REFORM

Core business

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Executive summary

What 16 year olds should expect at the end of compulsory education is rightly back on the education policy agenda, in particular due to the Conservative Party's review of school examinations in England led by Sir Richard Sykes. The English system offers a much lower level of attainment compared with competitor countries.

The English system expects students to achieve two academic GCSEs – English and mathematics – at age 16. Other developed countries typically expect four or five as a minimum. Of the ten leading developed countries, eight require examinations in at least four academic subjects.

The academic examinations taken by English students can be of much lower quality. For this paper, leading English, maths and science academics have analysed examinations in those subjects for 16 year olds from France, Germany, Japan, the US and Canada. They have found that mathematics and science GCSEs in England are of a much lower quality than in other countries. English GCSE is of a comparable quality.

Academic qualifications are becoming more important in the modern economy. They benefit individuals: GCSEs add 15 per cent to average earnings, whereas vocational qualifications can actually reduce earnings by up to 0.2 per cent. They improve general economic growth by enabling people to move between occupations. In contrast, vocational qualifications lead to occupational segregation, where different people become concentrated in different jobs, irrespective of their actual abilities.

The danger is that genuine academic qualifications such as the individual sciences or modern foreign languages will become restricted to independent, grammar and the best comprehensive schools, reducing social mobility. Only 0.2 per cent of individuals progress from non-academic routes into higher education.

Countries such as Japan and Canada already expect a high level of academic achievement from all pupils. Countries such as Germany and France are increasing the academic requirement of students. But England is stuck in a rut. Since the mid-1980s, and under governments of both parties, the assumption has been that a large minority of English students are not up to studying academic qualifications. Politicians have continued on a vain quest to invent a robust vocational route and to create parity of esteem between vocational and academic qualifications. The reality is merely that many children have been directed to follow poorly-regarded courses at the expense of academic qualifications.

In the last five years, the Government has accepted that there should be some "core" academic study. In 2005, it argued that the key measure in school performance tables for 16 year olds should include English and maths, and that students should study functional English and maths. The first proposal was right since it sends a clear incentive to schools and a clear message to students that English and maths are essential subjects. The second was wrong since the level of "functional skills" is far below that of GCSEs.

In this year's white paper, *Your child, your schools, your future*, the Government proposed a "guarantee" to pupils in regard to their school education, which will go into statute via the new Children, Schools and Families Bill. But the guarantee provides only a guarantee of choice of routes of learning rather than a broad core of high quality study.

English pupils need a different kind of guarantee – an expectation of academic achievement at the level of Japan and Canada. Two key reforms are necessary:

Introducing a strong academic core for all pupils, consisting of five academic GCSEs, and changing school league tables to incentivise attainment in the core.

Putting academics and subject experts in charge of GCSEs, in place of Ofqual and the Qualifications and Curriculum Development Agency, to ensure that the qualifications are rigorous and fit for purpose.

1
A narrow core

England currently has one of the narrowest curricula in the world for 16 year olds. The English system requires only two academic qualifications at age 16, compared to four or five in most other leading countries.[1]

Figure 1: Compulsory examinations at 16 in OECD countries
Source: International Review of Curriculum and Assessment Frameworks; Eurydice

Australia	Mathematics Literacy	
Austria	German Mathematics Foreign Language	
Belgium	Mathematics French English	Dutch Science
Canada	Mathematics English Science	Social Studies Foreign Language
Czech Republic	Czech Mathematics Foreign Language	Science History Geography
Denmark	Danish Mathematics English Physics	Chemistry 1 of Foreign Language, History or Social Studies 1 of Geography or Biology
England	Mathematics English	
Finland	Mathematics Finish Science History	Swedish Foreign Language Geography
France	Mathematics French Science	History Foreign Language Geography
Germany	Mathematics German	Science Foreign Language
Greece	Greek Ancient Greek History Social Studies	French or German Mathematics Science
Hungary	Mathematics Literacy	
Iceland	Mathematics Icelandic English	
Ireland	Mathematics English Science	Social Studies Irish

1 Qualifications and Curriculum Development Agency (2009), *The International Review of Curriculum and Assessment Frameworks (INCA) Internet Archive* (www.inca.org.uk).

Figure 1: Compulsory examinations at 16 in OECD countries
Source: International Review of Curriculum and Assessment Frameworks; Eurydice

Italy	Mathematics Italian Science	Social Studies Foreign Language
Japan	Mathematics Japanese Science	Social Studies Foreign Language
Luxembourg	No compulsory national examinations	
Mexico	No compulsory national examinations	
Netherlands	Mathematics Dutch English	History Science Geography
New Zealand	No compulsory national examinations	
Norway	Mathematics Norwegian Natural Science	Social Science English
Poland	Mathematics Polish Science	Humanities Foreign language
Portugal	Mathematics Portuguese	
Slovakia	No compulsory national examinations	
South Korea	Mathematics Korean Science	Social Studies Foreign language
Spain	Mathematics Spanish	Natural Science Social Science
Sweden	Mathematics Swedish English	
Switzerland	No compulsory national examinations	
Turkey	No compulsory national examinations	
USA	Mathematics English	Science History

