Edexcel International AS/A Level

Maths

Getting Ready to Teach

Event Code:

First teaching in 2018, first assessment 2019

Pearson Edexcel

Session Agenda

10:00 Introduction – outline – housekeeping

P1 and start of P2

11:20 – 11:35 Break

P2 continued

13:00 – 13:45 Lunch

P3

14:45 – 15:00 Tea

P4

16:00 Finish

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Aims and Objectives

During the day you will:

- Get an overview of the main changes in the new specification

- Explore possible teaching and learning strategies that may be employed for the new specification

- Look at Sample Assessments and Mark Schemes - Look at planning and organisation for the new specification

- Explore the support and resources available from Pearson to guide you through teaching the new specification

- Have the opportunity to network, discuss best practice and share ideas with other teachers.

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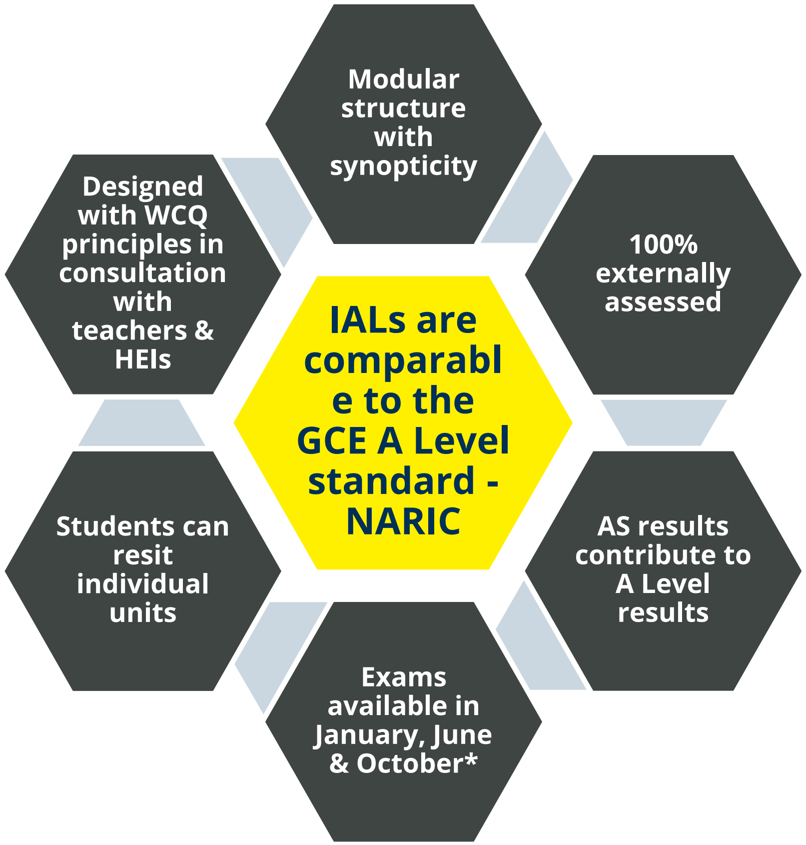
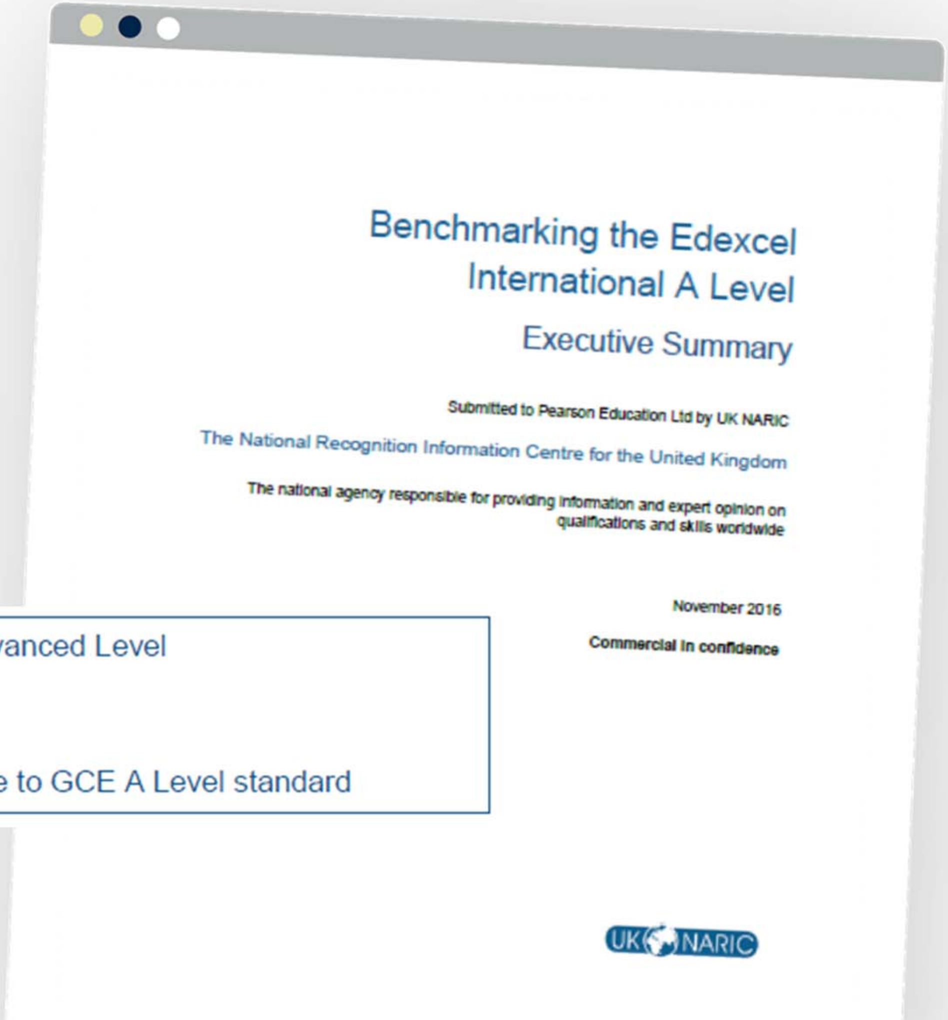
IAL Features

- International A Levels and AS Levels are created for International Students
- Globally recognised.



Updated NARIC report for Edexcel IAL

The executive summary confirms that Edexcel IALs are considered comparable to the GCE A Level standard following reforms to the UK regulated qualifications.


Benchmarking the Edexcel International A Level

Executive Summary

Submitted to Pearson Education Ltd by UK NARIC

The National Recognition Information Centre for the United Kingdom

The national agency responsible for providing information and expert opinion on qualifications and skills worldwide

November 2016

Commercial in confidence

UK NARIC

Qualification:	Edexcel International Advanced Level
Awarding Institution:	Pearson Education Ltd
Comparability:	Is considered comparable to GCE A Level standard

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IAS & IAL subjects

Biology	Chemistry	Physics	Mathematics	Further Mathematics
Pure Mathematics	Information Technology	Business	Economics	Accounting
English Language	English Literature	History	Geography	Psychology
Arabic	French	German	Greek	Spanish
		Law (IAL only)		

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World-class qualifications

All Edexcel qualifications are developed to meet Pearson's **World Class Qualification design principles**

Endorsement of educational **thought-leaders and assessment experts** from across the globe

Developed using an understanding and benchmarking of **all educational systems**

Qualifications that support young people to **develop the capabilities** they need to **progress** and prosper in their lives

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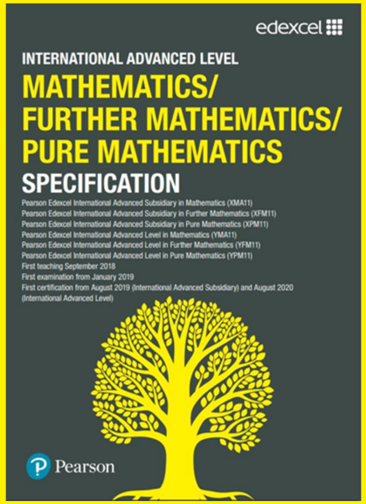
IAL 2018 Mathematics

Mathematics | Further Mathematics | Pure Mathematics

Reviewed and updated in light of GCE A level changes	Pure Mathematics content in 4 units	5 optional routes to achieve qualification
14 equally weighted units	Transferable Skills embedded	Fully modular Examinations three times a year AS contributes to A level
Dedicated textbooks are currently in production	TeachingMaths @pearson.com	



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Important information

- The Statistics, Mechanics and Further Pure Maths unit codes in the

Unit name	2018 Code
P1	WMA11
P2	WMA12
P3	WMA13
P4	WMA14
D1	WDM11
M1	No change
M2	No change
M3	No change
S1	No change
S2	No change
S3	No change
FP1	No change
FP2	No change
FP3	No change

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Structure of the qualification

- **IAL AS Mathematics**
  - Compulsory units
- P1 (WMA11/01) P2 (WMA12/01)
  - (each 90 minutes) (each 75 marks)

- Plus **one** of the following:
- D1 (WDM11/01), M1 (WME01/01), S1(WST01/01)

Requires knowledge of P1, P2 and 2D vectors

- (each 90 minutes) (each 75 marks)

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Structure of the qualification

- **IAL A2 Mathematics**
- Compulsory modules
- P1 (WMA11/01) P2 (WMA12/01)
- P3 (WMA13/01) P4 (WMA14/01)
- (each 90 minutes) (each 75 marks)

- Plus **one** of the following combinations:
- D1 + M1 or D1 + S1 or M1 + S1
- or M1 + M2 or S1 + S2
- (each 90 minutes) (each 75 marks)

Structure of the qualification

The course of study can be taught and assessed as:

- Distinct units with assessments taken at appropriate stage.

OR

- A linear course assessed in its entirety at the end.

Assessments will be available in Jan & June plus October in these units (Pure Maths, Mechanics 1 & 2 and Statistics 1 & 2)

First assessment of new units:

P1	Jan 2019
P2	June 2019
D1	June 2019
P3	Jan 2020
P4	June 2020

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Structure of the qualification

- All units allow the use of a suitable calculator.

Calculators must not:

- be designed or adapted to offer any of these facilities:
  - language translators
  - symbolic algebraic manipulation
  - symbolic differentiation or integration
  - communication with other machines or the internet
- be borrowed from another candidate during an examination for any reason*
- have retrievable information stored in them. This includes:
  - databanks
  - dictionaries
  - mathematical formulae
  - text.

However, an invigilator can give a candidate a calculator

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Structure of the qualification

- Why has the course changed?

The **content** has changed **slightly** in response to new thinking in the UK, especially in terms of:

Realising the importance of proof in mathematics

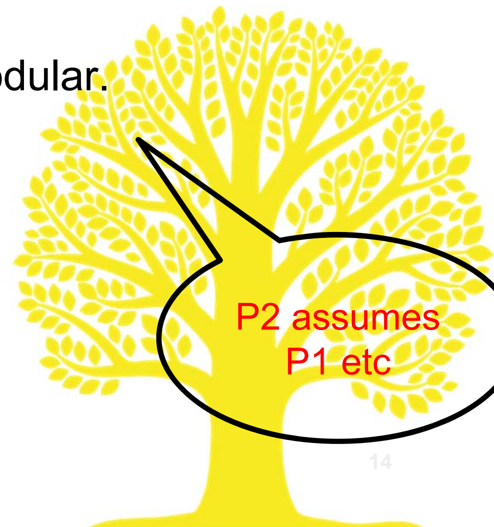
Realising the importance of problem solving skills in mathematics

Using mathematics in a more sophisticated way in modelling

With a significant impact on GCE A level

The assessment design has changed in **response to our centres**

Centres can decide whether to treat the course as linear or modular.
There are now 3 opportunities in the year to take most units.



P2 assumes P1 etc

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Structure of the qualification

- Proof lies at the very heart of 'pure' mathematics. Students should be taught to appreciate what a proof means in mathematics.
-
  The 2018 course now allows all students to experience the power of deductive proof.

- P2 – Section 1 - AS
- P4 – Section 1 - A

Who could not have their interest raised by the story of the (very) young Gauss finding the sum of the first 100 natural numbers in his head?

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Structure of the qualification

Modelling is the essence of ‘applied’ mathematics.
In the spirit of understanding by doing and by analysing, the course contains opportunities for both, especially in well-known and important contexts such as population change and differential equations. **The new course will address this in the same way as the current course.**

Much of the previous course with C12 and C34 did address all the aspects on this slide and the previous two and as such the amount of change in content of the new, 2018, course is **relatively modest.**

There are NO changes in the content of M1, S1, M2 and S2.

There are a **small number** of changes in the content of D1.

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Structure of the qualification

- Mathematics is about solving problems.
  Some of these ‘problems’ are relatively straightforward to solve, whilst others, either because of unfamiliarity, or complexity are very difficult.
- The following characteristics appear in problems (although not all in the same problem!)

