marks)**

E/P **7** Find the binomial expansion of $\left(x + \frac{1}{x}\right)^5$ giving each term in its simplest form. **(4 marks)**

Challenge

Show that $(a + b)^4 - (a - b)^4 = 8ab(a^2 + b^2)$.

Given that $82\,896 = 17^4 - 5^4$, write 82 896 as a product of its prime factors.

Challenge boxes provide stretch for more able students.

Problem-solving questions are integrated throughout the main exercises.

8.4 Solving binomial problems

You can use the general term of the binomial expansion to find individual coefficients in a binomial expansion.

■ **In the expansion of $(a + b)^n$ the general term is given by $\binom{n}{r}a^{n-r}b^r$.**

Example 6

a Find the coefficient of x^4 in the binomial expansion of $(2 + 3x)^{10}$.

b Find the coefficient of x^3 in the binomial expansion of $(2 + x)(3 - 2x)^7$.

a x^4 term $= \binom{10}{4}2^6(3x)^4$

$= 210 \times 64 \times 81x^4$

$= 1\,088\,640x^4$

The coefficient of x^4 in the binomial expansion of $(2 + 3x)^{10}$ is 1 088 640.

Use the general term. The power is 10, so $n = 10$, and you need to find the x^4 term so $r = 4$.

There are $\binom{10}{4}$ ways of choosing 4 '$3x$' terms from 10 brackets.

b $(3 - 2x)^7$

$= 3^7 + \binom{7}{1}3^6(-2x) + \binom{7}{2}3^5(-2x)^2$

$+ \binom{7}{3}3^4(-2x)^3 + \ldots$

$= 2187 - 10\,206x + 20\,412x^2$

$- 22\,680x^3 + \ldots$

$(2 + x)(2187 - 10\,206x + 20\,412x^2$

$- 22\,680x^3 + \ldots)$

First find the first four terms of the binomial expansion of $(3 - 2x)^7$.

Now expand the brackets $(2 + x)(3 - 2x)^7$.

Worked examples focus on the key types of questions students will need to tackle.

8

x^3 term $= 2 \times -22\,680x^3 + x \times 20\,412x^2$
$= -24\,948x^3$
The coefficient of x^3 in the binomial expansion of $(2 + x)(3 - 2x)^7$ is $-24\,948$.

There are two ways of making the x^3 term: (constant term × x^3 term) and (x term × x^2 term).

The binomial expansion can be used to solve problems where there is an unknown in the original expression.

Example 7

$g(x) = (1 + kx)^{10}$, where k is a constant.
Given that the coefficient of x^3 in the binomial expansion of $g(x)$ is 15, find the value of k.

x^3 term $= \binom{10}{3} 1^7 (kx)^3 = 15x^3$
$120k^3x^3 = 15x^3$
$k = \frac{1}{2}$

$a = 1$, $b = kx$, $n = 10$ and $r = 3$.

$k^3x^3 = \frac{15}{120}x^3$
$k^3x^3 = \frac{1}{8}x^3$
$k^3 = \frac{1}{8}$, $k = \sqrt[3]{\frac{1}{8}}$

Problem-solving hints help students get to grips with the style of question.

Example 8

a Write down the first three terms, in ascending powers of x, of the binomial expansion of $(1 + qx)^8$, where q is a non-zero constant.

b Given that, in the expansion of $(1 + qx)^8$, the coefficient of x is $-r$ and the coefficient of x^2 is $7r$, find the value of q and the value of r.

a $(1 + qx)^8$
$= 1^8 + \binom{8}{1} 1^7 (qx)^1 + \binom{8}{2} 1^6 (qx)^2$
$= 1 + 8qx + 28q^2x^2 + \ldots$

b $8q = -r$ and $28q^2 = 7r$
$8q = -4q^2$
$4q^2 + 8q = 0$
$4q(q + 2) = 0$
$q = -2$, $r = 16$

Problem-solving
There are two unknowns in this expression. Your expansion will be in terms of p and q.

Using $28q^2 = 7r$, $r = 4q^2$, $-r = -4q^2$

q is non-zero so $q = -2$.

Exercise 8D

1 Find the coefficient of x^3 in the binomial expansion of:

a $(3 + x)^5$	**b** $(1 + 2x)^5$	**c** $(1 - x)^6$	**d** $(3x + 2)^5$
e $(1 + x)^{10}$	**f** $(3 - 2x)^6$	**g** $(1 + x)^{20}$	**h** $(4 - 3x)^7$
i $\left(1 - \frac{1}{2}x\right)^6$	**j** $\left(3 + \frac{1}{2}x\right)^7$	**k** $\left(2 - \frac{1}{2}x\right)^8$	**l** $\left(5 + \frac{1}{4}x\right)^5$

Exercise questions are carefully graded so they increase in difficulty and gradually bring students up to standard.