League tables compel English and maths GCSE

In fact the English system does not formally require any academic examinations at all. It specifies a programme of study, but there is no statutory requirement to follow GCSEs in these subjects. The programme of study comprises:

- Statutory study of English, mathematics, science, ICT (information communication technology), physical education, citizenship and religious education.
- Four "entitlement areas" in the humanities, modern foreign languages, design and technology and the arts.[2]

In practice, however, almost all students do take at least one GCSE in each of English and maths. Partly this is a longstanding cultural expectation that school leavers should attempt those two qualifications. Partly it is due to the performance tables which measure school performance according to the proportion of students that achieve five GCSEs at A* to C (or equivalent) including English and maths. The result is that large numbers of students are not studying other academic subjects.

2 Qualifications and Curriculum Authority (2007), *The National Curriculum statutory requirements for key stages 3 and 4 from September 2008*.

Figure 2: Estimated percentage of 2008 cohort studying core academic subjects
Source: Reform calculations; Joint Council for Qualifications (2009), GCSE, Applied GCSE and Entry Level Certificate Results Summer 2009

Subject	Estimated percentage of cohort sitting GCSE
Core + Additional Science or Triple Science	71
History	31
Geography	28
French	28
German	10
Spanish	9
English Literature	76

The problem with science

Figure 3: Available combinations of science GCSEs
Source: Qualifications and Curriculum Authority (2003), Changes to the key stage 4 curriculum

Combination of GCSEs	Content	No. of GCSEs obtained	Estimated percentage of 2009 cohort taking this combination[3]
Core Science GCSE	Elementary study of physics, biology and chemistry examined together	1	14
Core Science GCSE + Additional Science GCSE	Intermediate level study of physics, biology and chemistry examined together	2	59
Core Science GCSE + Applied Science GCSE	Elementary academic study of the three sciences plus higher level non-academic science skills	2	3
Core Science GCSE + one of Physics GCSE, Chemistry GCSE and Biology GCSE	Elementary combined study of the three sciences plus advanced study of one of the three sciences examined separately	2	2
Core Science GCSE + two of Physics GCSE, Chemistry GCSE and Biology GCSE	Elementary combined study of the three sciences plus advanced study of two of the three sciences examined separately	3	0
All three of Physics GCSE, Chemistry GCSE and Biology GCSE	Advanced study of the three sciences, examined separately	3	10

3 *Reform* calculations; Joint Council for Qualifications (2009), *GCSE, Applied GCSE and Entry Level Certificate Results Summer 2009.*

The combination of Core Science and Additional Science, followed by a majority of pupils, should theoretically offer a reasonable standard of science (albeit perhaps not ideal preparation for A-level study), but there are two concerns. Firstly, the papers are "combined", testing all three sciences simultaneously; Professor Alan Spivey's analysis in Chapter 2 indicates that combined science exams are generally of markedly lower quality than exams in the separate sciences. Secondly, while in theory students studying Core and Additional Science should be taught the full higher-level content of Additional Science, in practice schools can focus on Core Science (achievement of a C in which satisfies league table requirements) while neglecting Additional Science, since the two are graded separately.

"Functional skills" are not a solution

The Government is placing a new emphasis on "functional skills", which feature in the Diploma and are also now being incorporated into GCSEs and their own qualification. Functional skills are designed to provide everyday competencies in maths, English and ICT.[4] The Qualifications and Curriculum Development Agency (QCDA) is encouraging schools to enter people for functional skills assessments as well as the maths and English GCSE, arguing that "that way, students' functionality will be guaranteed and they will be best prepared for progression to further study and employment".[5]

The functional skills criteria clearly lack academic rigour. In mathematics the subject criteria published by Ofqual only anticipate the highest tier of the functional skills assessment reaching level 6 mathematics, the expected average attainment of a 14 year old.[6]

It is striking, then, that the Government's view is that functional skills should be the primary focus of 14-19 education, with the 2005 Government white paper stating that "achieving functional skills in English and maths must be at the heart of the 14-19 phase".[7]

The academic superpowers

Reform has examined the education systems of a wide range of leading developed countries. Three of the highest performing countries – Canada, Japan and South Korea – ensure that all pupils cover a core academic curriculum until 16.

Japan: rigour for all

The Japanese education system is based on ensuring a standard, rigorous, academic curriculum for all students.[8] Japan prescribes a minimum of 675 hours per year for core subjects, one of the highest requirements within the OECD.[9] The core is much broader than England, including Japanese, social studies (history/geography), mathematics, science, fine art, music, industrial arts, homemaking and foreign languages.[10]

The Japanese curriculum is not only broad but also rigorous. The level of mathematics, for instance, has been found in general to be of the same standard of mathematics education in the US two years later.[11] The most common complaint from parents is not that the level of work is too easy but rather that it is too hard and that there is too much to cover.[12]

In general, teaching is focused on ensuring that students are able to identify patterns in data and making connections among ideas and evidence in order to ensure that students have the basic transferable skills which they need.[13] Those that are underachieving are expected to participate in after school classes or attend Juku,[14] special schools designed to ensure that everyone reaches a high school level of maths and literacy. The school day can be as long as 12 hours excluding homework.