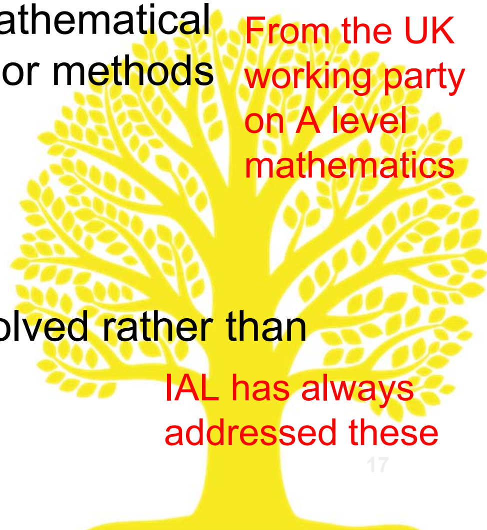
A. Tasks that have little or no scaffolding: there is little guidance given to the student beyond a start point and a finish point. Questions do not explicitly state the mathematical process(es) required for the solution.

B. Tasks that provide for multiple representations, such as the use of a sketch or a diagram as well as calculations.

C. The information is not given in mathematical form or in mathematical language; or there is a need for the results to be interpreted or methods evaluated, for example, in a real-world context.

D. Tasks have a variety of techniques that could be used.

E. The solution requires understanding of the processes involved rather than just application of the techniques.



From the UK working party on A level mathematics

IAL has always addressed these

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Problems and examples in this presentation

Edexcel exam questions undergo a rigorous process before any student sees the examination paper.
In several slides in this presentation the language and style are not fully that of the exams – indeed there are some problems that would not do at all as exam questions but do have a use as a teaching application.

The questions themselves are indicative also of the range that students should see in class. They are not intended in any way as a 'pointer' to examination questions.
The Edexcel team will be producing material which teachers will be able to use to support their teaching – especially of the new topics.

Exercises and activities in this presentation

There are several activities in this presentation.

Some are as material for delegates to engage with some mathematics, which may be unfamiliar.

In all of the activities delegates are encouraged to discuss with colleagues such issues as:

- Alternative methods of solution
- Teaching implications
  Demand
- How activities/tasks/questions could be adapted to suit a delegate’s students.

P1

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Introduction to the Assessment P1

Content

Algebra and functions
Coordinate geometry in the (x, y) plane
Trigonometry
Differentiation
Integration

Assessment Objectives / Skills Tested

AO1 recall. select and use mathematics
AO2 construct rigorous mathematical arguments and proofs.
AO3 recall select and use standard mathematical models
AO4 comprehend mathematical contexts and arguments
AO5 use calculators and other resources

Structure of Assessment

One end of unit test
All questions compulsory
90 minutes
75 marks

P1 Content

- What's new:

  1.5 Solution of quadratic equations by calculator

  1.7 Interpret linear* and quadratic inequalities graphically.

  1.8 Represent linear* and quadratic inequalities graphically.

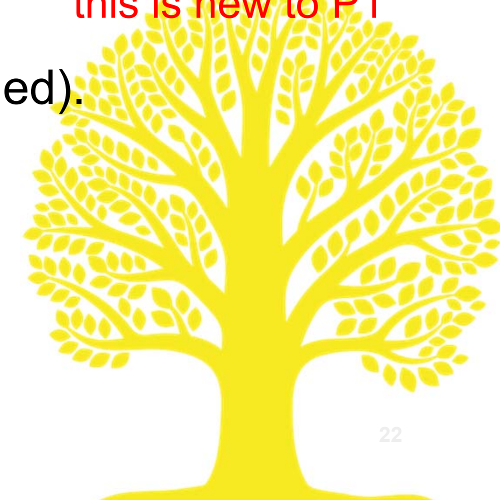
  Also, clarification about:

  3.1 The ambiguous case of the sine rule. (Included).

  5.2 Integration of x^{-1} (specifically excluded.)

Where working has to be shown, this will be signalled

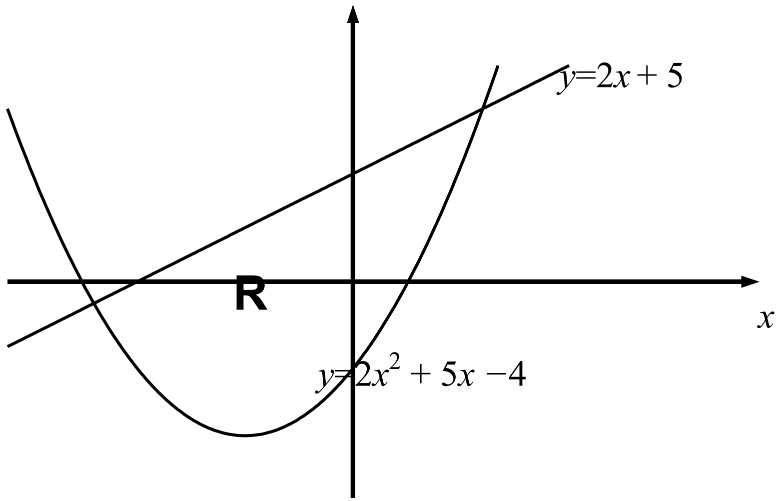
*Linear inequalities have always been assessed in D1, but this is new to P1"



P1 Content

- What's new

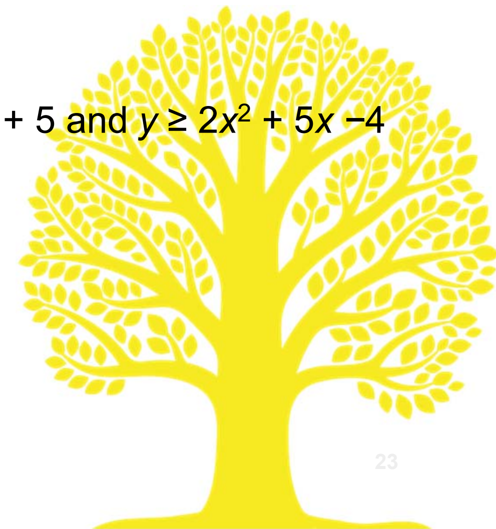
1.7 Interpret linear and quadratic inequalities graphically.



R is the region bounded by the line $y = 2x + 5$ and the curve $y=2x^2 + 5x - 4$ where the solid lines indicate that the inequalities are not strict

So $y \leq 2x + 5$ and $y \geq 2x^2 + 5x - 4$

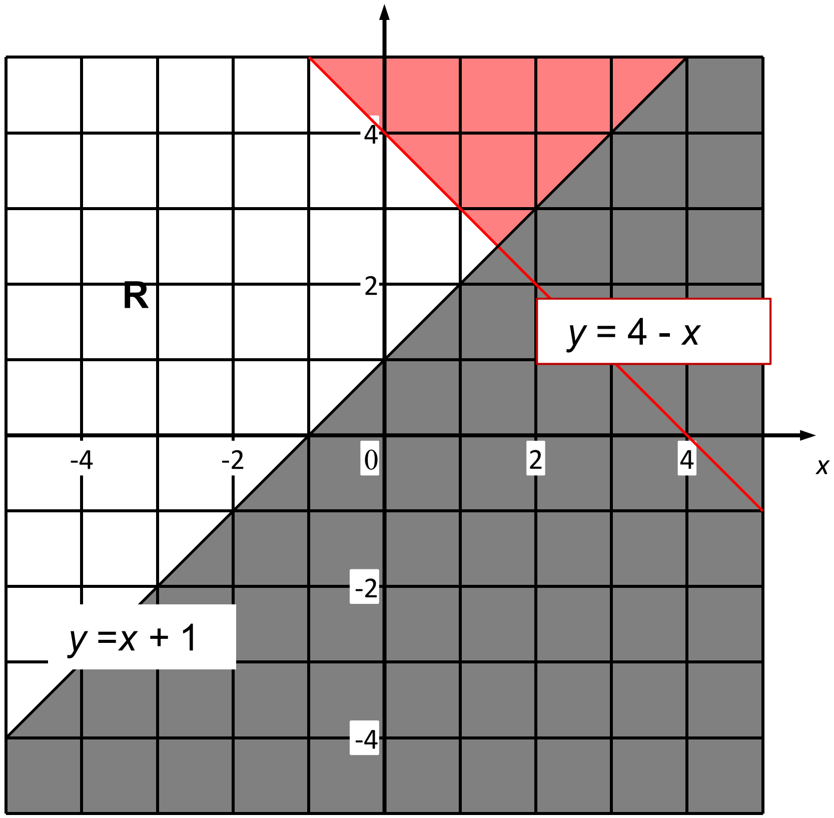
Relate this to the solution of $2x^2 + 5x - 4 \leq 2x + 5$



P1 Content

- What's new

1.8 Represent linear and quadratic inequalities graphically.



To be consistent with D1, a required region should be shown by shading out

e.g. Show and label the region **R** that has all points (x, y) satisfying both the inequalities
$y \leq 4 - x$ and
$y \geq x + 1$

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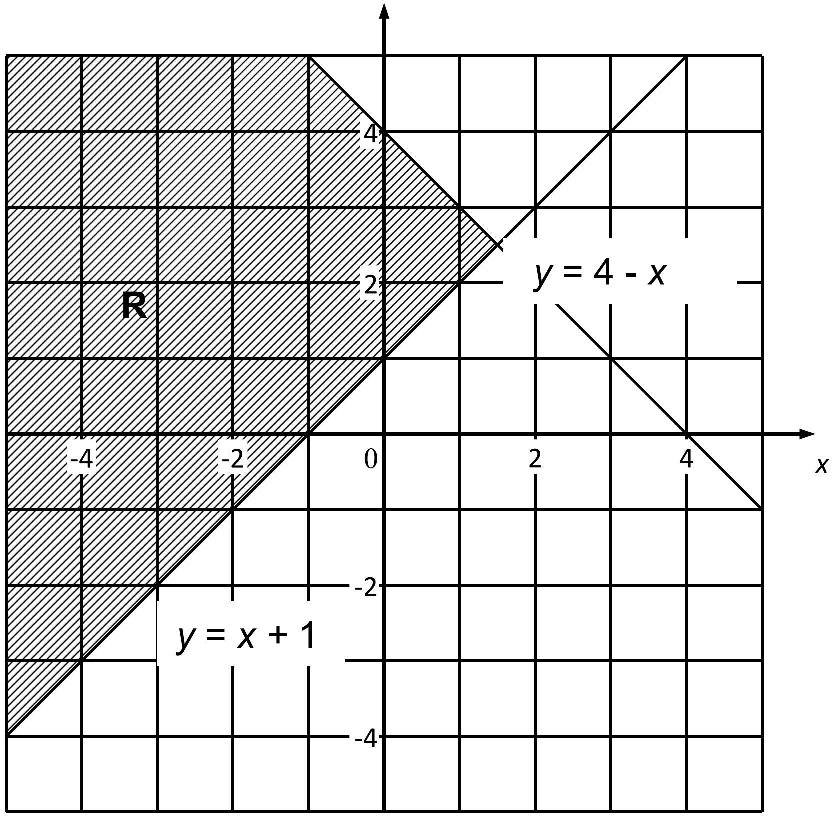
P1 Content

- What's new

1.8 Represent linear and quadratic inequalities graphically.



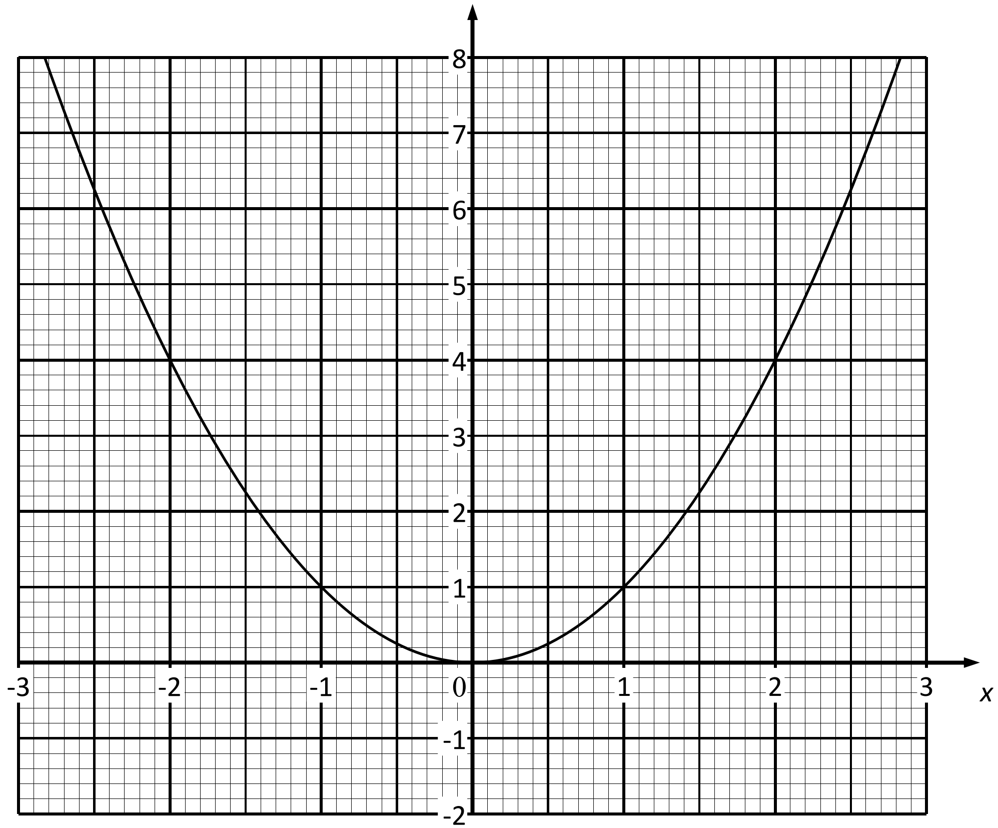
However, shading in would also be acceptable.

e.g. Show and label the region **R** that has all points (x, y) satisfying both the inequalities
$y \leq 4 - x$ and
$y \geq x + 1$

P1 Content

What's new?

