

The screenshot shows the MathsNetAlevel website interface. At the top, there's a navigation menu with categories like 'Home', 'About', 'Contact', 'Privacy Policy', 'Terms & Conditions', 'FAQ', 'Help', 'Feedback', 'Sitemap', 'RSS', 'Twitter', 'Facebook', 'LinkedIn', 'YouTube', 'Google+', 'Pinterest', 'Instagram', 'Snapchat', 'WhatsApp', 'Telegram', 'Viber', 'WeChat', 'Line', 'Kik', 'Signal', 'Skype', 'WhatsApp', 'Telegram', 'Viber', 'WeChat', 'Line', 'Kik', 'Signal', 'Skype'. Below the navigation, there's a main content area with a search bar and a list of topics. The main content area is titled 'Factorising a quadratic expression is an essential skill.' and contains a math problem: 'Find the values of the constants A, B, C and D in the identity  $x^2 + 4x + 3 = Ax^2 + Bx + C + D(x + 1)$ '. The solution is displayed step-by-step: 'Equate coefficients of  $x^2$ ', 'Equate coefficients of  $x$ ', 'Equate constants'. Below the solution, there are two interactive plots: 'Bar and whisker plots' and 'Stem and leaf diagrams'. The 'Bar and whisker plots' plot shows a distribution with a mean of 40 and a median of 42. The 'Stem and leaf diagrams' plot shows a distribution with a mean of 40 and a median of 42. The interface also includes a timer, a mark scheme, and a zoom function.

the question, based on a recent exam but with randomised elements

the solution, displayed one step at a time

change the question, display the solution one step at a time or all at once

a number that identifies this specific page

a timer that will count down the time you should allocate to this question

a mark scheme based on the familiar coding used by examiners

make the text larger or smaller or change its colour



Factorise:

$$x^2 + 13x + 36 = (x + 4)(x + 9)$$

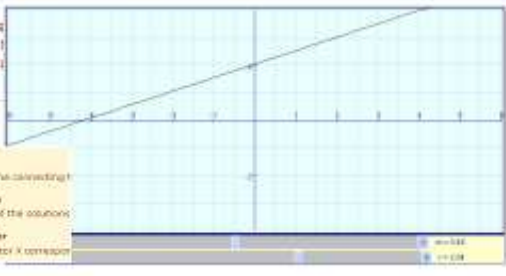
Once you've viewed the video, use the interactive to factorise a quadratic function. There may at first be only one way to factorise it, but as you progress, you will discover that some quadratic functions can be factorised in more than one way.

Factorise:

$$x^2 + 13x + 36$$

A B C D E F G H I

edge  
the line connecting  
expression  
one of the solutions  
slope/vector  
a vector X coordinate



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## 0 Introduction

Thank you for subscribing to our on-line service. This group of sites includes those accessible by the domain names: mathsnetalevel.com, mathsneta-level.com, mathsnetaib.com, mathsnetaap.com and mathnetap.com. We aim to cater for various specific advanced mathematics specifications, which currently include AQA, CCEA, Edexcel, OCR, Scottish Highers, WJEC, International Baccalaureate and AP Calculus. Users are able to subscribe to one specification, or half a specification. Individuals, teachers, tutors, schools or colleges can subscribe. The illustrations in this user guide are based on pages from the UK specifications. Although the International Baccalaureate and AP Calculus sites are organised slightly differently and look a little different too, they work in the same way as described here.

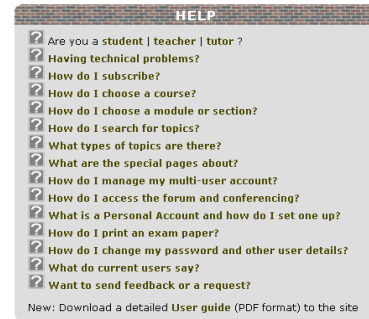


To access the site you need a username and password. If you misplace either there is a facility on the site to send you your password, or alternatively you can contact Chartwelle Yorke who manage all subscriptions at

Chartwell-Yorke Maths ICT Store  
114 High Street  
Belmont Village, Bolton, Lancashire BL7 8AL  
UK - England & Wales

Telephone: 01204 811001

Once logged on to the site you can if you wish change the username and password allocated to you. Many other details about the operation of the site are described on the Help page on the site, some of which this user guide expands further.



The basic content is arranged by module. For the UK specifications this will be defined by those specifications, and each module leads to a related module examination. For the International Baccalaureate and AP Calculus, the modules are essentially the different sections of the syllabus. Examination papers in these two cases range across all the modules. As an example Edexcel module C1 and International Baccalaureate Higher Level Module 4 appear like this:

MathsNet IB 4

Bryan Dye LOG OFF IB (HL) 4

INTRODUCTION 1 2 3 4 5 6 7 8 9 10 11 HELP

106 PAGES PRINT EXAM PAPER

### 1. Matrix Algebra

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$  An elementary introduction to matrices, including addition, subtraction, multiplication, determinant, the inverse and the solution of systems of linear equations in up to 3 unknowns. A GDC is to be used for inverses of 3x3 matrices.

<b>Storing data</b>	What is a matrix?	Sale prices	Price increases
	Sales targets		
<b>Matrix arithmetic</b>	Sums and products	Adding matrices	Adding matrices 2
	Adding matrices 3	Subtracting matrices	Quick test
	Multiplying matrices	Multiplying matrices 2	Multiplying matrices 3
	Multiplying matrices 4	Multiplying matrices 5	Multiplying matrices 6
	Multiplying matrices 7	The identity matrix	Multiplying by a scalar
	Multiplying by a scalar 2	Multiplying by a scalar 3	2007 EXAM QUESTION
	2007 EXAM QUESTION	2007 EXAM QUESTION	2008 EXAM QUESTION
	2008 EXAM QUESTION	2008 EXAM QUESTION	2009 EXAM QUESTION
<b>Inverses</b>	Determinants	Determinants 2	Determinants 3
	Determinants 4	Determinants 5	Inverses
	Inverses 2	Inverses 3	Inverses 4
	Inverses 5	Inverses 6	Inverses 7
	Property of Inverses	2005 EXAM QUESTION	2006 EXAM QUESTION
	2006 EXAM QUESTION	2007 EXAM QUESTION	2008 EXAM QUESTION
	2008 EXAM QUESTION	2009 EXAM QUESTION	2009 EXAM QUESTION
	2009 EXAM QUESTION	2009 EXAM QUESTION	

#### Latest Additions

- 6006 Matrix algebra : Inverses : Exam question 08
- 5995 Matrix algebra : Matrix arithmetic : Exam question 08
- 5966 Matrix Algebra : 3x3 matrices : Exam question 08
- 5938 Matrix algebra : Matrix arithmetic : Exam question 08
- 5888 Matrix algebra : Matrix arithmetic : Exam question 08
- 5883 Matrix algebra : The basics : Exam question 09
- 5866 Matrix Algebra : 3x3 matrices : Exam question 09
- 5865 Matrix algebra : Inverses : Exam question 09
- 5863 Matrix algebra : Inverses : Exam question 09
- 5861 Matrix algebra : Matrix arithmetic : Exam question 09
- 5724 Matrix algebra : Inverses : Exam question 09
- 5450 Matrix algebra : 3x3 matrices : Exam question 08
- 5406 Matrix Algebra : 3x3 matrices : Exam question 08
- 5401 Matrix algebra : Inverses : Exam question 08
- 5105 Matrix algebra : Simultaneous equations : Exam question 08

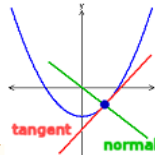
A list on the right shows the most recent additions to the module. Topics are arranged in a similar order to the specification. Within each topic there are specific subjects and then specific pages. Pages can be of 5 broad types, shown by the symbol icon to the left of each item.