4 http://www.qcda.gov.uk/6062.aspx.
5 http://www.qcda.gov.uk/22533.aspx.
6 Ofqual (2009), *Functional skills criteria for mathematics*.
7 Department for Education and Skills (2005), *14-19 Education and Skills*.
8 Willis, D. et al. (2008), *Frontiers of Education: Japan as "Global Model or "Nation at Risk"*.
9 Qualifications and Curriculum Development Agency (2009), *The International Review of Curriculum and Assessment Frameworks (INCA) Internet Archive* (www.inca.org.uk).
10 Ibid.
11 Whitman, N. (2003), *Learning from Japanese middle school math teachers*.
12 National Center for Education Statistics (2008), *The Education System in Japan*.
13 http://www.ed.gov/pubs/ResearchToday/98-3038.html.
14 Roesgaard, M. (2006), *Japanese Education and the Cram School Business: Functions, Challenges and Perspectives of the Juku*.

The Japanese education system rejects the idea that people are born with different levels of ability and are suited to different study. The system is predicated around an understanding that accomplishment can always be increased: as one teacher said, "as far as inborn ability goes, I can't say it isn't there, but I can say that it doesn't matter. Regardless of whether you have ability, if you persevere you can get a good outcome".[15] The vocational training that is provided is almost entirely enterprise based and industry led, in contrast to most other countries in which public education institutions have been the leaders.[16]

Canada: academia in ascendency

Canada was one of the first countries to discuss falling standards and grade inflation.[17] Although the education system varies between the states there is a common format. Students study for diploma exams at age 16 (that contribute towards an end-of-high-school diploma at the age of 18). Students are expected to study English, social sciences, science and mathematics, along with a range of optional subjects.

Almost all provincial governments stipulate the minimum amount of time that should be spent on the core subjects. In British Columbia, for instance, 65 per cent of time must be spent studying maths, English and science.[18] In both Alberta and British Columbia the system offers students the opportunity to pick the level at which they study the core subjects, ensuring that a basic academic education is accessible to all.[19]

Massachusetts: the leading laboratory

Massachusetts is widely cited as one of the top performing states in the US.[20] All students sit standardised tests (known as MCAS[21] tests) in science, maths, English and history at the end of the 10th grade (age 16).[22] Efforts have been made to combat grade inflation and there is an expectation of a universal minimum standard on MCAS assessments.[23]

Alongside South Carolina and Missouri, Massachusetts scores highest on National Assessment of Educational Progress (NAEP) tests and was one of the few states to register a statistically significant score improvement between 2003 and 2007.[24]

Seeing the light

This trend has been recognised by other countries across the world who are seeking to change their systems to deepen and broaden an academic core of study.

Germany: from complacency to reform

Until recently Germany took the approach of limiting academic study to the best students and seeking to teach the remainder vocational skills. But the German education debate was changed beyond all recognition by the publication of the 2000 PISA report, in which Germany performed below the OECD average in all three tested areas.[25] Indeed reading was below all but two of the countries who participated. Nearly a quarter of the 15 year old students did not exceed level 1 of the reading competency scale. That means that those students might perhaps be able to read a text aloud, but they are not really able to recognise what are they reading about.[26]

15 Stevenson, H. and Nerison-Low, R. (2002), *To Sum It Up: Case Studies of Education in Germany, Japan, and the United States*.
16 Keeves, J. et al. (2002), *The Handbook on Educational Research in the Asia Pacific Region*.
17 The Alberta Teachers' Association (2009), *A Brief History of Public Education in Alberta*.
18 Qualifications and Curriculum Development Agency (2009), *The International Review of Curriculum and Assessment Frameworks (INCA) Internet Archive* (www.inca.org.uk).
19 Government of Alberta Education (2009), *Curriculum Handbooks for Parents 2009-2010*.
20 O'Leary Morgan, K. and Morgan, S. (ed.) (2005), *Education state rankings 2005-2006; pre K-12 education in the 50 United States, 4th ed*.
21 Massachusetts Comprehensive Assessment System.
22 The history test has however been abandoned for this year due to the state's budget problems.
23 http://www.doe.mass.edu/mcas/overview.html?faq=4.
24 National Centre for Education Statistics (2007), *Mathematics 2007 National Assessment of Educational Progress at Grades 4 and 8*.
25 OECD (2000), *PISA 2000*.
26 Leutner, D. and Wirth, J. (2005) "What We Have Learned from PISA so far: A German Educational Psychology Point of View", *KEDI Journal of Educational Policy*, Vol. 2 No. 2.