- 1.8 Represent linear and quadratic inequalities graphically.



This includes inequalities with brackets and fractions. These would be reducible to linear or quadratic inequalities

An accurate graph of the curve $y = x^2$ has been drawn on the grid.

By drawing a suitable straight line on the grid solve

$$\frac{2}{x} < 1$$

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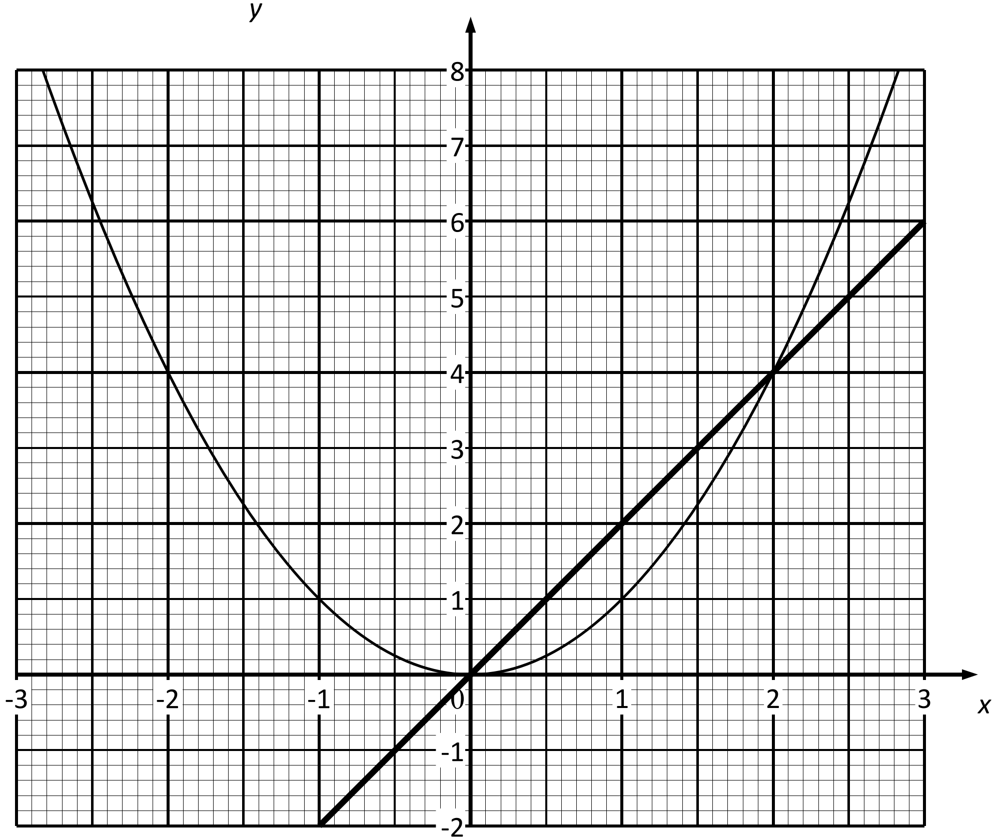
P1 Content

What's new?

- 1.8 Represent linear and quadratic inequalities graphically.

This includes inequalities with brackets and fractions. These would be reducible to linear or quadratic inequalities



By drawing a suitable straight line on the grid solve

$$\frac{2}{x} < 1$$

Multiply both sides by x^2

$$2x < x^2$$

So we look at where the line is below the curve.

$x < 0$ or $x > 2$

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P1 Content

- Any comments on the previous slide(s)?

P1 Content

Activity 1 Questions to discuss – issues

Graphs and quadratic and linear inequalities
– resources
– teaching implications

You can summarise on the response sheet.

P2

Introduction to the Assessment P2

Content	Assessment Objectives / Skills Tested	Structure of Assessment
Proof Algebra and functions Coordinate geometry in the (x, y) plane Sequences and series Exponentials and logarithms Trigonometry Differentiation Integration	AO1 recall. select and use mathematics AO2 construct rigorous mathematical arguments and proofs. AO3 recall select and use standard mathematical models AO4 comprehend mathematical contexts and arguments AO5 use calculators and other resources	One end of unit test All questions compulsory 90 minutes 75 marks

P2 Content

- Knowledge of the contents of P1 is required and may be tested

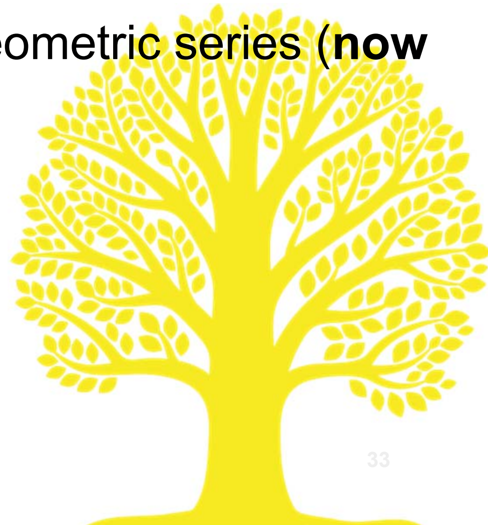
P2 Content

- **What's new**

2.1 Simple algebraic division, use of Factor Theorem and Remainder Theorem.
Now extended to divisors of the form $(ax + b)$ and $(ax - b)$

4.3 Increasing sequences, decreasing sequences and periodic sequences

4.4 Use of logs to find the value of n given the sum of a geometric series (**now explicit**)



Continued

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P2 Content

- **What's new – Content moved from C34 into P2**

1.1 Proof; understand and use the structure of mathematical proof proceeding from given assumptions through a series of logical steps to a conclusion.

1.2 Proof by exhaustion

1.3 Disproof by counter example.

8.3 Use of increasing number of trapezia to improve accuracy and an estimate of the error may be required.

8.2 Find, using integration, the area between two curves.

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P2 Content

- Exploring the proof section

1.1 Proof; understand and use the structure of mathematical proof proceeding from given assumptions through a series of logical steps to a conclusion.

Both the proof of the sum of an arithmetic series and the sum of a geometric series have always been explicitly mentioned in the C12specification………

Proof of the Factor Theorem, the Remainder Theorem are not – so should the proofs be taught?

Proofs that build on work done for IGCSE, for example

Given that any natural number can be written as $3n$ or $3n + 1$ or $3n + 2$, where $n \in \mathbb{N}$, show that any square number is either a multiple of 3 or leaves a remainder of 1 when divided by 3

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P2 Content

- Exploring the proof section

  1.2 Proof by exhaustion.

Usually, but not always deals with trying all the options explicitly.

Given that x, y are odd positive integers less than 7, show their sum is always even

x	y	x + y	Even?
1	1	2	✓
1	3	4	✓
1	5	6	✓
3	3	6	✓
3	5	8	✓
5	5	10	✓

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P2 Content

- Exploring the proof section

1.2 Proof by exhaustion.

Here is a more sophisticated example.

Show that no square number has a units digit of 3

n	0	1	2	3	4	5	6	7	8	9
n^2	0	1	4	9	(1)6	(2)5	(3)6	(4)9	(6)4	(8)1

The table shows the units digit of the squares of the numbers from 0 to 9.
We can use this to prove the statement.

We would need to add a little more on why we just have to consider the units digit.

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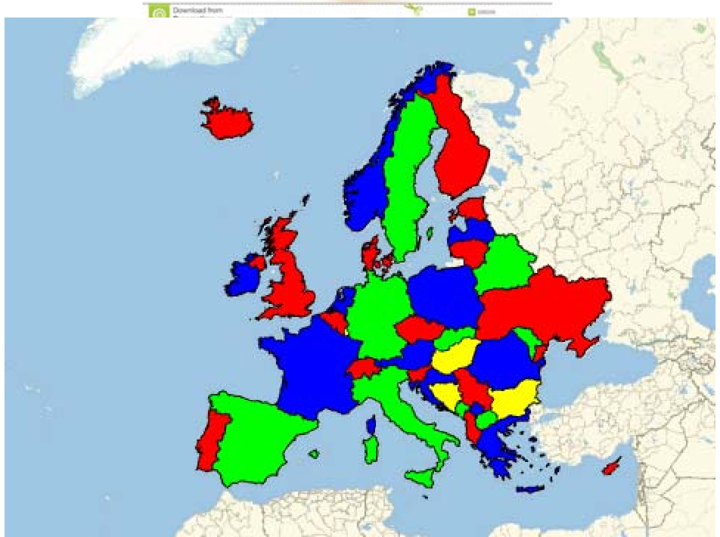
P2 Content

- Exploring the proof section (just for interest)

1.2 Proof by exhaustion has been used in some recent remarkable proofs (using computers to do the brute force checking).

Hales showed that the most efficient way to stack oranges is what greengrocer’s know already.



Appel et al proved the 4 colour theorem by reducing maps to over 1000 cases and writing a program to test each case in turn.

P2 Content

- Exploring the proof section (just for interest)

1.2 Disproof by counter example..

This involves disproving a ‘theorem’ by providing at least one case where the theorem is shown to be untrue.

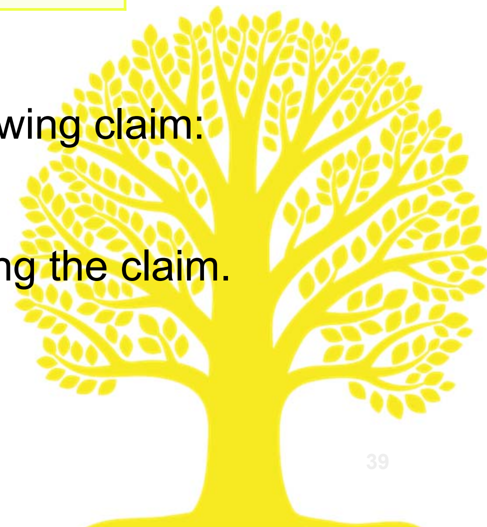
Consider $P(n) = n^2 + n + 41$

n	0	1	2	3	4	5	6	7	8	9
$P(n)$	41	43	47	53	61	71	83	97	113	131

All the values of P(n) in the table are prime. So we make the following claim:
P(n) is a prime number for all $n \in \mathbb{N}$

Give an obvious value of n for which P(n) is not prime, thus refuting the claim.

Now give a not so quite obvious value.



P2 Content

- Exploring the proof section (just for interest)

1.2 Disproof by counter example..

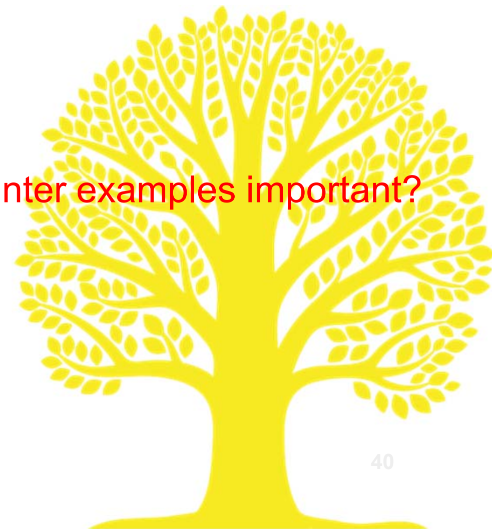
Fermat's Last Theorem

$x^n + y^n = z^n$ has no non-trivial integer solutions

A conjecture of the great Euler was that the correct generalisation of Fermat's last theorem was $x^3 + y^3 + z^3 = w^3$ has solutions in integers, but $x^4 + y^4 + z^4 = w^4$ does not.

However, this monster was found in 1988:
(and is the smallest possible counterexample)

$95800^4 + 217519^4 + 414560^4 = 422481^4$



Why are counter examples important?