- Algebraic or analytical, often involving step-by-step solutions to problems
- Visual or graphical, often involving interactive graphs or diagrams which can be manipulated by mouse actions like drag and drop.
- A quiz, usually multiple choice, which marks your answers and gives you a score.
- Video produced by MathsNetAlevel plus specifically for the site.
- Video produced by various sources.

A sixth type is the EXAM QUESTION based on a specific year. All pages are interactive in some form or other. The most common type is the first in the list above, which will take the form of a step by step walk through a particular mathematical concept. The page is arranged to encourage the users to figure out the mathematics involved for themselves *before* viewing how it should be done. For example, this page explains how to find the gradient of the tangent at a specific point on a curve.

**Finding tangents 1** Page ID: 89

To find the gradient of a tangent to a curve  $y = f(x)$  at a given point  $x = a$ :  
 firstly differentiate the equation of the curve in order to find  $\frac{dy}{dx}$ ,  
 secondly substitute into this expression the value  $x = a$ .



Find the gradient of the tangent at the point  $x = -2$  on the curve:  
 $y = x^3(6x^9 + 3x^3)$

$$y = x^3(6x^9 + 3x^3) = 6x^{12} + 3x^6$$

$$\frac{dy}{dx} = 72x^{11} + 18x^5$$
 at  $x = -2$ ,  $\frac{dy}{dx} = 72(-2)^{11} + 18(-2)^5 = -148032$ 

Change Restart  + black blue green - Change Restart All

The buttons at the bottom allow the question to be changed (the numbers will change), and the answer to be displayed one step at a time or all at once. Other buttons allow you to increase or decrease the font size or change its colour.

In addition to the basic topic content, which forms the heart of the site and of which there are well over 6000 different pages, there is an on line forum, conferencing facilities, the means of printing and saving exam papers which are created by the user using the questions available on the site, various reference pages and a help page. These are described in greater detail elsewhere.

### Use of interactive whiteboards

The pages on the site have been designed with interactive whiteboard (IWB) use in mind, which is why pages like the one above make maximum use of the browser window and have buttons at the bottom of the screen repeated on the left and right. Other pages have displays that include elements that respond to mouse actions like drag and drop. Generally it is rare for a page to require data entry from the keyboard.

Thought it is not easy to cater for all browsers, screen resolutions and IWB models, we have done our best to provide a set-up that should suit most. Pages are optimised primarily for the Firefox browser (which is the one we would recommend) and secondly Internet Explorer.

## 1 For students

This site should enable you to organise your learning and revision program for your coming exams. Your course will be divided into modules and for each one there is a wide variety of on-line material to help you.

Of course it is up to you how you use these resources, but there is one principle that the site recommends throughout: you have to do some work yourself. We will illustrate what we mean by considering this question taken from page ID 4168:

$$\text{Rationalise: } \frac{11 + \sqrt{7}}{4 + \sqrt{3}}$$

First, on paper, you should have a go at it yourself, and then if you were unable to complete it or want to check your answer, refer back to the webpage and use the buttons   to either move through the solution one step at a time or simply see it all at once:

$$\text{Rationalise: } \frac{11 + \sqrt{7}}{4 + \sqrt{3}}$$

$$\begin{aligned} \frac{11 + \sqrt{7}}{4 + \sqrt{3}} &= \frac{11 + \sqrt{7}}{4 + \sqrt{3}} \times \frac{4 - \sqrt{3}}{4 - \sqrt{3}} \\ &= \frac{(11 + \sqrt{7})(4 - \sqrt{3})}{(4 + \sqrt{3})(4 - \sqrt{3})} \\ &= \frac{44 - 11\sqrt{3} + 4\sqrt{7} - \sqrt{21}}{13} \end{aligned}$$

Did that help? Try again, return to the webpage, click  and you will see a new version of this question, for example:

$$\text{Rationalise: } \frac{10 + \sqrt{2}}{11 + \sqrt{7}}$$

You should have a clearer idea of how to do it now, so try again – on paper! Then check your answer with the webpage:

Rationalise:  $\frac{10 + \sqrt{2}}{11 + \sqrt{7}}$

$$\begin{aligned} \frac{10 + \sqrt{2}}{11 + \sqrt{7}} &= \frac{10 + \sqrt{2}}{11 + \sqrt{7}} \times \frac{11 - \sqrt{7}}{11 - \sqrt{7}} \\ &= \frac{(10 + \sqrt{2})(11 - \sqrt{7})}{(11 + \sqrt{7})(11 - \sqrt{7})} \\ &= \frac{110 - 10\sqrt{7} + 11\sqrt{2} - \sqrt{14}}{114} \end{aligned}$$

Did you get it right that time? If so you might want to move on; if not, go round the cycle again. Thus by repetitive practice you can develop the skills necessary to solve problems like this. There are literally thousands of pages like this one the site.

Advanced mathematics consists largely of problem solving, but in order to do that you must have the necessary skills at your fingertips which require practice. It is often said that mathematics consists of a collection of building blocks and the structure of most advanced courses reflects this. In simple terms you cannot master module C2 until you have mastered C1, and so on. In more detail, you cannot master plotting cubic curves until you have understanding of quadratic curves. This site is constructed with that in mind. For example if you are studying the solution of simultaneous equations then the site presents this sequence:

<input checked="" type="checkbox"/> Linear graphs	<input checked="" type="checkbox"/> Linear & quadratic	<input checked="" type="checkbox"/> Linear & quadratic 2
<input checked="" type="checkbox"/> Linear and quadratic	<input checked="" type="checkbox"/> Linear and quadratic 2	<input checked="" type="checkbox"/> Linear and quadratic 3
<input checked="" type="checkbox"/> Linear and quadratic 4	<input checked="" type="checkbox"/> Two quadratic graphs	<input checked="" type="checkbox"/> Two Quadratics
<input checked="" type="checkbox"/> Two Quadratics 2	<input checked="" type="checkbox"/> Linear equations on a GDC	<input checked="" type="checkbox"/> Linear equations on a GDC 2
<b>2000 EXAM QUESTION</b>	<b>2000 EXAM QUESTION</b>	<b>2003 EXAM QUESTION</b>

The first three topics provide you with graphs to visualise the situation, then the following seven topics show you how to solve first a linear and a quadratic equation then two simultaneous quadratic equations. If you have a graphic display calculator (GDC) then two pages show you how to use it to solve these equations. Finally, you can try recent examination questions on this topic. This list of exam questions will be from recent years and will usually include questions from the last exam season.

There are many types of pages on the site apart from the above. There are quizzes, multiple choice tests, drag and drop exercises and videos. See later sections in this guide for more details.

You can use the forum to make contact with other students or ask for help or advice on a topic. You can also create your own exam papers based on

any module you like, and print that paper along with a mark scheme to work on away from the computer. These papers can be saved too. See later sections for more on this.

## 2 For teachers and private tutors

You may have subscribed as a private individual or private tutor or as a school or college.

### Individual subscriptions

If you are single subscriber then you have direct access to the forums and conferences set up by us on the site. You will be able to contribute to them but you cannot create your own. You will also be able to create, print and save exam papers that only you can access.

### Multi-user accounts

As a teacher at a school or college that has subscribed to a multi-user account, or as a private tutor who has created a multi-user account for yourself plus a specific number of students, you will have access to management facilities including the forum and conferencing, and when your students have created their usernames on the site you will be able to monitor their access.

On the Manage Student Accounts screen, which you access by clicking on your user name, you can view the status of your students' accounts. You can approve new students or delete old students. You can view whether the student is currently on line or has been on line today, how many times they have been online in the last month, and the dates they were online over the last three months.