Up until this point Germany had always assumed that it led the way in world education, so the 2000 results were labelled as "the PISA shock".[27] This triggered a national debate around education and led to a wholesale review of the system, with headlines such as "Abysmal marks for German students"[28] and "Germany brings home a poor report card".[29] German politicians immediately accepted that the results had to be an impetus for reform. Then Education Minister Edelgard Bulmahn accepted that the results "show that we have considerable flaws in our school system".[30]

The results led to calls to abandon the traditional three school structure.[31] The more vocational Hauptschule, for the least academic 30 per cent of students, were criticised for effectively having become a "school for leftovers".[32] Ministers introduced more standards for maths, German and science taught in the Hauptschule[33] and standardised curricula for pupils in all schools in these subjects and a modern foreign language,[34] recognising the importance of the basic academic core.

Texas: following the lead

Texas' persistent poor performance in the NAEP[35] led it to look to the more successful states in the US in order to improve its education.[36] Its Texas Assessment of Knowledge and Skills tests (TAKS), standardised tests which all students are supposed to sit at the age of 16, have been subject to criticism for numerous reasons, particularly because of grade inflation, dilution and because poorer performing pupils were often excluded from the tests in order to boost results.[37] Policymakers recognised the need for reform through higher standards and a broad academic curriculum. As a report to the Texas State Senate education select committee stated: "Now is the time to take the next steps – to push all students farther. Texas can, with some further improvements, establish itself as a 'high skill state'."[38]

In response it has this year scrapped TAKS assessments, instead introducing compulsory, academic, end of course assessments in maths, all three sciences, English language and literature, history and geography.[39]

France: a common platform

The publication of the 2003 PISA results revealed that French students were performing poorly relative to other nations in maths, reading and science.[40] The French response was to strengthen the Brevet, the standard examination which all students take at the age of 16, to require all students to study a modern foreign language, economics, physics, chemistry, biology and art education.[41] The 2005 Education Law was designed to ensure that "compulsory schooling guaranteed every student the means necessary to the acquisition of a common platform made up for an ensemble of knowledge that it is absolutely necessary to master ... to build a personal and professional future and succeed in their lives in society".[42]

27 Martens, K. and Leibfried, S. (2008), "The PISA Story – How educational policy went international: a lesson in politics beyond the nation-state", *The Atlantic Times*, January.
28 *Frankfurter Allgemeine Zeitung* (2001), "Miserable Noten für deutsche Schüler", 4 December.
29 *Deutsche Welle* (2001), "Germany Brings Home a Bad Report Card", 4 December.
30 *Deutsche Welle* (2003), "Germany Searching for Educational Solutions", 7 March.
31 *Deutsche Welle* (2007), "Experts Push For Overhaul of German School System", 26 July.
32 Beck, M. et al. (2007), *Reform in the German Educational System: An Ongoing Process*.
33 Waldow, F. (2009), "What PISA Did and Did Not Do: Germany after the 'PISA-shock'", *European Educational Research Journal*, Vol. 8 No. 3.
34 *Deutsche Welle* (2003), "Germany To Introduce Federal School Standards", 5 December.
35 National Centre for Education Statistics (2007), *Mathematics 2007 National Assessment of Educational Progress at Grades 4 and 8*.
36 Texas Institute for Education Reform (2007), *Texas Public Schools Today and Tomorrow: Call to Action and Agenda for Success Academic Standards for the Schools We Need*.
37 Terry, B. (2007), *Implementing End of Course Examinations*, Texas Public Policy Foundation.
38 Texas Institute for Education Reform (2007), *Texas Public Schools Today and Tomorrow: Call to Action and Agenda for Success Academic Standards for the Schools We Need*.
39 Terry, B. (2007), *Implementing End of Course Examinations*, Texas Public Policy Foundation..
40 OECD (2003), *PISA 2003*.
41 Qualifications and Curriculum Development Agency (2009), *The International Review of Curriculum and Assessment Frameworks (INCA) Internet Archive* (www.inca.org.uk).
42 Education Law 2005, Article 9.

2
The hollow core

The other dimension of education standards is depth of study. A strong education comprises both a broad range of subjects and subjects studied at appropriate depth.

Reform asked leading academics to conduct a major new qualitative analysis of exam papers at 16 in core subjects across the UK's main competitor countries. The academics compared exams in English (or the equivalent national language), mathematics and science with those of France, Germany, Japan, the US and Canada.

These countries have been selected as in terms of population and GDP per capita they are the UK's statistical neighbours. All of the countries selected take part in the PISA study in maths, science and reading and have some form of equivalent examination at the age of 15/16 in maths, science and English or the national language. The American states of Massachusetts, New York and Texas have been selected in order to give a broad overview of educational attainment in the US. Based on their performance in the 2007 NAEP test of reading Massachusetts was the highest performing state, New York was slightly above the median state performance and Texas' scores were below that of the median state.[43]

The analysis is based on GCSE papers and the equivalent international exams taken by most students at 16 from 2008 and 2009 (where available; some countries' systems differ slightly). The academics have considered three main criteria: the content covered, the difficulty of the exam and the style of questions. Sample questions from the six countries' exam papers are presented in the Appendix.