P2 Content

- Exploring the proof section (just for discussion)

1.2 Disproof by counter example.

Find a counter example to the conjecture that all natural numbers can be written as the sum of natural numbers.

Can you then modify the conjecture so that you are (more) confident it is a theorem?

P2 Content – An example or two to work on

- The hand out has some examples for you to work through and discuss.

- Which, if any, would you use to motivate/engage your class?
- Which are the best exemplars?
- Which are too easy/ too hard?

Activity 2 Work on the proofs

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P2 Content – An example or two to work on

- The hand out has some examples for you to work through and discuss.
- Which, if any, would you use to motivate/engage your class?
- Which are the best exemplars?
- Which are too easy/ too hard?

Activity 2 Work on the proofs

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

$(x-y)(x+y)=1\times p$ so $x-y=1, \quad x+y=p$

$$x=\frac{p+1}{2}, \quad y=\frac{p-1}{2}$$

Since p is odd, both x and y are integers

What about writing even numbers as a difference of squares?

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P2 Content – An example or two to work on

- The hand out has some examples for you to work through and discuss.
- Which, if any, would you use to motivate/engage your class?
- Which are the best exemplars?
- Which are too easy/ too hard?

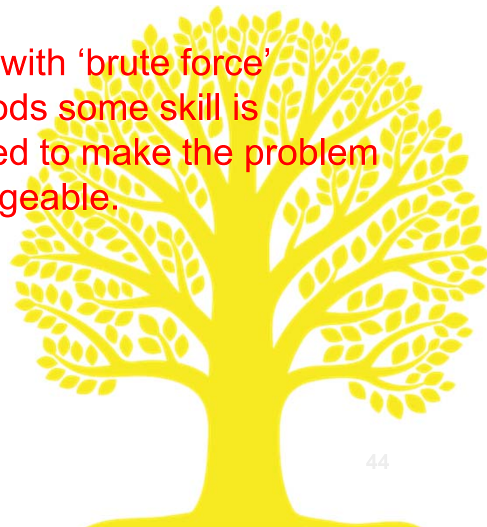
Activity 2 Work on the proofs

4

x	$y=\sqrt{24-x^2}$	
1	$\sqrt{23}$	×
2	$\sqrt{20}$	×
3	$\sqrt{15}$	×
4	$\sqrt{8}$	×
5	×	×

The x values have been listed systematically.

Even with ‘brute force’ methods some skill is needed to make the problem manageable.



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P2 Content – An example or two to work on

- The hand out has some examples for you to work through and discuss.
- Which, if any, would you use to motivate/engage your class?
- Which are the best exemplars?
- Which are too easy/ too hard?

Activity 2 Conclusions so far?

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P2 Content

2.1 Simple algebraic division, use of Factor Theorem and Remainder Theorem.
Now extended to divisors of the form ($ax + b$) and ($ax – b$)

Show that ($3x – 4$) is a factor of $P(x) = 3x^3 - 10x^2 – x + 12$

Without any further statement this could be done by theFactor Theorem or by division

$$P\left(\frac{4}{3}\right) = 3 \times \left(\frac{4}{3}\right)^3 - 10 \times \left(\frac{4}{3}\right)^2 - \frac{4}{3} = 12$$

$$P\left(\frac{4}{3}\right) = \frac{64 - 160 - 12}{9} + 12 = 0$$

Therefore, (3x – 4) is a factor

What interesting things could students then go on to do?

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P2 Content

2.1 Simple algebraic division, use of Factor Theorem and Remainder Theorem.
Now extended to divisors of the form $(ax + b)$ and $(ax - b)$

Show that $(3x - 4)$ is a factor of $P(x) = 3x^3 - 10x^2 - x + 12$

$P(x) = (3x - 4)(x^2 \;\ldots\ldots\; -3)$

$P(x) = (3x - 4)(x^2 - 2x - 3)$

$P(x) = (3x - 4)(x - 3)(x + 1)$

Full factorisation can then be done by inspection

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P2 Content

4.3 Increasing sequences, decreasing sequences and periodic sequences

A sequence u_n is increasing if $u_{n+1} > u_n$ for all n

So 1, 3, 5, …….

A sequence u_n is decreasing if $u_{n+1} < u_n$ for all n

So 100, 50, 25, …….

A sequence u_n is periodic if $u_{n+k} = u_n$ for all n

k will be the <u>period</u> if it is the least number for which $u_{n+k} = u_n$

P2 Content

4.3 Increasing sequences, decreasing sequences and periodic sequences

A sequence u_n is periodic (of period k) if $u_{n+k} = u_n$ for all n

The sequence $u_{n+1} = \dfrac{1}{u_n}$ with $u_1 = u$ ($\neq 0$) has u, $1/u$, u, … is periodic ($k = 2$)

The sequence $u_{n+1} = 7 - u_n$ is periodic ($k = 2$) when $u_1 = u$

Show that the sequence $u_{n+1} = a - u_n$ is periodic

P2 Content

4.4 Use of logs to find the value of *n* given the sum of a geometric series (now explicit)

This is not so much new as an important use of logs that has been a weakness – see previous examiner reports and Edexcel feedbacks.

The first term of a geometric series is 6 and the common ratio is 0.92.

June 2016 C12 Q9

The sum to *n* terms of this series is greater than 72.

(*b*) Calculate the smallest possible value of *n.* **(4)**

$$6\frac{(1-0.92^n)}{1-0.92} > 72 \Rightarrow 0.92^n < 0.04$$

$$n\log 0.92 < \log 0.04$$

$$n > \frac{\log 0.04}{\log 0.92} = 39$$

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P2 Content

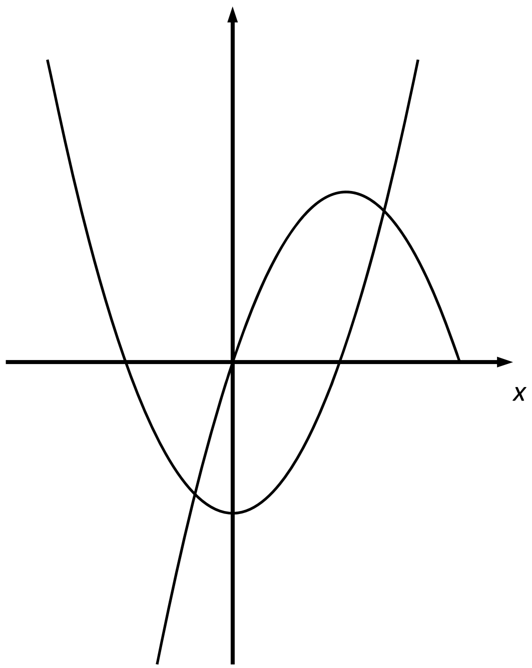
The new specification has $(a + bx)^n$ as its main heading

Again this is essentially a clarification

$n = 0, 1, 2, 3, \ldots\ldots\ldots$

P2 Content

8.2 Find, using integration, the area between two curves



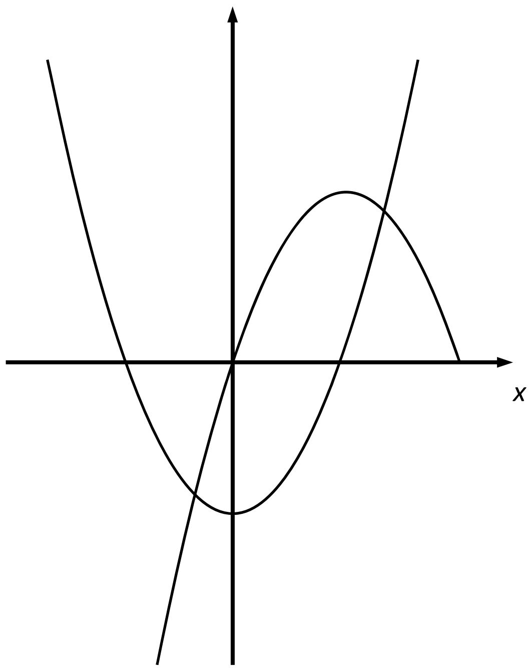
The sketch shows parts of the graphs of
$y = 3x - x^2$ and
$y = x^2 - 2$

Find, using calculus, the area of the finite region bounded by the two curves.

How could we structure this question to make it more accessible?

P2 Content

8.2 Find, using integration, the area between two curves



The curves intersect at the solutions

$3x - x^2 = x^2 - 2 = y$

$x = 2$ or $x = -\frac{1}{2}$

$$\int_{-\frac{1}{2}}^{2} (3x - x^2 - [x^2 - 2])\mathrm{d}x$$

$$= \int_{-\frac{1}{2}}^{2} (2 + 3x - 2x^2)\mathrm{d}x$$

$$= \left[2x + \frac{3}{2}x^2 - \frac{2}{3}x^3\right]_{-\frac{1}{2}}^{2} = \frac{125}{24}$$

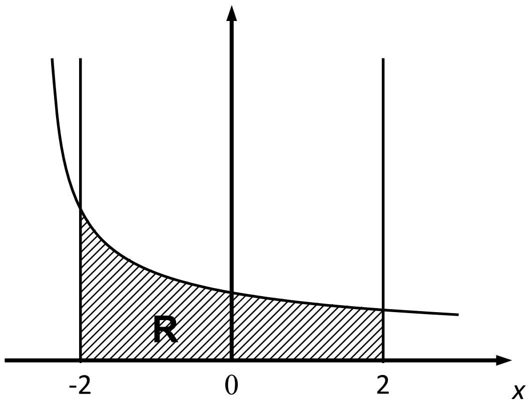
How could we structure this question to make it more accessible/less accessible?

Pearson Edexcel

P2 Content

This was in C34

8.3 Use of increasing number of trapezia to improve accuracy and an estimate of the error may be required.



The figure shows a sketch of part of the curve C, with equation

$$y = \frac{1}{\sqrt{2x+5}}$$

The finite region **R** shown shaded is bounded by C, the *x*-axis and the lines *x* = ±2

x	-2	-1	0	1	2
$y = \frac{1}{\sqrt{2x+5}}$	1		0.4472		0.3333

(a) Complete the table.

(b) Use the trapezium rule to find an estimate of the area of **R**.

(c) Given that the exact area of **R** is 2, work out an estimate of the error.

In the exam the language is much more precise!

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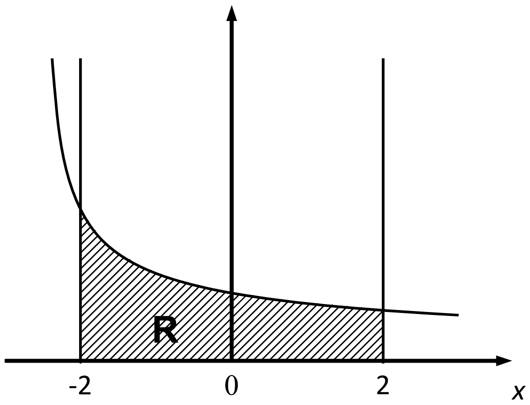
P2 Content

8.3 Use of increasing number of trapezia to improve accuracy and an estimate of the error may be required.



x	y	x	y
-2	1	-2	1
-1	0.57735	-1.5	0.707107
0	0.447214	-1	0.57735
1	0.377964	-0.5	0.5
2	0.333333	0	0.447214
	2.069195	0.5	0.408248
		1	0.377964
		1.5	0.353553
		2	0.333333
			2.019052

In this case doubling the number of strips reduces the error from about 3½% to about 2%

If you are faced with the question does doubling the number of strips half the error, how would you answer it?

Geometrically more strips leads to a lower error because ………

However, we must be careful when increasing the number of strips because…..

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P2 Content

Activity 3
There are 5 or 6 questions based on P2 (but only one proof!).
You will need your copy of the specification.

Please think about the following:

Which sections of the specification do students need to know to do the question?
Is the question suitable (with rigorous wording etc) for a written examination?
Is the question better suited to classroom use?
Avoid this question!

For Q4, please write a suitable mark scheme.

Pearson Edexcel

P2 Content

Activity 3
There are 5 or 6 questions based on P2 (but only one proof!).
You will need your copy of the specification.

Please think about the following:

3 $\mathrm{P}(x) = ax^3 + bx^2 + cx + d$ $\qquad$ $\mathrm{P}(n) = an^3 + bn^2 + cn + d = 0$

$d = -n(an^2 + bn + c)$ QED

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P2 Content

Activity 3
There are 5 or 6 questions based on P2 (but only one proof!).
You will need your copy of the specification.

Please think about the following:

6 (a) Sequence is 5 3 5 3 5…..