Account Summary		Manage Main Account	Manage Personal Account	Manage Student Accounts	Exam Papers
User Name	Student Name	Email	Online (past month)	Approved	Delete
STUDENT	STUDENT	STUDENT@MYTUTOR.COM	No (1)	Yes	<input type="checkbox"/>
STUDENT	STUDENT	STUDENT@MYTUTOR.COM	No (8)	Yes	<input type="checkbox"/>
STUDENT	STUDENT	STUDENT@MYTUTOR.COM	Yes (4)	Yes	<input type="checkbox"/>
STUDENT	STUDENT	STUDENT@MYTUTOR.COM	No (3)	26 Mar, 2009 1 Apr, 2009	<input type="checkbox"/>
STUDENT	STUDENT	STUDENT@MYTUTOR.COM	No (6)	2 Apr, 2009	<input type="checkbox"/>

Approve/Delete Selected Accounts

Total Student Log-ons  
April: 35

### Private forums

You can create a private forum that only you and your students can access.

Private Forums				
Forum	Threads	Posts	Status	School
Revision ideas	1	2 / 3 Apr, 2009	ST ✓	MyTutor
Up coming lessons	2	4 / 4 Apr, 2009	ST ✓	MyTutor
Past papers	3	14 / 8 Apr, 2009	ST ✓	MyTutor

- Through this you can organise your planned tutoring of the students by publishing dates of meetings, deadlines for work to be done, or specific work to be completed using resources on the site. See the section on Forums for more ideas on their use.

### Exam papers

You can create and save on the site exam papers tailored to your specific needs. These could consist of a typical selection of questions making up an exam paper, or you could create an exam paper on a specific topic, "All you need to know about implicit differentiation", for example. These papers will always contain questions from real exams set in recent years.

Exam Papers			
Module	Name	Title	Delete
C3	c3paper1	C3 Exam Paper - 13 Jan, 2009	<input type="checkbox"/>
C3	c3paper2	C3 Exam Paper - 14 Jan, 2009	<input type="checkbox"/>
C4	c4int01	C4 Exam Paper - 19 March, 2009	<input type="checkbox"/>
C4	c4diff01	C4 Exam Paper - 23 February, 2009	<input type="checkbox"/>
C4	c4diff02	C4 Exam Paper - 9 March, 2009	<input type="checkbox"/>

### Conferencing

Through the forum you can also announce live conferences that you may have with your students.

A conference enables you to communicate in real time with your students (as in instant messaging). You can share best practice by discussing specific topics and referring students to specific pages on the site. They can respond with questions and ideas about the topic under consideration.

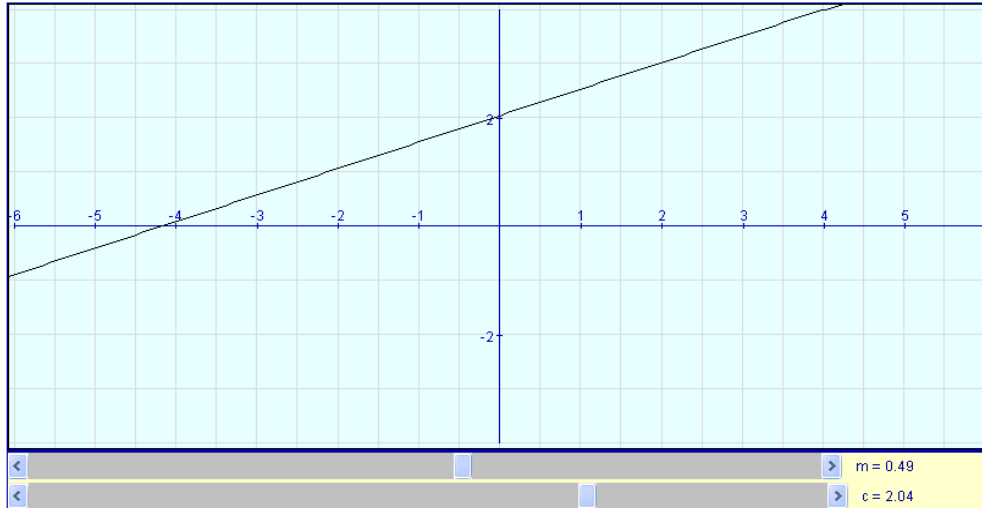
## 3 For professional development

The various facilities mentioned in the previous section, and expanded in later sections, such as conferencing and forums, do allow the site to be used as the basis for continuing professional development. This may be for established teachers, newly qualified teachers or those seeking advanced skills status. On-line courses can be based around the resources available, with planning and timetabling arranged via the forum. The conferencing facility can be utilised to get teachers together (virtually) and to enable them to discuss aspects of the subject that may cause concern or that are particularly difficult to understand. For example some modules, such as M3 or DE, are only rarely studied by students and consequently very rarely taught by teachers.

Subscription options to the site are flexible. Contact Chartwell-Yorke directly if you wish to subscribe in a way tailored to your specific development needs.

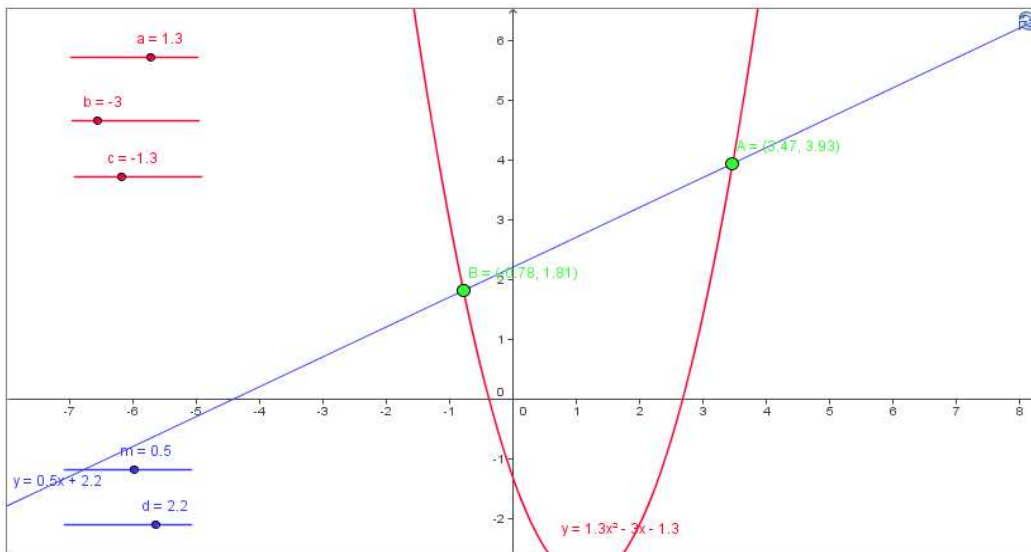
## 4 Graphs

The site features a large collection of interactive graphs. There are various types. A simple one is shown here:

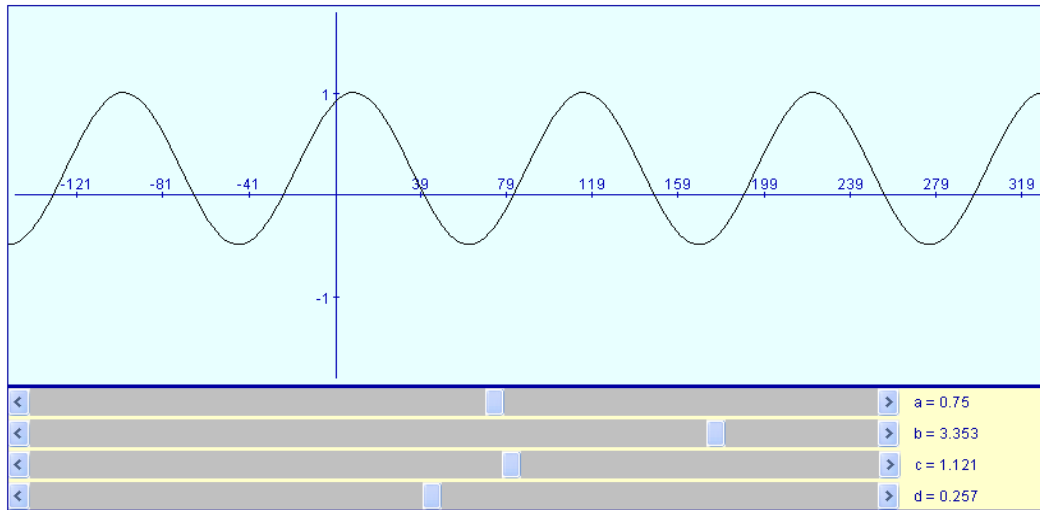


The sliders at the bottom allow you to alter the values of the variables, **m** and **c** in this case, which in turn affect the shape of the graph,  $y = mx + c$  in this case. Thus an understanding of gradient and intercept can be gained dynamically. Dragging a window across the screen with the mouse will cause the graph to zoom in on that area. Dragging with the right button will drag the whole graph. Shift-click will zoom out.

In this second example, the sliders are on the graph display.



In the following example, the sliders allow you to investigate the effect of changing the variables  $a$ ,  $b$ ,  $c$  and  $d$  on the graph of  $y = a \sin(bx + c) + d$ .

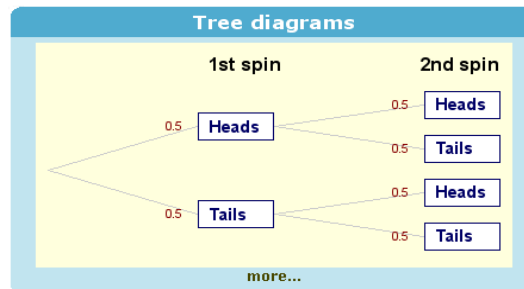
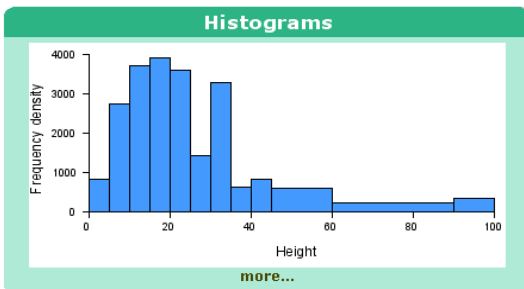
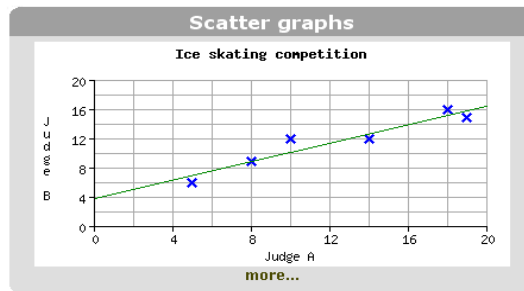
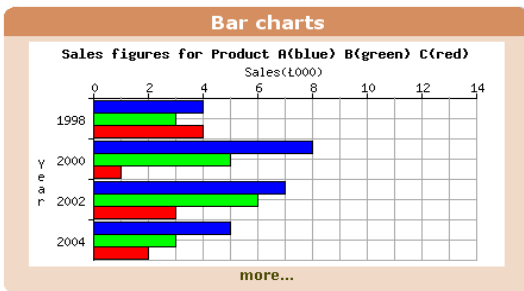
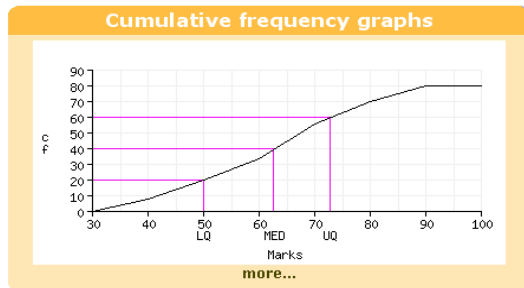
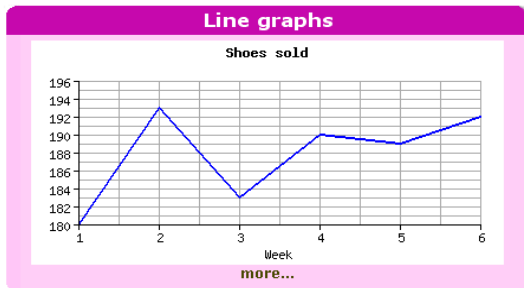
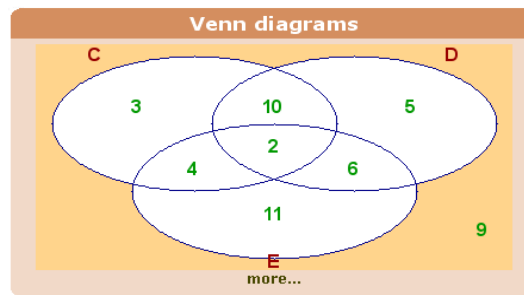
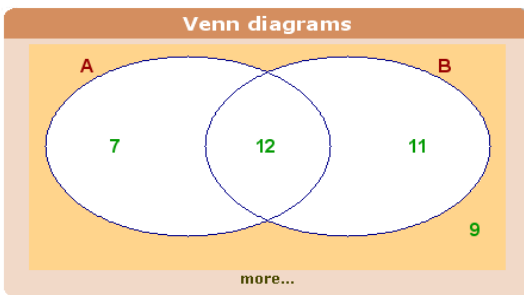
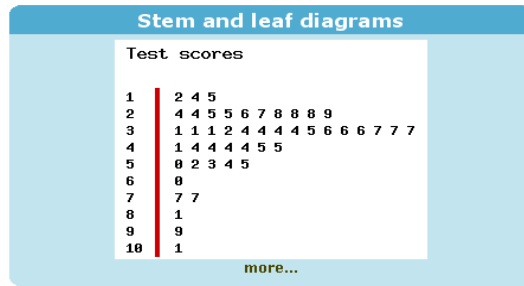
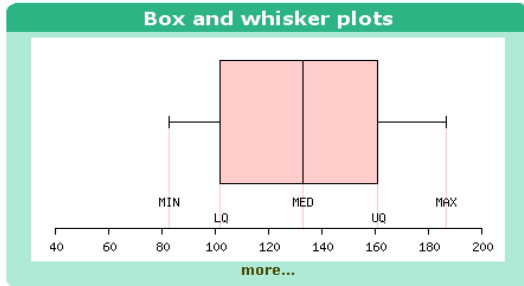


There is a Graph library which collects together all the graphs that are likely to occur on any advanced course, including:

linear: $y=ax+b$	cosecant: $y=acosec(bx+c) + d$
quadratic: $y=ax^2+bx+c$	cotangent: $y=acot(bx+c) + d$
cubic: $y=ax^3+bx^2+cx+d$	inverse trig: $y=a.arcsin(bx+c) + d$
reciprocal: $y=a/x$	inverse trig: $y=a.arccos(bx+c) + d$
circle: $(x-a)^2+(y-b)^2=c^2$	inverse trig: $y=a.arctan(bx+c) + d$
sine: $y=asin(bx+c)+d$	rational: $y=a/(x+b) + c$
cosine: $y=acos(bx+c)+d$	rational: $y=ax/(x-b)(x-c)$
tangent: $y=atan(bx+c)+d$	rational: $y=(x^2+ax+b)/(x^2+cx+d)$
modulus: $y= ax+b $	parabola: $y^2=4ax$
modulus: $y= ax^2+bx+c $	ellipse: $x^2/a^2+y^2/b^2=1$
modulus: $y= ax^2+bx^2+cx+d $	hyperbola: $x^2/a^2-y^2/b^2=1$
modulus: $y=a x^2 +b x^2 +c x +d$	rectangular hyperbola: $xy=a$
exponential: $y=aexp(bx+c)+d$	hyperbolic sine: $y=a.sinh(bx+c) + d$
natural log: $y=a\ln(bx+c)+d$	hyperbolic cosine: $y=a.cosh(bx+c) + d$
secant: $y=asec(bx+c) + d$	hyperbolic tangent: $y=a.tanh(bx+c) + d$

## 5 Statistical diagrams

The site contains a comprehensive collection of interactive statistical diagrams.