What emerges are clear differences in content, difficulty and style of question, which reduce the value of England's exams. The analysis shows that GCSEs, which mark a key stage where the basic tools of language and science should have been mastered, are often less rigorous than their international counterparts. This particularly appears to be the case in the sciences, where intellectual coherence and rigour have been sacrificed for topicality and accessibility.

Science

Professor Alan C. Spivey, Department of Chemistry, Imperial College London

Content

England, France, Canada, Texas: combined disciplines lack depth

The countries which offer general or combined science papers clearly lack advanced content in comparison to more specialised exams focusing on each of the scientific disciplines individually.

The English GCSE papers[44] cover biology, chemistry and mechanics. The French paper[45] covers just chemistry and physics, while both Canadian papers (Alberta[46] and British Columbia[47]) and the Texas paper are very similar in style, content and difficulty and cover a broad range of general science topics. In the case of England a list six basic equations are provided in a form which avoids the use of symbols and uses words instead. The Texas exam[48] is accompanied by a detailed periodic table (PT) and a formula sheet; both symbols and words are provided for equations and units are indicated for all constants, as with the English paper.

The content of the combined science papers is at a significantly lower level than the other specialist papers from Germany,[49] New York[50] and Massachusetts,[51] although even some of these (e.g. Texas) have breadth of coverage greater than for the English paper.

43 National Centre for Education Statistics (2007), *Mathematics 2007 National Assessment of Educational Progress at Grades 4 and 8*.
44 OCR GCSE Additional Science B Unit 1 Higher Tier January 2009.
45 National Brevet Diploma Physics/Chemistry 2009.
46 Grade 9 2006.
47 Science 10 Form A June 2009.
48 TAKS Grade 10 April 2009.
49 Bavaria Realschulen Physics Final Examination 2008.
50 Regents High School Examination Physical Setting Chemistry 2009.
51 MCAS High School Chemistry Test Spring 2008.

Germany, Massachusetts, New York: individual sciences push students further

The German paper is much more specialised and covers specific aspects of physics. The Massachusetts chemistry paper provides a PT and a chemistry formula and constants sheet not dissimilar to that provided in a UK university; symbols and units are clearly indicated. The range of topics is significantly wider, requiring knowledge of advanced, specialised topics. In the case of both Germany and Massachusetts the depth is significantly greater than in England and in the case of the Massachusetts papers the breadth is greater too. There is a separate three-hour New York paper for each of chemistry, physics and biology, and accordingly both the breadth and depth of required knowledge is greater than most of the other papers examined.

Difficulty

Canada and England: an aversion to rigour

Many of the English chemistry questions actually require no chemical knowledge but simply an ability to add up (e.g. "which formula contains 7 atoms?") or apply simple logic. The numerical difficulty of the problems is minimal. There is a clear aversion to academic rigour and competence/familiarity with scientific nomenclature in these papers; units of measurement are avoided and all scope for original interpretation of the problem is discouraged by the narrow nature of the questions. The English papers show a noticeable intellectual deficiency when compared with the other countries.

The level of difficulty of the Canadian papers is similar to that of the English papers, i.e. it is relatively low, but the time pressure on these papers will be higher due to the large number of questions. Many of the questions while having a science context simply test logic and ability to interpret data – which just happens to be science based. Of the papers examined, the Canadian are the most similar to those used in England in terms of level. There is a balance of recall and reasoning with a high proportion of the former – particularly, a large number of questions testing specific, specialised, obscure and not very fundamental, terms and definitions.

France and Germany: a rigorous scientific approach

In the French papers, the use of units is clearly emphasised and an ability to work with equations containing symbols for quantities such as kinetic energy is clearly required.

The German questions are not so prescriptive about how the answer should appear. For example the very first question on the paper requires a graph to be plotted from some data – the equivalent question on the English paper has a grid already prepared with axes and more hints as to how to do this. Again there is a balance of recall and reasoning but the emphasis is on reasoning and numeracy; no hints as to which equations to use are provided.

Style

England, Canada, Texas: steering the answer in the right direction

In the English papers, the questions are highly structured, the marks per part indicated, and the space provided for the answer clearly limited. The two papers provided have significant overlap of diagrams and questions. There is balance of recall and reasoning but the difficulty and volume of both is low in comparison to most of the other scripts examined.

The multiple choice question (MCQ) format of the Canadian and Texan papers gives similar rigidity to the range of possible answers as the hints and narrow wording of the English exams. The Texas paper is marginally more difficult than the English paper; although it covers more content, the nature of the MCQ format is very poor at testing real understanding over ability to gamble on odds.