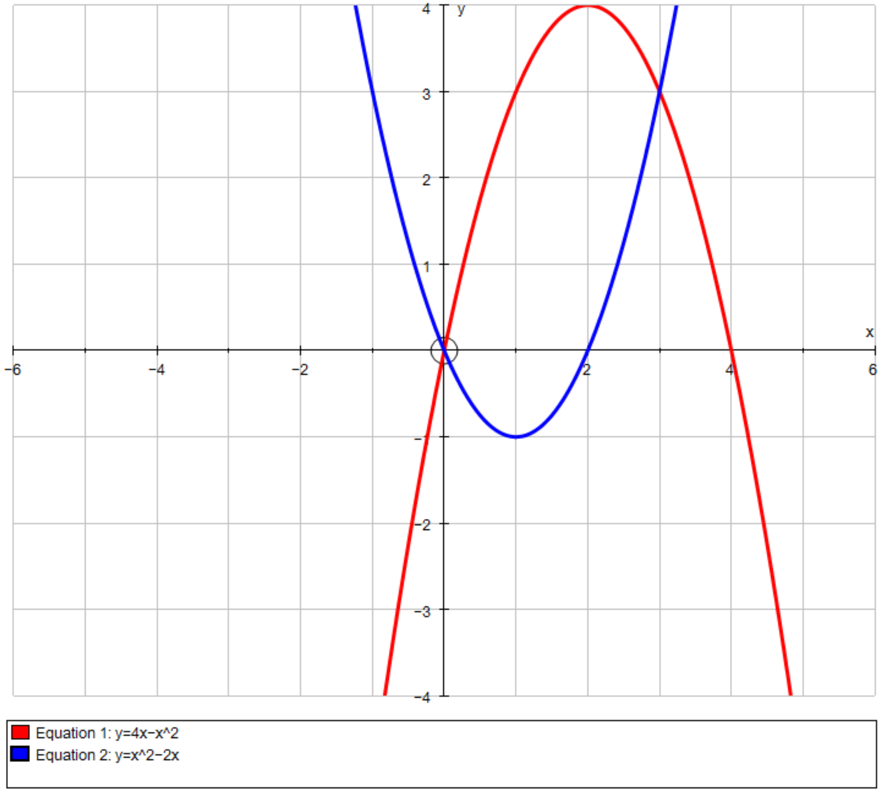
(b) Suppose $x_1 = x$ $\qquad x_2 = 2 + \dfrac{3}{x-2}$ $\qquad x_3 = 2 + \dfrac{3}{x_2 - 2} = 2 + \dfrac{3}{2 + \dfrac{3}{x-2} - 2}$

$x_3 = 2 + \dfrac{3}{\dfrac{3}{x-2}} = 2 + x - 2 = x$ QED

P2 Content

Area between two curves.
Are there any issues in a case such as the one shown?

Find, by integration, the area of the finite region between $y = 4x - x^2$ and $y = x^2 - 2x$



P3

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Introduction to the Assessment P3

Content	Assessment Objectives / Skills Tested	Structure of Assessment
Algebra and functions Trigonometry Exponentials and logarithms Differentiation Integration Numerical methods	AO1 recall. select and use mathematics AO2 construct rigorous mathematical arguments and proofs. AO3 recall select and use standard mathematical models AO4 comprehend mathematical contexts and arguments AO5 use calculators and other resources	One end of unit test All questions compulsory 90 minutes 75 marks

Pearson

P3 Content

Knowledge of the contents of P1 and P2 is required and may be tested.

The content of C12 was always required for C34, so the fact that the knowledge of P1 and P2 is needed for P3 follows the same philosophy.

P3 Content

- What's new

1.3 The modulus function. The use of sketch graphs as an aid to solving equations of the form $|f(x)| = g(x)$ and inequalities of the form $|f(x)| > g(x)$ where f and g are linear.

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = ab^x$

4.1 Differentiation of e^{kx} , ln *kx*, sin *kx*, cos *kx*, tan *kx* is an **explicit** section

4.4 Understand and use exponential growth and decay. Students should be familiar with terms such as 'initial' and be able to explore behaviour for large values of *t* or to consider whether the range of values predicted is appropriate.

4.4 Understand and use exponential growth and decay. Consideration of a second improved model may be required.

For 4.4 the second sentence is there for clarification

Continued……

P3 Content

- What's new

5.1 Integration of e^{kx} , sin kx, cos kx and $1/x^n$ **explicitly** given

5.2 Integration by recognition of known derivatives

$$\int f'(x)[f(x)]^n \, dx = \frac{[f(x)]^{n+1}}{n+1} + c$$

Pearson Edexcel

P3 Content

- What's new

1.3 The modulus function. The use of sketch graphs as an aid to solving equations of the form $|f(x)| = g(x)$ and inequalities of the form $|f(x)| > g(x)$ where f and g are linear.

(a) Sketch the graphs of $y = |2x - 3|$ and $y = x + 1$ on the same axes.
(b) Use your sketch to solve $|2x - 3| < x + 1$

(c) For the equation $|2x - 3| = kx + 1 \quad k \in \mathbb{R}$

what is the relationship between the number of real solutions and the value of k?

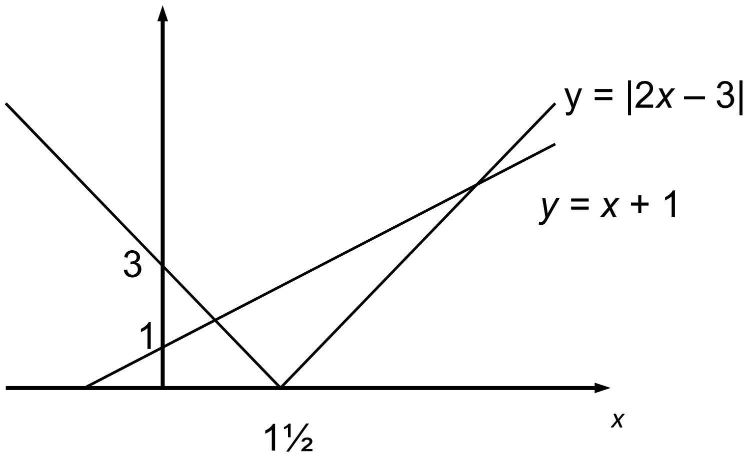
Pearson Edexcel

P3 Content

- What's new

(a) Sketch the graphs of $y = |2x - 3|$ and $y = x + 1$ on the same axes.

(b) Use your sketch to solve $|2x - 3| < x + 1$



Possible approaches for (b)?

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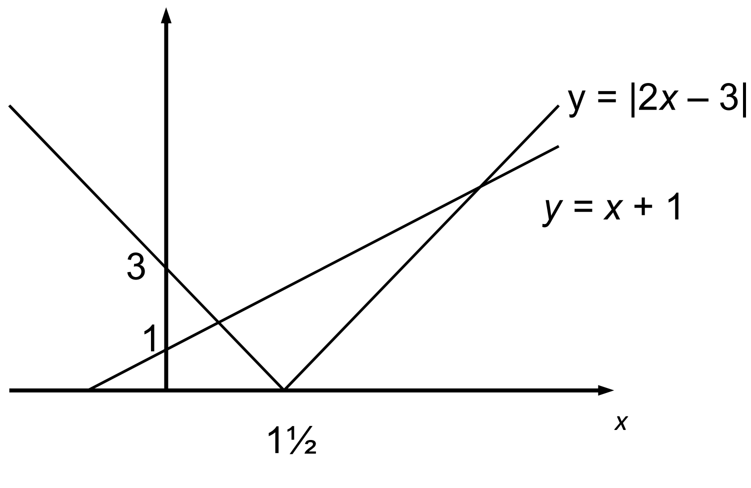
P3 Content

- What's new



Possible approaches for (b)?

Mine is for $x > 1.5$ we consider

$x+1 = 2x - 3 \Rightarrow x = 4$ ✓

For $x < 1.5$ we consider

$x+1 = -(2x - 3) \Rightarrow x = 2/3$ ✓

So $2/3 < x < 4$

An alternative which will work here is to square both sides and the roots of the resulting quadratic are the critical values.

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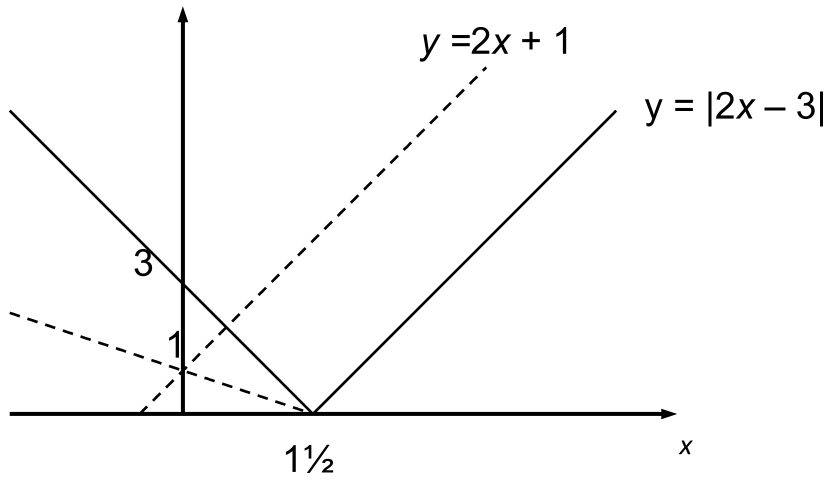
P3 Content

- What's new

(c) For the equation $|2x - 3| = kx + 1 \quad k \in \mathbb{R}$

what is the relationship between the number of real solutions and the value of *k?*



I've marked some relevant straight lines which have a bearing on the question.

So for $k > 2$ there is 1 real solution

What about the other values of k ?

P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form

$y = ax^n$ and $y = ab^x$

$y = ax^n$
$\log y = \log a + n\log x$

$Y = \log a + nX$

Gives a straight line graph in the (X, Y) plane with gradient n and intercept on the y-axis of $\log a$

My scientist colleagues seem to prefer common to natural logs

What are the teaching issues, if any, with using common instead of natural logarithms?

$y = ab^x$
$\log y = \log a + x\log b$

$Y = \log a + x\log b$

Gives a straight line graph in the (x, Y) plane with gradient $\log b$ and intercept on the Y-axis of $\log a$

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P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form
$y = ax^n$ and $y = ab^x$

$y = ab^x$
$\log y = \log a + x\log b$

$Y = \log a + x\log b$

Gives a straight line graph in the (x, Y) plane with gradient $\log b$ and intercept on the Y-axis of $\log a$

Of course, the points could be plotted directly onto semilog graph paper – but this is not required for the exam or tested.

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P3 Content

Power laws are common in nature

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$

A company make models in different sizes of an iconic building.
The table gives information about the costs and heights of the models.

Height(h cm)	10	15	20	30	50
Cost (\$$y$)	3	8	20	70	300

Trip Advisor

Assuming the relationship between cost (\$y) and height (h cm) is $y = ah^n$

(a) draw a suitable straight line graph

(b) Use your graph to find an estimate for n and an estimate for a.

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P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$

Height(h cm)	**10**	**15**	**20**	**30**	**50**
Cost (\$$y$)	3	8	20	70	300

Log h	1.00	1.18	1.30	1.48	1.70
Log y	0.40	0.93	1.30	1.83	2.49

$y = ah^n$

$\log y = \log a + n\log h$

$Y = \log a + nX$

Gives a straight line graph in the (X, Y) plane with gradient n and intercept on the y-axis of $\log a$

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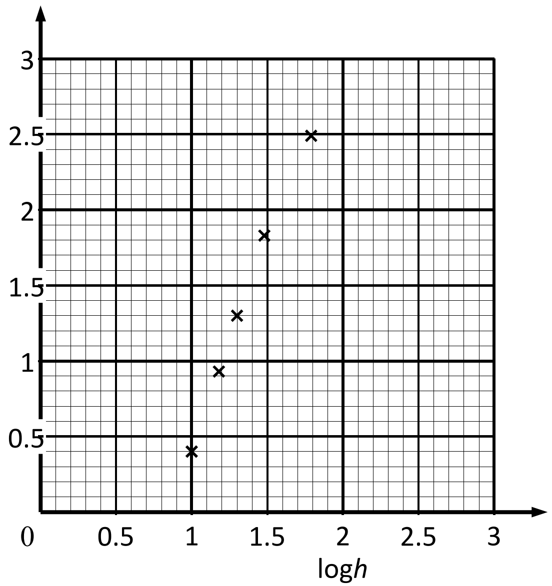
P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$

Log *h*	1.00	1.18	1.30	1.48	1.70
Log *y*	0.40	0.93	1.30	1.83	2.49



$y = ah^n$

$\log y = \log a + n\log h$

$Y = \log a + nX$

Gives a straight line graph in the (X, Y) plane with gradient n and intercept on the y-axis of $\log a$

The points lie near to straight line.
Draw the best straight line by judgment

It will not be possible to read of the intercept on the log y axis from the graph…….