## 6 Quizzes

The site features a large collection of quizzes of various types. They will all include some form of direct marking or feedback.

### Multiple choice test

Correct: <input type="text"/>		Attempts: <input type="text"/>		% Correct: <input type="text"/>		Reset the scores	
1	$\frac{d}{dx}(x^3) =$	A $3x$ <input type="radio"/>	B $3x^2$ <input type="radio"/>	C $x^2$ <input type="radio"/>	D $3$ <input type="radio"/>	E $x^4$ <input type="radio"/>	
2	$\frac{d}{dx}(x^2 + 7) =$	A $2x$ <input type="radio"/>	B $2x + 7$ <input type="radio"/>	C $9$ <input type="radio"/>	D $x$ <input type="radio"/>	E $x + 7$ <input type="radio"/>	
3	$\frac{d}{dx}(4x - 9) =$	A $4x$ <input type="radio"/>	B $x$ <input type="radio"/>	C $-9$ <input type="radio"/>	D $-5$ <input type="radio"/>	E $4$ <input type="radio"/>	

Each question has five optional answers. A score is given at the top. You lose 1 mark for a wrong selection. The aim is to get 100%, which can only be attained by getting each option correct first time.

### True or false

Only two options are available: true or false. As with multiple choice tests, the aim is to get 100%, which requires no mistakes.

Correct: <input type="text"/>		Attempts: <input type="text"/>		% Correct: <input type="text"/>		Reset the scores	
1	if $y = 3x^2$ then $\frac{dy}{dx} = 6x$	True <input type="radio"/>	False <input type="radio"/>				
2	if $y = x(x - 3)$ then $\frac{dy}{dx} = 2 - 3x$	True <input type="radio"/>	False <input type="radio"/>				
3	if $y = 4x^{-3}$ then $\frac{dy}{dx} = 12x^{-2}$	True <input type="radio"/>	False <input type="radio"/>				
4	if $y = 3x^2 + 5x^3$ then $\frac{dy}{dx} = 15x^2 + 6x$	True <input type="radio"/>	False <input type="radio"/>				
5	if $y = (x + 1)^2$ then $\frac{dy}{dx} = 2x + 2$	True <input type="radio"/>	False <input type="radio"/>				
6	if $y = (x - 1)(x + 1)$ then $\frac{dy}{dx} = 2x$	True <input type="radio"/>	False <input type="radio"/>				

## Drag and drop

In this quiz you drag the items on the right across to their matching pair on the left.

Match the derivatives on the right with the functions on the left.

1. $x^7$	2+2x-3x <sup>2</sup>
2. 3x <sup>-3</sup>	5-28x <sup>3</sup>
3. x <sup>-2</sup> +x <sup>2</sup>	-18x <sup>2</sup>
4. 2x+x <sup>2</sup> -x <sup>3</sup>	14+2x
5. 5x-7x <sup>4</sup>	-2x <sup>-3</sup> +2x
6. 7-6x <sup>3</sup>	-9x <sup>-4</sup>
7. 14x+x <sup>2</sup>	2x+11x <sup>-2</sup>
8. x <sup>2</sup> -11x <sup>-1</sup>	7x <sup>6</sup>

Match the derivatives on the right with the functions on the left.

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5. 5x-7x <sup>4</sup>	-2x <sup>-3</sup> +2x
6. 7-6x <sup>3</sup>	-9x <sup>-4</sup>
7. 14x+x <sup>2</sup>	2x+11x <sup>-2</sup>
8. x <sup>2</sup> -11x <sup>-1</sup>	7x <sup>6</sup>

## Ordering

A set of instructions or analytical steps are given. You have to drag them into the correct order. A gauge to the right gives you direct visual feedback on whether or not you are moving things in the right direction.

- 1 a + b = 2(n + m)
- 2 Add a and b:
- 3 therefore a = 2m where m is an integer
- 4 which is an even number
- 5 Let a and b be two even numbers:
- 6 therefore a + b is an even number
- 7 Factorise:
- 8 and b = 2n where n is an integer
- 9 a + b = 2n + 2m

- 1 a + b = 2(n + m)
- Let a and b be two even numbers:
- 3 Add a and b:
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- 7 Factorise:
- 8 and b = 2n where n is an integer
- 9 a + b = 2n + 2m

## 7 Videos

The site features a growing collection of videos from various sources, such as YouTube and M.I.T. and from other collections on the web. At MathsNet we are also producing our own videos too, as in these two examples.

Simplify:

$$x^7 \times x^5$$

$$y^7 \div y^5$$

$$(z^7)^5$$

$$\sqrt[5]{w^7}$$


---


$$x^7 \times x^5 = x^{7+5}$$

Factorising a quadratic expression is an essential skill.

Factorise:  
 $x^2 + 13x + 22$

---

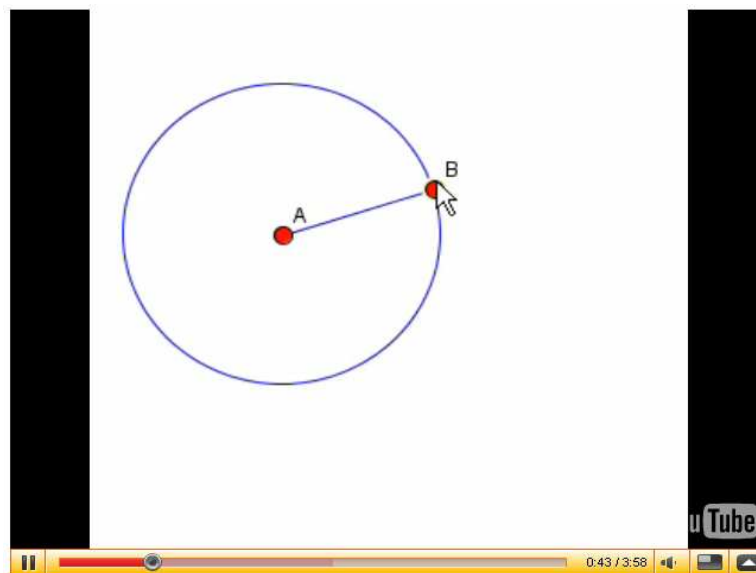
$x^2 + 13x + 22 = (x + \dots)(x + \dots)$

Once you've viewed the video, use the interactive display below to practicing using "empty" brackets to factorise a quadratic function. There may at first appear to be a choice of which numbers you use (bearing in mind that  $12 = 1 \times 12, 12 \times 1, 2 \times 6, 6 \times 2, 3 \times 4, 4 \times 3$  and  $-3 \times -4$  for example). However, all quadratic functions can only be factorised in one way.

Factorise:

$$x^2 + 13x + 36$$

Some of our videos have been transferred to our channel on YouTube.



## 8 Graphic calculator pages

As all specifications allow use of the graphic display calculator (GDC), the site has many pages dedicated to their use. Currently the site actively supports the TI-84 calculator from Texas Instruments, but the pages are

easily adaptable to other similar calculators from Casio, Hewlett Packard, etc. The following is a typical example.