New York, Massachusetts, Germany: focus on academics and reasoning

The Massachusetts papers have a number of MCQs but also several "open response" questions. The papers require recall and reasoning but the emphasis is on the latter. In general, and probably because of the format, the answers required are more qualitative than quantitative – in contrast to the German papers which are highly quantitative. The level of the Massachusetts papers is significantly higher than in English. It is difficult to compare the level of difficulty with the more challenging German paper because the MCQ format necessarily gives strong hints as to the answers – in many cases a minimal knowledge of chemistry will narrow the answer to one or two choices.

The New York papers are the most overtly academic in style and require the students to refer to a published chemistry reference table for data. The difficulty of the questions and the breadth of chemistry examined is very similar to the Massachusetts paper. The New York paper most closely resembles a university examination paper and the balance of recall vs. reasoning lies heavily on the side of reasoning. Unlike the Canadian papers and the English papers, chemistry knowledge and understanding is required to perform most of the reasoning; just logic is not sufficient.

Combined science is more "topical" but less scientifically coherent

On the Texas paper, there is clear intent in these papers to make the questions "topical and interesting" in much the same manner as the English, French and Canadian papers (but unlike the German and other US ones). This seems to be a hallmark of combined science papers and is always accompanied by a greater reliance on logic/common sense over scientific knowledge and understanding to answer the questions. For most of these questions the correct answer can be narrowed down to one or two possibilities by simple logic or application of common sense. In the German paper, for example, no attempt is made to make the questions topical – the data provided is of a form that might be the output of a real experiment rather than a contrived data set clearly dreamt up by the examiner to fit a particular relationship.

It is clear that the "combined science" papers are less rigorous in their requirements for numeracy and also for real scientific understanding than the single subject papers. The level and rigour required to complete the German, New York and Massachusetts exam papers was significantly higher than the English papers against any criteria.

Mathematics

Professor Peter Cameron, Director of Pure Mathematics, Queen Mary, University of London

Content

The content of the English papers[52] is broadly similar to that of most of the comparison countries, covering a wide selection of geometry, algebra, graphing and using statistical data. There are two main differences: the first is that on some of the papers (particularly Germany[53]) the content is markedly more advanced than on England's GCSE. The second is that some countries (e.g. Japan[54] and Canada[55]) put a much greater emphasis on basic algebraic and numerical manipulation.

Germany: more advanced content

The content of the German paper in particular is far more advanced than that of the GCSE, with questions more likely to be found on an AS-level paper. British Columbia also has some content more advanced than is found on the GCSE.

Japan and British Columbia: building the basic toolkit

The papers from Japan and British Columbia contain question after question focusing on rearranging equations, simplifying or factorising expressions and so on. This emphasis on basic algebraic and numerical skills is clearly designed to build up the basic toolkit of manipulation which is essential for any further advancement in mathematics.

52 AQA GCSE Specification A Higher Tier Paper 2 June 2008.
53 Brandenburg State Year 10 2008.
54 Japanese Middle School examination questions (http://testkyouzai.zero-yen.com/fddata.htm).
55 British Columbia Principles of Mathematics 10 Form A 2008.

Difficulty

The English papers avoid multiple choice questions, unlike the North American and Japanese exams. However on the English papers candidates are frequently led through the solutions in very small steps. This prevents the students from having to understand the mathematics needed to work out the right method for solving a larger or multi-stage problem.

New York: students need deep understanding to problem-solve

The New York papers'[56] open-ended questions provide no steps or guidance whatsoever, posing challenging, multi-stage problems and leaving the students to work out how best to approach them. These questions require students to have a deep understanding of the mathematics involved as well as an ability to think about the steps involved in tackling a particular mathematical problem, rather than the "functional" approach of solving a series of single, small-scope questions generally found on the English papers.

British Columbia, Japan and Texas: multiple choice but not dumbed down

Many of the international papers have a reliance on multiple choice, although in some of these cases (e.g. New York) they are also supplemented by numerous and extensive open-ended questions. In fact some of the MCQs, particularly those from the New York exams, could be better than the English equivalents, as they avoid the multiple stage approach but still pose challenging problems. The Texas paper,[57] despite not requiring a particularly advanced standard of maths, does ask some challenging one-step MCQs. The papers from British Columbia and Japan, with their emphasis on basic manipulation, are quite suited to multiple choice, although obviously this is likely to increase students' marks on questions they could not otherwise answer.

Style

In England each question is restricted to a single topic, discouraging students from understanding how the different elements of mathematics relate to one another; other countries mix different parts of the syllabus in a single question. Also, the English papers shy away from asking for proofs or explanations. I think that application will succeed in most of the questions on all of the papers. But those requiring proof or reasoning are more likely to test innate ability (teaching proof is hard, though essential!).

France and New York: testing reasoning not recall

Some questions on the French[58] and New York papers require proofs or explanations which demonstrate real understanding of a mathematical concept and require the ability to work through a problem. The nearest the English papers come to this is "Show your working", which is not really the same thing.