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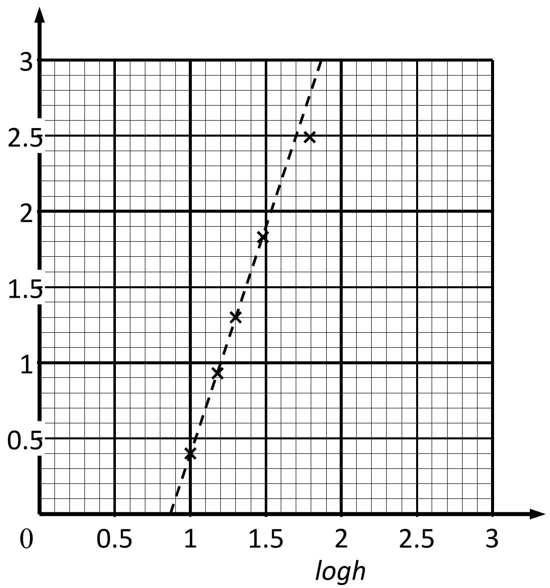
P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form

$y = ax^n$ and $y = ab^x$

Log h	1.00	1.18	1.30	1.48	1.70
Log y	0.40	0.93	1.30	1.83	2.49



Gradient = $\dfrac{2.5-0.1}{1.7-0.9} = 3$

It will not be able to read of the intercept on the log y axis from the graph

This will happen when $0<a<1$

So pick a suitable value of (X, Y) on the line to calculate an estimate log$a$

I chose (1, 0.4) so that $0.4 = \log a + 3 \times 1$

$\log a = -2.6$ so $a = 10^{-2.6} = 0.0025$ (2 d.p.)

So $y = 0.0025h^3$

We then could (but shouldn't) predict the cost of a one metre tower

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P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ab^x$

These are essentially exponential increase and decrease laws

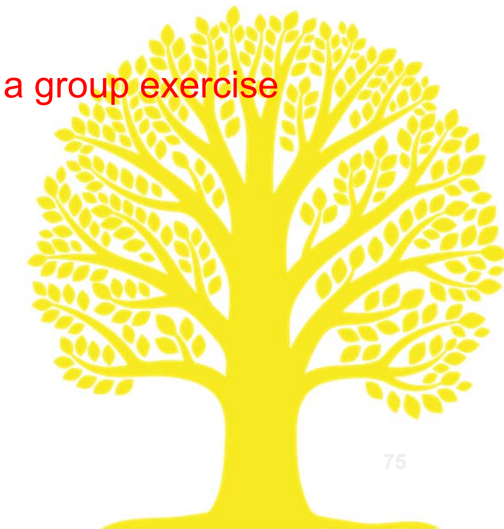
t (hours)	20	40	60	80	100	120
Mass (grams)	8.11	6.57	5.33	4.32	3.50	2.84

The table shows the mass (m grams) of radioactive molybdenum 99 in a container after t hours.

Given that the relationship is thought to be of the form $m = ab^t$
draw a suitable graph to confirm this and estimate the values of a and b

Estimate the initial mass of molybdenum 99

This is a group exercise



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P3 Content

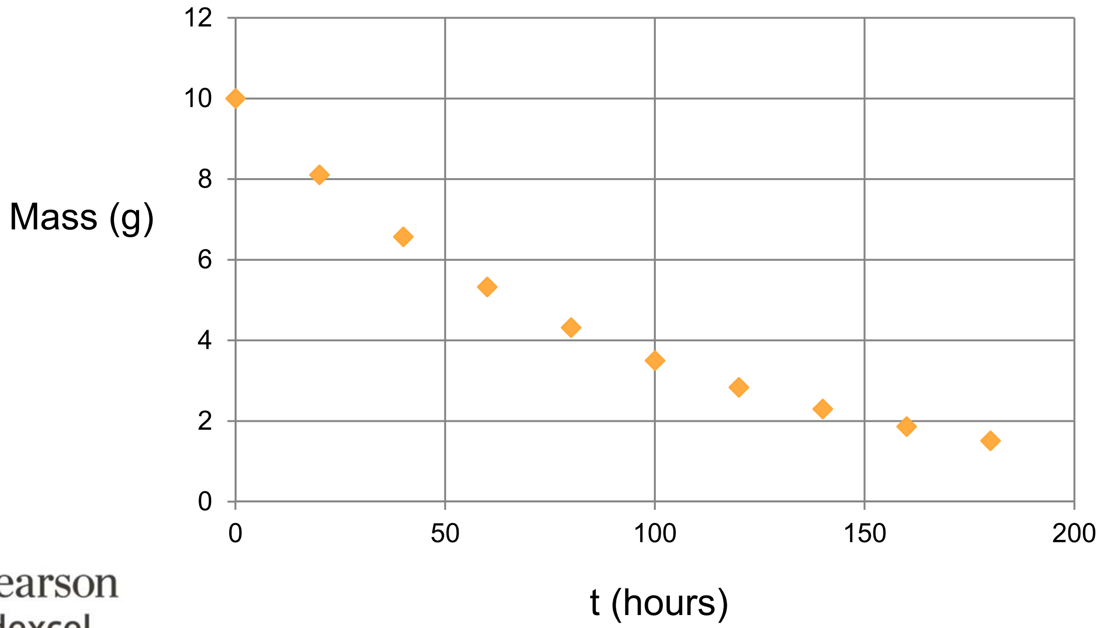
- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ab^x$

These are essentially exponential increase and decrease laws

t (hours)	20	40	60	80	100	120
Mass (grams)	8.11	6.57	5.33	4.32	3.50	2.84

The table shows the mass (m grams) of radioactive molybdenum 99 in a container after *t* hours.



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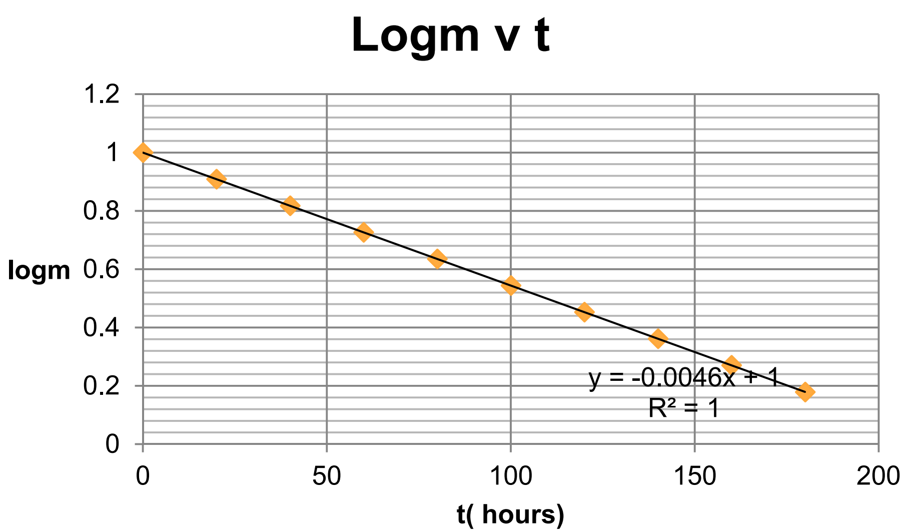
P3 Content

- What's new

3.3 Use logarithmic graphs to estimate parameters in relationships of the form $y = ab^x$

These are essentially exponential increase and decrease laws



Intercept = 1
Slope = -0.0046

a= 10
logb = -0.0046
b = 0.99

Say 4/5 marks - 2 for the correct form to plot
- 2 for finding *a* and *b*
-1 for accurate values of *a* and b

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P3 Content

- What's new

4.1 Differentiation of e^{kx} , ln *kx,* sin *kx*, cos *kx,* tan *kx* is an explicit section

Students should be fluent in differentiation of these so the derivative of e^{kx} is known to be $k\,e^{kx}$

P3 Content

- What's new

4.4 Understand and use exponential growth and decay. Students should be familiar with terms such as 'initial' and be able to explore behaviour for large values of *t* or to consider whether the range of values predicted is appropriate.

13.

Figure 5

A colony of ants is being studied. The number of ants in the colony is modelled by the equation

$$P = 200 - \frac{160e^{0.6t}}{15 + e^{0.8t}} \qquad t \in \mathbb{R}, t \geqslant 0$$

where P is the number of ants, measured in thousands, t years after the study started. A sketch of the graph of P against t is shown in Figure 5

Up to time T

Taken from C34 June 2017

(a) Find the initial number of ants in the study.

(b) Show that the minimum value of P occurs at time T.

(c) What happens to the value of P as t increases beyond T?

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P3 Content

- What’s new

4.4 Understand and use exponential growth and decay. Students should be familiar with terms such as ‘initial’ and be able to explore behaviour for large values of *t* or to consider whether the range of values predicted is appropriate.

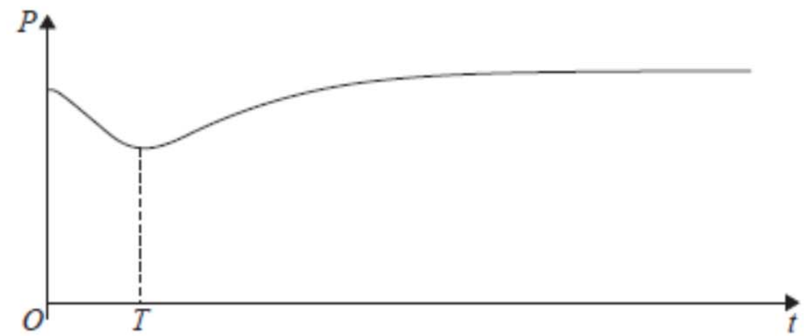

Figure 5

Taken from C34 June 2017

(b) Show that P has a minimum at time *T*.

(a) Find the initial number of ants in the study.

T = 0 , P = 200 – 160/(15 + 1) = 190

(b) Show that P has a minimum at time *T*.

$$\frac{dP}{dt} = -\frac{(15+e^{0.8t})\times 96e^{0.6t} - 160e^{0.6t}\times 0.8e^{0.8t}}{(15+e^{0.8t})^2}$$

$$\text{Sets } \pm\frac{(15+e^{0.8t})\times 96e^{0.6t} - 160e^{0.6t}\times 0.8e^{0.8t}}{(15+e^{0.8t})^2} = 0 \Rightarrow e^{0.8t} = 45$$

$$\Rightarrow T = \frac{\ln 45}{0.8} = 4.76$$

Taken from C34 June 2017 mark scheme

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P3 Content

- What's new

4.4 Understand and use exponential growth and decay. Students should be familiar with terms such as 'initial' and be able to explore behaviour for large values of *t* or to consider whether the range of values predicted is appropriate.

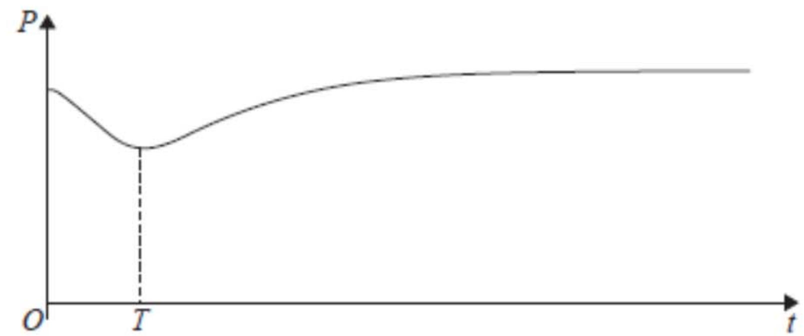


Figure 5

Taken from C34 June 2017

(c) What happens to the value of *P* as *t* increases beyond *T*?

For large values of *t* , *P* behaves like $200 - 160e^{-0.2t}$ *so tends towards 200 from below* (as, in fact shown in the figure)

Taken from C34 June 2017 mark scheme

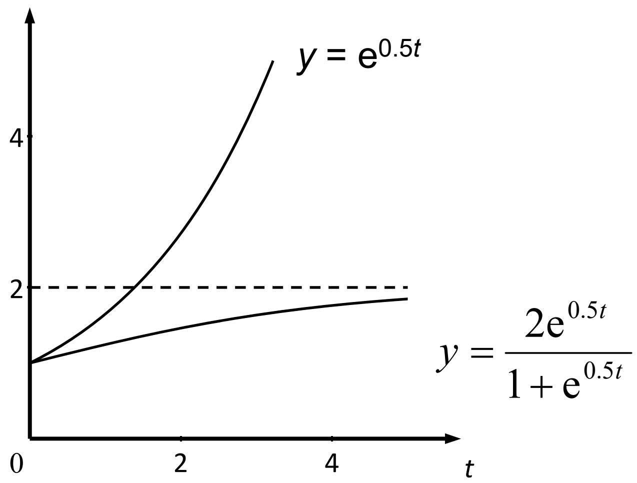
P3 Content

- What's new

  4.4 Understand and use exponential growth and decay. Consideration of a second improved model may be required.

The simple model of exponential growth $N = N_o e^{kt}$ predicts unrestricted growth as t increases.