**Using a GDC** Page ID: 2438

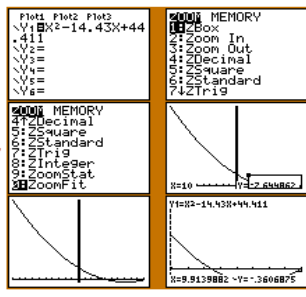
How to solve a quadratic equation on a GDC (graphical display calculator). This explanation uses the TI-82/83/84 calculators.

1. Press **Y=** to select the equation entry menu.
2. Enter your quadratic equation followed by **ENTER**.
3. You could press **GRAPH** but it is better to press **ZOOM** then press 6 or select **ZStandard**.
4. You will see a display of your graph. Press **ZOOM** again then press 1 or select **ZBox**
5. Once back on the graph display, use the cursor keys and press **ENTER** at the top left and bottom right to create a zoom box

By repeated zooming in and use of the **TRACE** function you can obtain an accurate estimate of where the curve crosses the x-axis.

Solve by using a GDC:

$$x^2 - 10.24x + 13.824 = 0$$



The pictures to the right show screens from a TI-84 calculator. On the left is a step by step guide to using the options available on the calculator.

In the next example the solver function is explained. The solver function can be used to solve any equation that may occur on an advanced mathematics course. This may be particularly useful for checking answers obtained from a numerical method such as an iterative solution to an equation or the Newton Raphson method.

**Using a GDC 3** Page ID: 2597

How to solve a quadratic equation on a GDC (graphical display calculator). This explanation uses the TI-82/83/84 calculators.

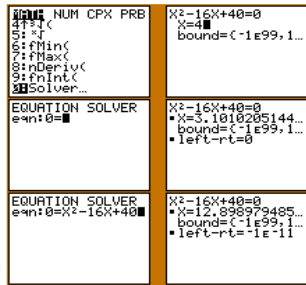
For example, to solve:  $x^2 - 16x + 40 = 0$

1. Press **MATH** **0** to select **Solver...**
3. Enter  $x^2 - 16x + 40$  and press **ENTER**
4. If you have a rough idea what X might be, enter it and press **ALPHA** **ENTER** to select **SOLVE**

After a short delay, the required value, 3.101..., should be displayed. To find the other solution, change X to your estimate and press **ALPHA** **ENTER**

Solve by using a GDC:

$$x^2 - 13.9492x + 25.86638 = 0$$



Graphic calculators usually have a collection of statistical functions. Here is an example of drawing a box plot:

**Box and whisker plots on a GDC** Page ID: 2503

How to display a box and whisker plot on a GDC (graphical display calculator). This explanation uses the TI-82/83/84 calculators.

To produce a box and whisker plot of the data 124, 180, 151, 106, 133, 174:

1. Press the **STAT** key. This brings you to a statistics menu.
2. Type a 1 (or **ENTER**) to select EDIT.
3. Now enter your set of values in the column headed L1.
4. Press **STAT PLOT** (by pressing **2ND** **Y=**). Press **ENTER** to select Plot 1
5. Select **Plot 1 On** and then the boxplot icon and press **ENTER**
6. Press **ZOOM** and select **ZoomStat**.

A display of your box and whisker plot will be shown. Press **TRACE** to read values from it, including the minimum, lower quartile (Q1), median, upper quartile (Q2) and maximum. You could enter a second set of data into L2 and repeat the above process using Plot 2 to show two box plots.

Get your GDC to display a box plot of these data  
58, 123, 182, 146, 93, 132, 166.

## 9 Exam Pages

The site features a regularly updated collection of exam questions based on recent papers set by the various examination boards. Each question comes with a mark scheme. Here is a typical example:

**Exam question 07** Page ID: 2558

The following is based on a typical examination question. 5 marks 08:38

Find the values of the constants  $A$ ,  $B$ ,  $C$  and  $D$  in the identity

$$x^3 - 8 \equiv (x - 7)(Ax^2 + Bx + C) + D$$

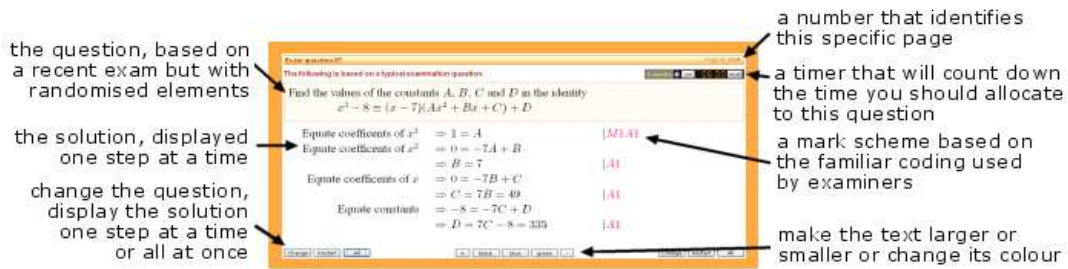
Equate coefficients of $x^3$	$\Rightarrow 1 = A$	M1A1
Equate coefficients of $x^2$	$\Rightarrow 0 = -7A + B$	
	$\Rightarrow B = 7$	A1
Equate coefficients of $x$	$\Rightarrow 0 = -7B + C$	
	$\Rightarrow C = 7B = 49$	A1
Equate constants	$\Rightarrow -8 = -7C + D$	
	$\Rightarrow D = 7C - 8 = 335$	A1

Change Restart All

+ black blue green -

Change Restart All

The various elements of this display are:



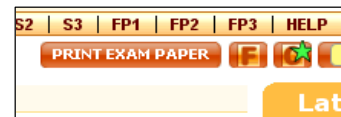
Using the options provided, you can display many different versions of the same question, each accompanied by its specific mark scheme that can be displayed one step at a time (useful when going through the question on an interactive whiteboard) or all at once. The time you should spend on the question is given in the form of a countdown timer. You can also alter the size of the text and, if appropriate, its display colour.

The ID number of the page (2558 in this case) is given so that you can return easily to this specific page, refer to it when working with other people, identify it when saving your own exam papers for printing or use it when sending feedback to the site creators.

The fact that every exam question contains randomised elements means that this resource is in effect inexhaustible. The teacher or tutor can print and use exam papers with students over the duration of the course, even allow students to practise the same question repeatedly, and still be able to set a formal test based on this material at the end of the course, all without any exact duplication.

## 10 Printing and saving Exam Pages

The site features a regularly updated collection of exam questions based on recent papers set by the examination boards. You can create and save your own examination papers based on these, together with mark schemes. To do this, first choose a module and click on PRINT EXAM PAPER.



You will then see a display of all available exam questions for that module, sorted by topic.