Perhaps unsurprisingly the North American papers are strongest on this. Many of them are expressed as "word problems" describing everyday situations and requiring the student to figure out how the mathematics applies. There is nothing similar in the English papers.

Texas and France: students need a good level of understanding

The Texas paper mostly covers arithmetic and algebra but contains many questions of the form "what extra information is needed ...?" or "which statement best describes ...?" that require a degree of reasoning or lateral thinking from students, although the mathematics itself is not much more advanced on this paper.

56 Regents Examination in Geometry Fall 2008.
57 TAKS Grade 10 April 2009.
58 National Brevet Diploma 2009.

Questions like the below, from the French paper, may appear trivial but do have some value:

France
National Brevet Diploma 2009

Exercise 1

$$A = \frac{8 + 3 \times 4}{1 + 2 \times 1{,}5}$$

1 Calculate A

2 To calculate A, a student typed the following sequence into his calculator.

8	+	3	×	4	÷	1	+	2	×	1	.	5	=

Explain why he has not obtained the correct answer.

By asking why a naive sequence of keypresses on a calculator will not give the correct answer to a given problem, this question requires some understanding of both the rules for algebraic calculation and the mode of operation of a calculator.

English

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Content

What is taught varies – rightly – across countries

What can a comparison tell us? I must be clear, first of all, about some context. The idea of an "equivalent" is potentially misleading, since the education structures of different countries (modes and expectations of teaching and assessment, time spent studying, relationship between education at 16 and earlier years) are not taken into account in my analysis. Similarly, the place of "English" (or the national language) as part of the wider curricula is not consistent. And it is important to remember that the skills in English usage are tested and taught in many other subjects. Matters of expression, and accurate and clear writing, as well as the ability to construct arguments, to analyse problems verbally, and to comprehend written and spoken language are not the monopoly of studying "English".

Style

The need to test what can be taught

But some conclusions can be drawn. In a comparison between papers I have examined, the first obtrusive question is about whether the examination papers test what can be taught. The "comprehension" tests, as they used to be called, which are common across all the papers – written and on some occasions oral – are always problematic in this respect. This is a well-recognised challenge for educationalists and there are no easy answers. Able students can do them with or without teaching; but teaching less naturally accomplished students is no guarantee of significant improvement. It is a little like high level aural tests in music that can be taught to an extent, but those with perfect pitch can do them whether they show up to the lessons or not.

France, Canada and the US: relying on the tick-box

However, the extensive use of multiple choice on "comprehension" exercises raises some harder questions. The examinations in French in France[59] and in English in New York,[60] British Columbia,[61] Texas[62] and Massachusetts[63] are among those using MCQs as assessment modes (in Texas in March 2009, students were tested through MCQs on their understanding of a short 11-image comic). MCQs have advantages, not least that they are easy and cheap to mark, and – so long as there are no ambiguities in the questions or answers (which there often are) – "objective" to mark as well. But it is easy to see the limits of MCQs: they test understanding, but sometimes crudely; they don't permit discursive answers that try to catch more shaded forms of meaning; guesswork can sometimes produce good results; and they let the exam question do a lot of the thinking for you.

England: writing from scratch

AQA, the English awarding body whose papers I considered,[64] declines to use this method in the current specification, and prefers in both the Foundation and Higher Tier of GCSE English to concentrate on the more teachable skills of "Writing to Inform, Explain or Describe". The preference is for grappling with the challenge of a blank piece of paper. Actually, they take this the full extent, and don't have answer booklets with the questions inside, but simply exam papers, and genuinely blank exam booklets for the students' responses. Pupils really do have to face the daunting prospect of a *tabula rasa*.

This is by no means the case in the international examinations. The tasks for the GCSE paper involved writing about an experience, a person the pupil admired, and the winning invitation: "Write a letter to a Minister for Education informing him or her of the things you think should be done to improve education for teenagers". These are appropriately motivating assignments, but not ones in which less able pupils will fail to secure marks with good teaching. Appropriate guidance on structuring essays – helpful but not restraining – is given for the Foundation level.

Difficulty

England and Germany: an opportunity to shine

On the AQA papers, ability to read and understand is tested through questions about extracted or anthologised literary texts and there is a keenness to ask some searching questions. Steinbeck's *Of Mice and Men* may be a little over-familiar as a text for study at this level, but a question such as, "Choose two characters from the list below, say why you think they are important in the novel and how Steinbeck presents them" give plenty of opportunity for students to shine. Being able to say why you think something is important is a valuable skill.

The German paper[65] I looked at was perhaps the most demanding (with England in second place). It was a four-hour test in discursive ability (both in discussion format and in essays), and it offered a tough examination in verbal ability to construct argument and reflect on ideas.

US and Canada: begging the question

Of course, every paper I considered includes some writing task or other (I have not considered coursework elements here in any context). British Columbia, for instance, had unsurprisingly the North American preference for "writing prompts" rather than actual specific questions. Their test for last year after all the MCQs included asking pupils to take up the prompt: "The lessons we learn affect our future".