A more sophisticated model with $k > 0$ is the 'logistic' equation $N = \dfrac{Ae^{kt}}{1 + Be^{kt}}$



The initial value of N is $A/(1 + B)$

N tends to A/B as t gets large.

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P3 Content

- What’s new

5.1 Integration of e^{kx}, sin *kx*, cos *kx* and $1/x^n$ explicitly given

This is, as with a similar statement in differentiation 4.1, a question of being fluent.

P3 Content

- What's new

5.2 Integration by recognition of known derivatives

$$\int \frac{f'(x)}{f(x)}\,dx = \ln f(x) + c \text{ and}$$

$$\int f'(x)[f(x)]^n\,dx = \frac{[f(x)]^{n+1}}{n+1} + c$$

The first being more familiar to students than the second.

$$\int \frac{x}{x^2+4}\,dx$$

$$\int_0^{\pi/2} \frac{\sin x - \cos x}{\sin x + \cos x}\,dx$$

P3 Content

- What's new

5.2 Integration by recognition of known derivatives

$$\int \frac{f'(x)}{f(x)}\,dx = \ln f(x) + c \text{ and}$$

$$\int f'(x)[f(x)]^n\,dx = \frac{[f(x)]^{n+1}}{n+1} + c$$

The first being more familiar to students than the second.

$$\int \sqrt{x+4}\,dx$$

$$\int x\sqrt{x^2+1}\,dx$$

$$\int_0^{\pi/2} \sin 2x(1+\sin^2 x)^2\,dx$$

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P3 Content

Activity 4

There are 5 or 6 questions based on P3
You will need your copy of the specification.

Please think about the following:

Which sections of the specification do students need to know to do the question?

Is the question suitable (with rigorous wording etc) for a written examination?

Is the question better suited to classroom use?

Avoid this question!

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P3 Content

Activity 4
There are some questions based on P3
You will need your copy of the specification.

3 $\dot{N} = -\frac{(a+be^{\lambda t})ke^{kt} - e^{kt}\lambda e^{\lambda t}}{(a+be^{\lambda t})^2} = -\frac{e^{kt}\left(a+(bk-\lambda)e^{\lambda t}\right)}{(a+be^{\lambda t})^2}$

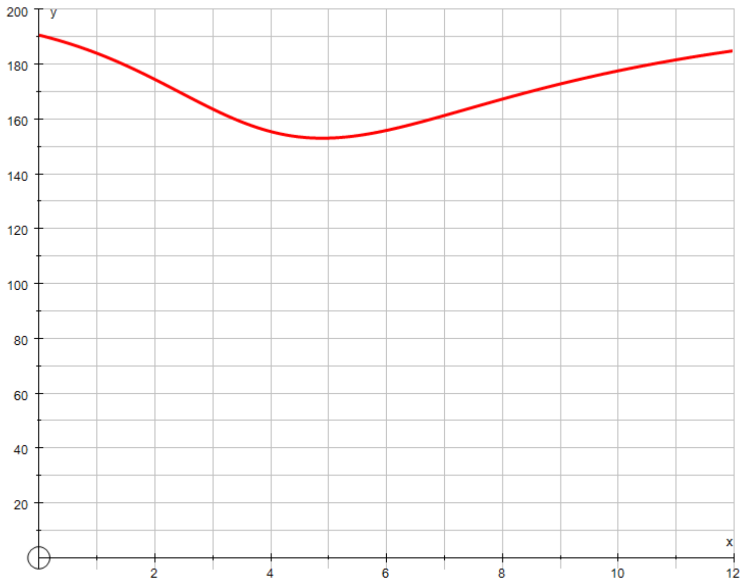
$\dot{N} = 0 \Rightarrow a + (bk-\lambda)e^{\lambda t} = 0 \Rightarrow e^{\lambda t} = \frac{a}{\lambda -}$

So $\lambda > bk$

The exam question June 17 can be rewritten as

y=200−e^(0.6x)/(0.1+0.006e^(0.8x))

for plotting and is shown here.



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P3 Content

Activity 4
There are some questions based on P3
You will need your copy of the specification.

4 (a) $\int \frac{\cos x - \sin x}{\cos x + \sin x} \mathrm{d}x = \ln(\cos x + \sin x) + c$ (b) $\int \sec x \tan x dx = \sec x + c$

(c) 'Obviously' 0 (d) $\left(\ln(1 + x^2)\right)^2 + c$

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P4

Pearson Edexcel

Introduction to the Assessment P1

Content	Assessment Objectives / Skills Tested	Structure of Assessment
Proof Algebra and functions Coordinate geometry in the (x, y) plane Binomial expansion Differentiation Integration Vectors	AO1 recall. select and use mathematics AO2 construct rigorous mathematical arguments and proofs. AO3 recall select and use standard mathematical models AO4 comprehend mathematical contexts and arguments AO5 use calculators and other resources	One end of unit test All questions compulsory 90 minutes 75 marks

P4 Content

- P4 assumes knowledge of P1, P2 and P3

P4 Content

- What's new - NOTHING!

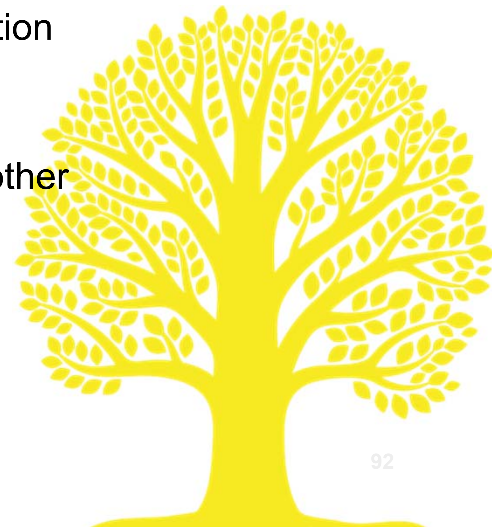
There is no new content in P4 although we have made some more explicit statements than in C34 :

1.1 Proof by contradiction – including the irrationality of $\sqrt{2}$ and the infinity of primes

6.2 Simple cases of integration by substitution where the student has to decide on and use a suitable substitution

6.2 Simple cases of integration by parts where more than one application may be required,

6.3 Simple cases of integration using partial fractions – integration of other rational expressions is also required (not just in P4)



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P4 Content

http://www.numberempire.com/numberfactorizer.php

- Exploring the proof section

1.1 Proof by contradiction –the infinity of primes.

Euclid's proof of the infinity of primes.

The idea is to consider the sequence which starts

$2 \qquad 2 + 1 \qquad 2 \times 3 + 1 \qquad 2 \times 3 \times 5 + 1 \qquad 2 \times 3 \times 5 \times 7 + 1$

with values

$2 \qquad 3 \qquad 7 \qquad 31 \qquad 211$ which are all prime

so is

$2 \times 3 \times 5 \times 7 \times 11 + 1 = 2311$

But $2 \times 3 \times 5 \times 7 \times 11 \times 13 + 1 = 30031$ is not prime $(= 59 \times 509)$

However………..

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P4 Content

- Exploring the proof section

1.1 Proof by contradiction – the infinity of primes.

We need an economical way of representing primes.

So p_n is the largest prime number.

The sensible way is to let p_n be the nth and final prime.

Then, as in the previous slide let $N = 2 \times 3 \times 5 \times \ldots\ldots \times p_n + 1$

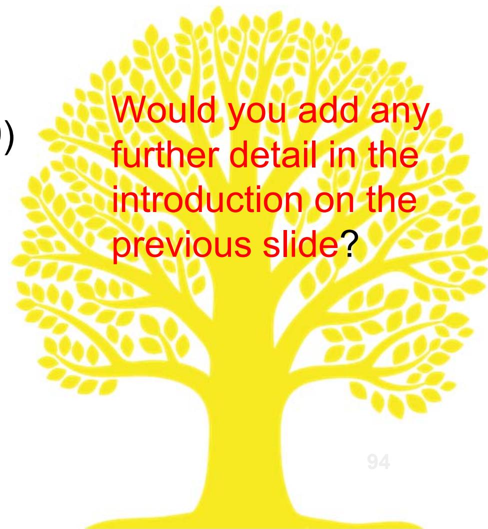
The product consists of all the primes.

None of the primes 2, 3, 5, ….., p_n will divide into N exactly because N will give a remainder of 1 when divided by any of them .

But thinking of the case $2 \times 3 \times 5 \times 7 \times 11 \times 13 + 1 = 30031$ ($= 59 \times 509$)

So we cannot claim N is prime.

However,……….



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P4 Content

- Exploring the proof section

1.1 Proof by contradiction – the infinity of primes.

Define the function $f(n) = n! + 1, \quad n \in \mathbb{N}$

Could we use $f(n)$ to prove the infinity of primes?

How about this approach?
We find an infinite increasing sequence of natural numbers $u_1, u_2, u_3, \ldots\ldots$ such that no two terms in the sequence have a common factor.

Would this lead to showing that the number of primes is infinite?

The answer is yes, if we can find one!

P4 Content

- Exploring the proof section

1.1 Proof by contradiction – including the irrationality of √2.

Euclid's proof of the irrationality of √2

Suppose to the contrary √2 is rational

We need a way of representing this

$\sqrt{2} = a/b$ where $a, b \in \mathbb{N}$

$2b^2 = a^2$ so a must be even

Let $a = 2k$

$2b^2 = (2k)^2 \Rightarrow b^2 = 2k^2$ so b must be even

Although students will have met rationalising denominators they may need to be taught about what an irrational number is

This 'proof' is incomplete – what's missing?

Is this obvious?.

Would you add any further detail in the introduction on the previous slide?

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P4 Content

- Exploring the proof section

1.1 Proof by contraction – including the irrationality of $\sqrt{2}$.

We can also look at the proof in a slightly different way.

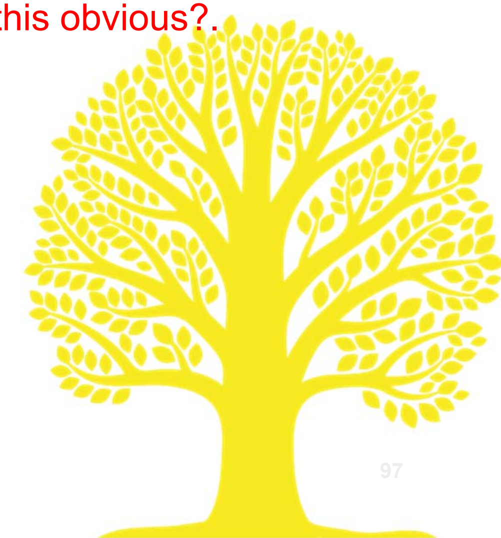
At the stage where

$2b^2 = a^2$

Think of a and b each written as a product of prime factors.

Then all the powers of the primes in the prime factor product representations of a^2 and b^2 must be even. But at least one prime in the prime factor representation of $2b^2$ is to an odd power.

Is this obvious?.



P4 Content

- Exploring integration

6.2 **Simple** cases of integration by substitution where the student has to decide on and use a suitable substitution

Find $I = \int x^2 \sqrt{2x+1}\,\mathrm{d}x$

Heuristic: when faced with a product substitute for the more complicated one

$$u = 2x + 1 \quad \mathrm{d}u = 2\mathrm{d}x$$

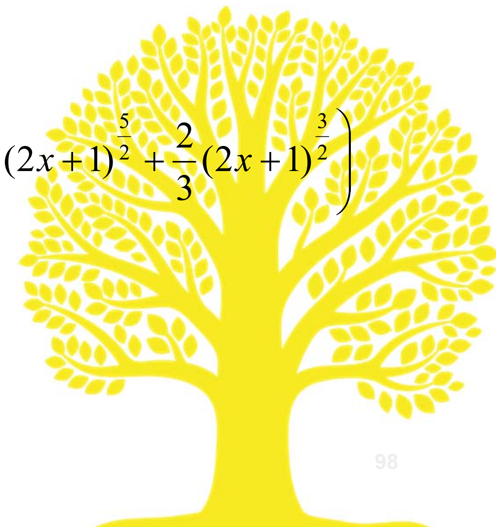
Do we have any comments on this?

$$I = \int x^2 \sqrt{u}\,\frac{1}{2}\mathrm{d}u$$

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

When in the evaluation should we do this?

$$I = \int \frac{(u-1)^2}{8} u^{\frac{1}{2}}\mathrm{d}u \qquad = \frac{1}{8}\int u^{\frac{5}{2}} - 2u^{\frac{3}{2}} + u^{\frac{1}{2}}\,\mathrm{d}u \qquad = \frac{1}{8}\left(\frac{2}{7}(2x+1)^{\frac{7}{2}} - \frac{4}{5}(2x+1)^{\frac{5}{2}} + \frac{2}{3}(2x+1)^{\frac{3}{2}}\right)$$



P4 Content

- Exploring integration

6.2 **Simple** cases of integration by substitution where the student has to decide on and use a suitable substitution

Find the exact value of $\displaystyle\int_{-1}^{2} \frac{4x}{\sqrt{2x+1}}\,\mathrm{d}x$

Design a mark scheme for this question. I'll leave the total number of marks to you.