Paper Title

Paper Size

Deadline:  -  -   Optional Group:

**Algebra and functions**

Functions	Functions and inverses	Modulus graphs	Rational curves
<input type="checkbox"/> 2000 Exam (573) [5/6]	<input type="checkbox"/> 2000 Exam (659) [4/5]	<input type="checkbox"/> 2000 Exam (532) [3/4]	<input type="checkbox"/> 2000 Exam (560) [7/8]
<input type="checkbox"/> 2003 Exam (551) [6/7]	<input type="checkbox"/> 2004 Exam (811) [5/6]	<input type="checkbox"/> 2003 Exam (557) [3/4]	
<input type="checkbox"/> 2004 Exam (866) [9/11]	<input type="checkbox"/> 2005 Exam (947) [6/7]	<input type="checkbox"/> 2003 Exam (686) [8/10]	
<input type="checkbox"/> 2007 Exam (3575) [7/8]	<input type="checkbox"/> 2006 Exam (2321) [7/8]	<input type="checkbox"/> 2004 Exam (852) [8/10]	
<input type="checkbox"/> 2007 Exam (4342) [4/5]	<input type="checkbox"/> 2006 Exam (4361) [6/7]	<input type="checkbox"/> 2006 Exam (4535) [8/10]	
<input type="checkbox"/> 2007 Exam (5361) [5/6]	<input type="checkbox"/> 2007 Exam (933) [9/11]	<input type="checkbox"/> 2008 Exam (5385) [5/6]	
<input type="checkbox"/> 2008 Exam (5175) [6/7]	<input type="checkbox"/> 2007 Exam (4350) [12/14]	<input type="checkbox"/> 2008 Exam (5576) [5/6]	
<input type="checkbox"/> 2008 Exam (5307) [7/8]	<input type="checkbox"/> 2007 Exam (4496) [9/11]	<input type="checkbox"/> 2008 Exam (5762) [4/5]	
<input type="checkbox"/> 2008 Exam (5311) [5/6]	<input type="checkbox"/> 2007 Exam (4507) [9/11]	<input type="checkbox"/> 2009 Exam (5837) [3/4]	
<input type="checkbox"/> 2008 Exam (5439) [7/8]	<input type="checkbox"/> 2007 Exam (5360) [6/7]		

Each question tells you the year the original question was set, its ID number, and, in square brackets, its worth in marks and time allocation, ie, **2000 Exam (573) [5/6]** means the question was set in 2000, has ID number 573, is worth 5 marks and should take 6 minutes to complete.

Choose your title for the paper

Choose your paper size for printing

Choose a date for this task to be completed by

Designate a class or group name

Choose your filename

unique ID number

year the question was originally set

[marks / time]

Questions: 13  
Time: 1h 30m  
Marks: 75

Choose the questions that you require. A display to the left of the screen will tell you the total worth of your paper in marks and time. You may choose to make a selection of questions across all the available topics to produce a module, or alternatively to choose only from one topic to produce a topic test. Enter a title for the paper and a filename and you will then be able to print and save that paper. If you are a teacher then you will see additional options allowing you to set a deadline for the task to be completed by your students and an option to choose a name for your group or class. All papers saved with the same group name will be displayed together. The resulting printout will be in two parts. The first part will be the question paper itself, for example:

<b>C1 June 2008 Edexcel</b>		
10 Questions	Time: <b>1 hour 22 minutes</b>	Total Marks: <b>67</b>
<b>Q1</b> - ID: 3456	<i>[5 marks, 6 minutes]</i>	
Given that the equation $8qx^2 + qx - 8 = 0$ , where $q$ is a constant, has no real roots, (a) show that $q^2 + 256q < 0$ . (b) Hence find the set of possible values of $q$ .		
<b>Q2</b> - ID: 3453	<i>[3 marks, 4 minutes]</i>	
Factorise completely $x^3 - 9x$ .		

The mark scheme will be printed at the end

<b>C1 June 2008 Edexcel - Mark Scheme</b>		
<b>A1</b> - ID: 3456		
(a)	$\begin{aligned} \text{no real roots} &\Rightarrow b^2 - 4ac < 0 \\ &\Rightarrow q^2 - 4 \times 8q \times -8 < 0 \\ &\Rightarrow q^2 + 256q < 0 \end{aligned}$	M1A1
(b)	$\begin{aligned} q^2 + 256q < 0 &\Rightarrow q(q + 256) < 0 \\ &\Rightarrow -256 < q < 0 \end{aligned}$	M1  M1A1
<b>A2</b> - ID: 3453		
	$\begin{aligned} x^3 - 9x &= x(x^2 - 9) \\ &= x(x - 3)(x + 3) \end{aligned}$	M1  M1A1

Note that the quality and layout of your print-out will depend to a large extent on what browser, operating system and printer you are using, although we have done our best to cater for the most common configurations. You will find a help page on the site full of advice to help with printing. A useful free utility to help with testing your printouts without wasting paper is the program **PDF Creator** (available from <http://sourceforge.net/projects/pdfcreator/>). Once installed it acts as a printer driver - you print to PDF Creator instead of your normal printer and it will create a PDF file of the output instead.

All papers that have been saved will be available to you later to print again. If you are a single user then you alone will have access to that saved paper. If you are a teacher or tutor then all the students associated with your account will be able to access the paper. Note that because each question contains a randomised element then each time the same exam paper is printed the questions will differ slightly.

To access saved papers, click on your user name towards the top right of the screen. Then from the options presented, select **Exam Papers**. You will see a display of any saved



papers. These saved papers may appear in up to three groups: those created by yourself, those created by your teacher, or those created by us. You will only be able to delete them if you created them yourself. The ones created and saved by us will normally be based on specific exam specifications and specific exam dates. For example in the diagram below all the papers listed are based on the given specific exam. Note that you are not accessing the original examination paper. They can only be obtained from the respective examination board. Instead you are accessing an interactive version based very closely on that exam paper.

Account Summary		Exam Papers	
Exam Papers			
Module	Name	Title	Delete
C1	c1jan2008edexcel	C1 Jan 2008 Edexcel	<input type="checkbox"/>
C1	c1june2008edexcel	C1 June 2008 Edexcel	<input type="checkbox"/>
C2	c2june2008edexcel	C2 June 2008 Edexcel	<input type="checkbox"/>
C2	c2jan2008edexcel	C2 Jan 2008 Edexcel	<input type="checkbox"/>
C2	c2jan2009edexcel	C2 Jan 2009 Edexcel	<input type="checkbox"/>
C3	c3jan2008edexcel	C3 Jan 2008 Edexcel	<input type="checkbox"/>
C3	c3june2008edexcel	C3 June 2008 Edexcel	<input type="checkbox"/>

## 11 Forums

The website includes a dedicated forum available only to subscribers to the site. To access it click on the **F** logo at the top right of the screen.

















If this logo appears "greyed out" it simply means you need to register your own personal account with the site. Do this by clicking on your user name and following the options provided.

There are two types of forum: General and Private.

### General Forums

These are set up by us for your use and will usually contain items of general interest. They may include forums specific to the specification you have subscribed to.

General Forums				My Posts	Add Forum
Forum	Threads	Posts / Last	Status		
<b>Competitions</b>	5	5 / 15 Apr, 2009	 		
<b>Test area</b> Please leave messages here to test the forum. This area will emptied regularly.	1	1 / 22 Mar, 2009	 		
<b>Careers for Mathematicians</b>	1	3 / 6 Apr, 2009	 		
<b>Courses for mathematicians</b>	1	3 / 6 Apr, 2009	 		
<b>Site highlights</b> With many thousands of pages available on this site, do you have any personal favourites to recommend?	2	2 / 6 Apr, 2009	 		
<b>Edexcel</b>	1	1 / 13 Apr, 2009	 		
<b>Study groups</b> Other students are trying to learn the same material that you are. Take advantage of that by organizing a study group that meets regularly online. Benefits: • Tackle difficult topics together • Build support and sense of community • Organise your time to make better use of it • Compare and improve class or lecture notes. • Work through homework together • Verify with fellow students confusing or difficult concepts • Reduce mathematics and exam anxiety	0	None	 		

## Private forums

As a teacher or tutor in a multi-user account, you can create private forums that only you and your students can access.

Private Forums				
Forum	Threads	Posts	Status	School
<b>Revision ideas</b>	1	2 / 3 Apr, 2009	 	MqTutor
<b>Up coming lessons</b>	2	4 / 4 Apr, 2009	 	MqTutor
<b>Past papers</b>	3	14 / 8 Apr, 2009	 	MqTutor

Through this you can organise your planned tutoring of the students by publishing dates of meetings, deadlines for work to be done, or specific work to be completed using resources on the site. You can also give advanced notice of a live conference. See the next section for more on this. In addition, the students can use the forum themselves to



- tackle difficult topics together
- build support and sense of community
- organise their time to make better use of it
- compare and improve class or lecture notes
- work through homework together
- verify with fellow students confusing or difficult concepts
- reduce mathematics and exam anxiety

## 12 Conferencing

The website includes a dedicated conferencing facility available only to subscribers to the site. To access it click on the **C** logo at the top right of the screen.