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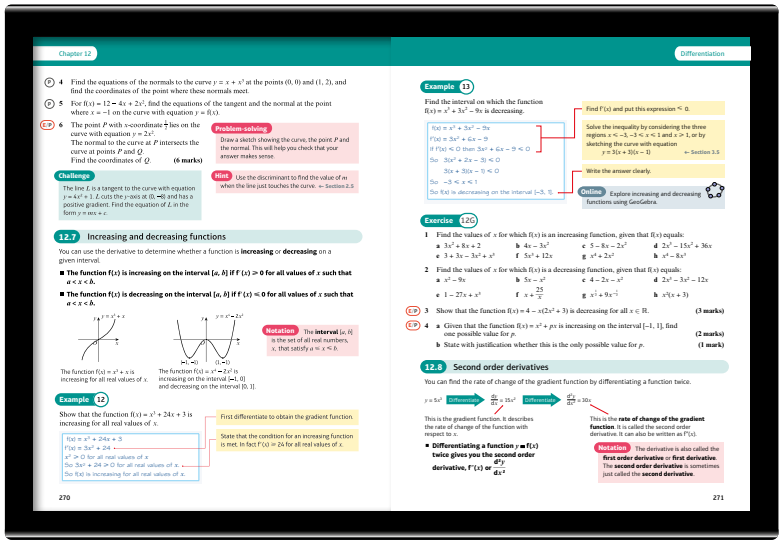

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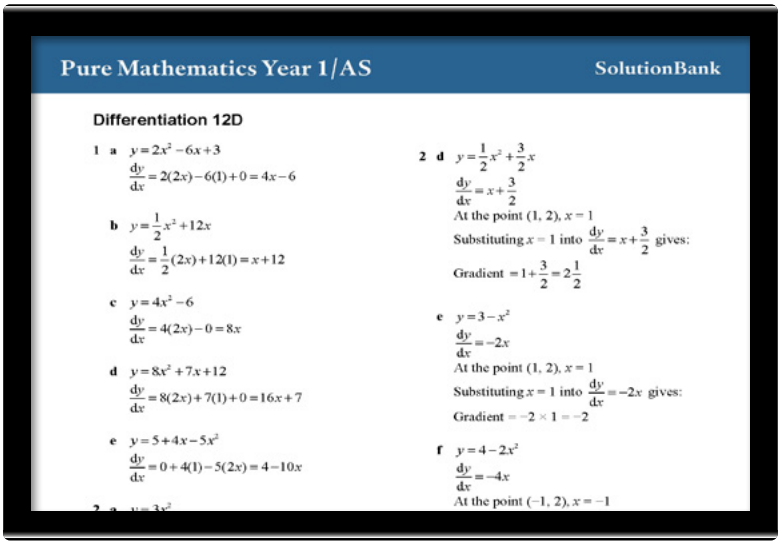

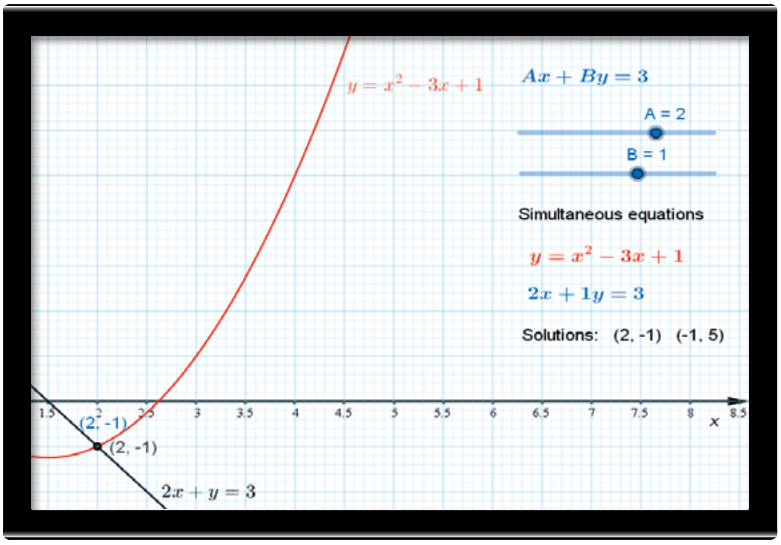

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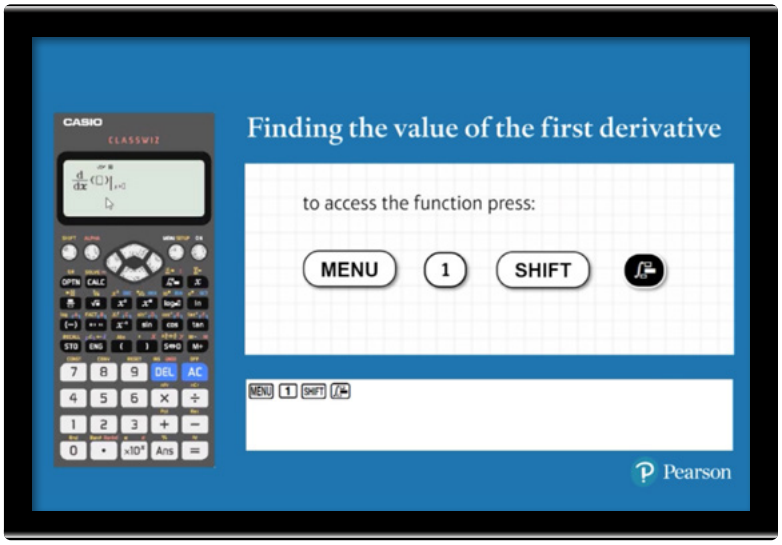

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