Originally I had $x + 1$ under the square root. Suggest a reason why I changed it.

P4 Content

- Exploring integration

6.2 **Simple** cases of integration by substitution where the student has to decide on and use a suitable substitution

Find the exact value of $I = \int_0^4 \frac{4x}{\sqrt{2x+1}} \mathrm{d}x$

Put $u = 2x + 1$

$\mathrm{d}u = 2\mathrm{d}x$

New limits are 1 and 9

$$I = \int_1^9 \frac{4x}{\sqrt{u}} \frac{1}{2} \mathrm{d}u = \int_1^9 \frac{u-1}{\sqrt{u}} \mathrm{d}u$$

$$I = \int_1^9 u^{\frac{1}{2}} - u^{-\frac{1}{2}} \mathrm{d}u$$

$$I = \left[\frac{2}{3} u^{\frac{3}{2}} - 2u^{\frac{1}{2}} \right]_1^9 \quad = \frac{40}{3}$$

I might want to give it a different number of marks according to the use of the task.

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P4 Content

- Exploring integration

6.2 **Simple** cases of integration by substitution where the student has to decide on and use a suitable substitution

Find the exact value of $$I = \int_0^4 \frac{4x}{\sqrt{2x+1}}\,\mathrm{d}x$$

Put $$u = 2x + 1$$ $$\mathrm{d}u = 2\mathrm{d}x$$

B1 for a suitable substitution

I might want to give it a different number of marks according to the use of the question

New limits are 1 and 9

$$I = \int_1^9 \frac{4x}{\sqrt{u}}\frac{1}{2}\mathrm{d}u = \int_1^9 \frac{u-1}{\sqrt{u}}\mathrm{d}u$$

M1 for using du/dx = 2 and an integrand a function of u only

$$I = \int_1^9 u^{\frac{1}{2}} - u^{-\frac{1}{2}}\mathrm{d}u$$

M1 for a form which can readily be integrated

$$I = \left[\frac{2}{3}u^{\frac{3}{2}} - 2u^{\frac{1}{2}}\right]_1^9 \quad = \frac{40}{3}$$

M1 (dep for an integrated form and new limits (or equivalent)

A1

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P4 Content

Integrals

Please spend a few minutes working through the integrals sheet

Make any notes about what issues arose

P4 Content

Activity 5
There are 5 or 6 questions based on P4 (some are proofs!).
You will need your copy of the specification.

Please think about the following:

Which sections of the specification do students need to know to do the question?

Is the question suitable (with rigorous wording etc) for a written examination?

Is the question better suited to classroom use?

Avoid this question!

P4 Content

Activity 5
There are 5 or 6 questions based on P4 (some are proofs!).
You will need your copy of the specification.

Please think about the following

5 Prove, by contradiction, that no power of 2 can be written as the sum of consecutive numbers.

5 Suppose it can.

$2^k = n + n + 1 + ... + n + r - 1$ where $r > 1$

Using sum of an arithmetic series $2^k = n + n + 1 + ... + n + r - 1 = \frac{r}{2}(2n + r - 1)$

$2^{k+1} = r(2n + r - 1)$ (*)

So r must be a power of 2, say 2^s $(k + 1 > s > 0)$

(*) then becomes $2^{k+1-s} = 2n + 2^s - 1$ which is a contradiction as the left had side is even but the right hand side is odd

P4 Content

Activity 5
There are 5 or 6 questions based on P4 (some are proofs!).
You will need your copy of the specification.
Please think about the following – how, if at all, would you use it?

Start with $(\sqrt{2}-1)(\sqrt{2}+1)=1 \Rightarrow \sqrt{2}=\dfrac{1}{\sqrt{2}-1}-1$

Now let $\sqrt{2}=\dfrac{a}{b}$ where a, b are whole numbers in their lowest terms and $2b>a>b>1$

So $\sqrt{2}=\dfrac{1}{\sqrt{2}-1}-1 \Rightarrow \sqrt{2}=\dfrac{1}{\frac{a}{b}-1}-1=\dfrac{2b-a}{a-b}$

Now $2b-a$ and $a-b$ are positive whole numbers but $a-b<b$ and $2b-a<a$ so we have a new denominator and numerator …………

7 We need a and b to be positive, so having $a, b \in \mathbb{N}$ is needed.

$2b>a>b>1$ needs to be justified.

The final line should be completed by noting we assumed a, b in its lowest terms, but we have replaced them by numbers that are smaller, so we get a contradiction.

D1

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D1 Content

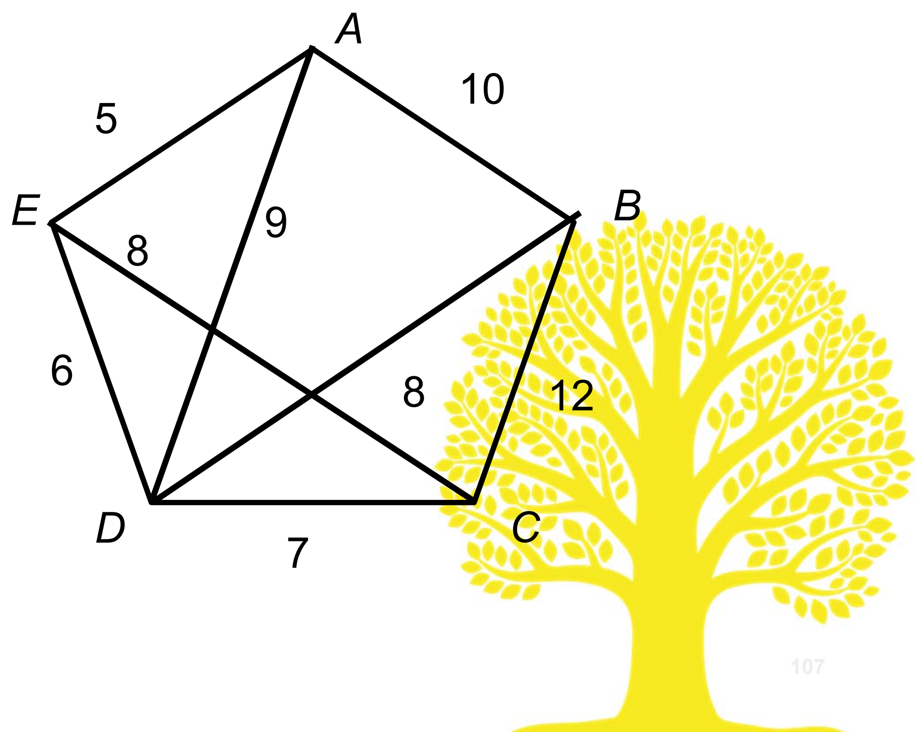
What's new?

The Travelling Salesman Problem (TSP)

Given a connected graph with distances on all arcs, find the tour of the graph which has minimum length

What is the length of the shortest tour that starts and ends at A?

Each vertex must be visited at least once



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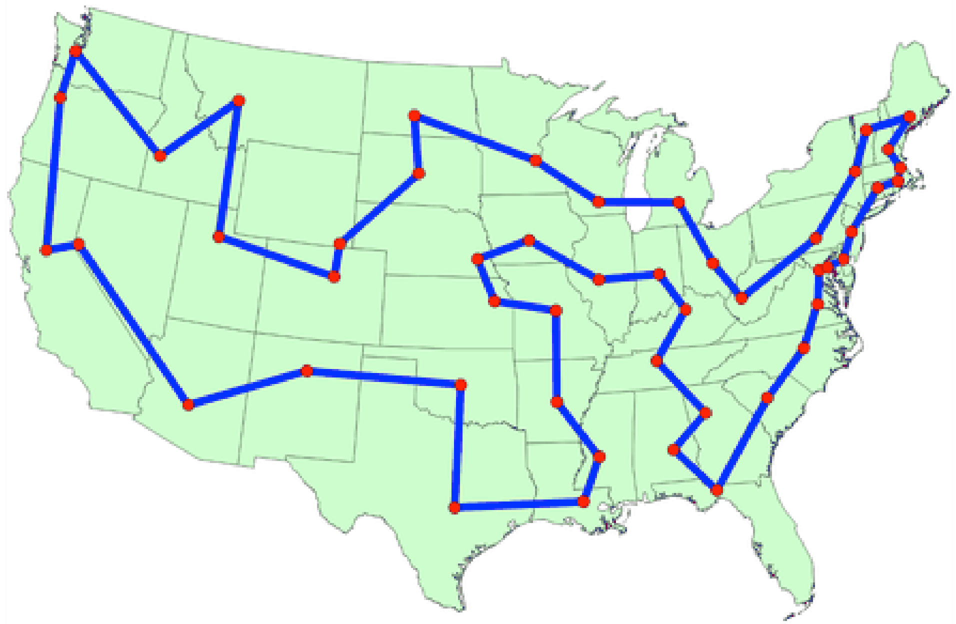
D1 Content

What’s new?

The Travelling Salesman Problem (TSP)

TSP is a good example of showing why ‘brute force’ (enumeration) cannot always work.

This is a tour of 48 state capitals, one in each state, in continental USA



If I start from Tallahassee, there are 47 possible cities to visit next . From the second city 46 and so on so the total number of tours is (2 × 47!) or about 5 × 10^{59}

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D1 Content

What's new?

Is 5×10^{59} a 'big' number?

A state of the art processor can perform about 3×10^{11} instructions per second

$48 \times 5 \times 10^{59} \div (3 \times 10^{11})$ is about 8×10^{49} seconds

D1 Content

To keep the volume of content equivalent in the new course the section on Matching in the current course has been deleted.

Considering Delivery Strategies and sharing best practice

1. Teaching Strategies.
2. Resources.
3. Technology.

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New IAL Content

We hope you agree with us in feeling that the changes made to the content are manageable

That the scheme of assessment has the flexibility you like.

That you have sufficient resources to deliver the course to a high standard.

It is sufficiently challenging at the top end but accessible at the bottom end

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Support Overview

Free Support

Getting Started Guide & Scheme of Work	Getting Ready to Teach Events	Subject interpretation of transferable skills
Subject Advisor	**Results Plus**	Regional Support Manager

Additional support for selected subjects

Curriculum Matched Publishing	Lesson plans	Exemplar Marked Responses
Topic booklets & Subject guides	Additional SAMs	**Exam Wizard**

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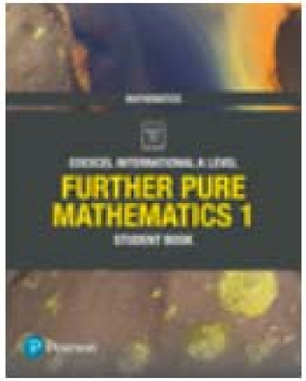
Current Published Materials



- Please see the Published Resources web-page for available resources, including:
  - Student books
  - Teacher Resource books

Other useful links

1.**Grade Boundaries**
This page shows the minimum marks needed to achieve a certain grade for all UK and international examinations. Also refer to the examiners report which is available for download with other documents.

2.**Examination Results Statistics**
Results statistics summarise the overall grade outcomes of candidates sitting Pearson Edexcel examinations.

3.**Progress to University**

Here you can find information and guidance about how to progress to universities worldwide with Pearson Edexcel qualifications.

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ResultsPlus

- Free online results analysis tool for teachers
- Provides a detailed breakdown of student performance in Edexcel exams.
- Identify topics and questions where the student could benefit from further learning
- Use this knowledge to inform teaching strategies and approaches
- Provides a comparison of student performance at regional level.
- Allows centres to view their country’s results compared to the total Edexcel cohort.
- Mock exams results can also be fed into the system to produce an analysis
- Schools can sign up for free ResultsPlus account in just a few quick and easy steps: https://qualifications.pearson.com/en/support/Services/ResultsPlus.html

examWizard

- Free tool for teachers containing a bank of past paper questions to help create their own bespoke mock exams and tests to focus on particular topic areas as needed
- Use existing mark schemes for accurate marking
- Use existing examiner report for insight
- Use the results to understand where students need more support, informing teaching strategies.

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Contact your dedicated Subject Advisor

Subject Advisor details

Your subject advisor is **Graham Cumming**
Phone: **+44 (0)20 7010 2174**
Twitter: **@EmporiumMaths**
Email: TeachingMaths@pearson.com

Sign up for monthly newsletters from Graham to stay on top of qualification updates, training, course materials and industry news.

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Any questions?

Thank you for attending this event.

How did we do?
Please fill in the ***evaluation form*** *that you'll receive via e-mail in a few minutes.*

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There's so much more to learn

Find out more about our range of events at
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ALWAYS LEARNING