If this logo appears "greyed out" it simply means you need to register your own personal account with the site. Do this by clicking on your user name and following the options provided. Teachers in a multi-user account can set up their own conferences and control who can join it.

When a conference has been set up for specific time and date, the logo changes to . When that time has come and the conference is live, the logo changes to .

To participate in a conference you must request to join it and the moderator of the conference has then to confirm that.

Conferencing allows a kind of “instant messaging”, whereby a teacher and students can discuss their work together, as in this example.

The screenshot shows a vertical list of chat messages. The messages are as follows:

- El Nombre (11 Jun 2009, 14:25:00)**  
Excellent. Just working through a few questions.  
  
ID - 377 part (b)  
I know  $dy/dx$  to be  $\cos x/\sin y$   
How would I work out the points at which  $dy/dx$  would be zero? Both  $x$  and  $y$  are between  $-\pi$  and  $\pi$ .
- Mr Dye (11 Jun 2009, 14:27:11)**  
 $dy/dx$  is zero if the numerator is zero
- El Nombre (11 Jun 2009, 14:28:23)**  
So where  $\cos x$  is 0? Where  $x$  is  $\pi/2$
- El Nombre (11 Jun 2009, 14:28:45)**  
Or, I suppose, negative  $\pi/2$
- El Nombre (11 Jun 2009, 14:33:35)**  
How would I work out  $y$  in the above? Couldn't it be anything... as whatever it is is divided into 0.
- Mr Dye (11 Jun 2009, 14:36:24)**  
In ID 377, first find  $\sin x$ , then use the original equation to find  $\cos y$  and hence  $y$ .

The responsibility for moderating the conference and ensuring it is used appropriately remains with the teacher.

A key difference between forums and conferences is that conferences must happen in “real time”. In a conference, those participating must be simultaneously on-line, whereas a forum can be viewed and contributed to at any time. For this reason, a conference needs to be announced in advance, so those interested in contributing are aware of what time it will run. The best way to announce an upcoming conference is via the forum. You could create a forum specifically for announcements of your conferences.

## 13 Reference

In addition to material aimed closely at specification requirement, the site also includes reference material. Each page will include at the bottom a glossary explaining any key words appearing on that page. In addition the site includes a comprehensive interactive glossary, a set of biographies of key mathematicians, and tips and advice on examination technique.

### The Interactive glossary

The interactive glossary provides an A-Z of key terms in mathematics.

<b>A</b>	
<b>B</b>	
<b>C</b>	
<b>D</b>	
<b>E</b>	<b>edge</b> the line connecting two vertices of a graph, also known as arc or line.
<b>F</b>	
<b>G</b>	
<b>H</b>	
<b>I</b>	
<b>J</b>	
<b>K</b>	
<b>L</b>	
<b>M</b>	
<b>N</b>	
<b>O</b>	
<b>P</b>	
<b>Q</b>	

Associated with the glossary is a set of quizzes to test your knowledge. Here are excerpts from two of them:

**Question 3**

Match the following definition with one of the terms below it

The range that the test statistic must fall into for the null hypothesis not to be rejected.

- one-tailed test
- type I error
- two-tailed test
- null hypothesis
- acceptance region

**X**  
The correct answer is acceptance region

0 out of 10

[Continue](#)

**Question 1**

Match the following definition with one of the terms below it

Category: Calculus

a function,  $f(x)$ , such that for any two values  $a < b$ ,  $f(a) < f(b)$ .

- chain rule
- power series
- quotient rule
- increasing function
- decreasing function



**✓**  
Correct!

0 out of 10

[Continue](#)

## Mathematicians

To help develop your background knowledge of the subject an extensive collection of short biographies of key mathematicians is provided

<p><b>Galton</b></p>  <p>After studying mathematics at Cambridge University, medicine in Birmingham and London Francis Galton (1822-1911) spent some years exploring Africa; his eminence as an African explorer and geographer led to his election to the Royal Society in 1860. Galton became interested in the phenomena of heredity in the 1860s and most of his contributions to statistics arose out of that study. Apart from his books Hereditary Genius (1869) and Natural Inheritance (1889) he wrote many articles. His cousin Charles Darwin, whom he advised on statistical matters, was an important influence. Galton contributed a large number of terms to statistics, including many of those used in elementary statistics, e.g. ogive, percentile and inter-quartile range.</p>	<p><b>Gauss</b></p>  <p>Johann Carl Friedrich Gauss (1777 - 1855) was a German mathematician and scientist who contributed significantly to many fields, including number theory, statistics, analysis, differential geometry, geodesy, electrostatics, astronomy, and optics. Sometimes known as the princeps mathematicorum (Latin, usually translated as "the Prince of Mathematicians", although Latin princeps also can simply mean "the foremost") and "greatest mathematician since antiquity", Gauss had a remarkable influence in many fields of mathematics and science and is ranked as one of history's most influential mathematicians. Gauss was a child prodigy. There are many anecdotes pertaining to his astounding precocity while a mere toddler, and made his first ground-breaking mathematical discoveries while still a teenager. He completed Disquisitiones Arithmeticae, his magnum opus, in 1798 at the age of 21, though it would not be published until 1801. This work was fundamental in consolidating number theory as a discipline and has shaped the field to the present day.</p>
--	--

## Exam technique

Brief advice is included on how to approach your examinations, how they are marked and the language used in them.

### Examiner's speak

- write down, state  
You'll get the mark even if you show no working or method
- calculate, find, determine, show, solve, deduce, prove  
you must provide sufficient working to earn the method marks
- exact value  
your answer may involve fractions, surds, pi or some other mathematical constant; do not approximate and do not use decimals
- draw  
accuracy is required; use graph paper
- sketch  
a sketch does not require plotting, but key aspects should be shown carefully

### How to avoid getting zero marks

- Look for a word or phrase in the question that suggests a standard formula - quote that formula. Then try to use it.
- If the question is of the form: "Given A, B and C, show D"  
don't think about how to get D, instead think about A, B and C and apply rule 1
- Draw some kind of diagram or sketch - even if this is not asked for
- If the question is in parts and you can't do part (a), then look at part (b) - can you do that?
- Look through the whole question for any single part you can do - and do it.
- Don't cross anything out - unless you are ABSOLUTELY SURE it is wrong
- If the question says "state the..." or "write down the...", make a guess
- If totally stuck, leave it and come back later

## 14 Technical requirements

This site has been tested on a number of Operating Systems such as Windows, Mac OS X (10.3 onwards recommended) and Linux (Ubuntu), and web browsers such as IE (Internet Explorer), FireFox, Opera, Safari and Chrome. This testing will continue as new versions of browsers are published. The site also uses a wide range of methods of interactivity. Your browser will need to be enabled for Java and Javascript and must accept cookies. If you are in doubt about the set-up of your computer then use the option on the Help page to check your own computer system.

IE8 Users Please Note: We are aware of problems with the release version of IE8 that prevent the full display of some pages. If you are experiencing this problem please click the Compatibility View icon which you will find next to the address bar near the top of the IE8 browser - this will switch in IE7 compatibility. Alternatively, please use another web browser such as FireFox or any of the others mentioned above.

The image shows a window titled "Your computer" with a list of system components and their corresponding input fields. The components are: Web Browser, Operating System, Screen Resolution, JavaScript, Java Installed, Java Enabled, Cookies, and IP Address. Each component has a text input field next to it. At the bottom right of the window is a button labeled "Check Computer".