Actually, I think pupils *should* get used to answering specific questions at this stage: no one can escape the responsibility for responding directly to questions in later life, so it seems a pity to avoid them at this stage. But for all the challenges around science and maths in an international context, I saw evidence in these examples of assessment in national languages of strength in England. In its current specification, AQA has offered, I think, probing assessment that encourages meaningful teaching – not least because it assesses that which can be taught. And it has avoided the peril of the tick-box.

59 National Brevet Diploma College Level French 2009.
60 Regents High School Comprehensive Examination in English Session One 2008.
61 English 10 Release Exam 2008/09.
62 TAKS Grade 10 English Language Arts March 2009.
63 MCAS Grade 10 English Language Arts Test Spring 2009.
64 AQA GCSE English A Paper 2 Higher Tier June 2008.
65 Bavaria Realschulen German Final Examination 2006.

Educational disadvantage

The poor quality of England's core academic exams relative to our most successful competitors is evidenced by two international surveys of education: the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA).[66] Neither are perfect surveys; PISA has been criticised for being too applied[67] and disadvantaging those from different cultural contexts,[68] whilst TIMSS has faced the charge of ignoring large areas of mathematical testing[69] and having a rapidly fluctuating sample which makes comparison over time difficult. But they do suggest that those countries which maintain a rigorous core academic curriculum are the ones which perform better and are producing the best educational outcomes.

Figure 4: PISA 2006 mean scores
Source: OECD (2006), PISA 2006

	Science	Mathematics	Reading
Finland	563	548	547
Korea	522	547	556
Canada	534	527	527
New Zealand	530	522	521
Netherlands	525	531	507
Australia	527	520	513
Japan	531	523	498
Switzerland	512	530	499
Belgium	510	520	501
Ireland	508	501	517
Germany	516	504	495
Sweden	503	502	507
Austria	511	505	490
Czech Republic	513	510	483
United Kingdom	515	495	495
Denmark	496	513	494
Poland	498	495	508
Iceland	491	506	484
France	495	496	488
Hungary	504	491	482
Norway	487	490	484
Luxembourg	486	490	479
Slovak Republic	488	492	466
United States	489	474	-
Spain	488	480	461
Portugal	474	466	472
Italy	475	462	469
Greece	473	459	460
Turkey	424	424	447
Mexico	410	406	410

66 Biesta, G. (2009), "Good education: what it is and why we need it". Inaugural lecture, University of Stirling.
67 Prais, S. (2003), "Cautions on OECD's recent educational survey", *Oxford Review of Education* , No. 29.
68 Wu, M. (2009), *A critical comparison of the contents of PISA and TIMSS mathematics assessments*.
69 McNab, D. (2000), "Raising Standards in Mathematics Education: Values, Vision and TIMSS", *Educational Studies in Mathematics*, Vol. 42 No. 1.

Figure 5: TIMSS 2003 mean scores (OECD countries in bold)[70]
Source: National Centre for Education Statistics (2007), Trends in International Mathematics and Science Study 2007.

	Science	Mathematics
Singapore	578	605
Chinese Taipei	571	585
Korea	558	589
Hong Kong	556	586
Japan	552	570
Estonia	552	531
Hungary	543	529
Netherlands	536	536
Belgium (Flemish)	516	537
Australia	527	505
United States	527	504
Slovak Republic	517	508
Sweden	524	499
Lithuania	519	502
Russian Federation	512	508
Latvia	512	508
Malaysia	510	508
New Zealand	520	494
Slovenia	520	493
Scotland	512	498
England	498	498
Israel	488	496
Italy	491	484
Norway	494	461
Bulgaria	479	476
Romania	470	475
Serbia	468	477
Moldova	472	460
Armenia	453	478
Cyprus	441	459
Macedonia	449	435
Iran	449	411
Bahrain	438	401
Indonesia	420	411
Egypt	421	406
Lebanon	393	433
Palestinian National Authority	435	390
Tunisia	404	410
Chile	413	387
Morocco	396	387
Philippines	377	378
Botswana	365	366
Saudi Arabia	398	332
Ghana	255	276
South Africa	244	264

70 England sample may not be large enough to provide a fair comparison. TIMSS 2003 used rather than the most recent survey (2007) because a large number of comparator countries did not participate in 2007.

GCSEs in decline

Analysis by Robert Coe of Durham University for the Office of National Statistics suggests that standards have indeed fallen.[71] Coe compares GCSE results with students' performance on YELLIS (Year 11 Information System), a test in mathematics and vocabulary which is used as a comparison to measure a student's ability.[72] His analysis shows that students with the same YELLIS score now achieve higher average GCSE results than in the past. Coe suggests that performance in maths increased by almost 0.8 of a grade in the decade to 2006; history and French by around two-thirds of a grade; and English by just under half a grade.[73]

Figure 6: The decline in standards[74]
Source: Joint Council for Qualifications (2009), GCSE, Applied GCSE and Entry Level Certificate Results Summer 2009; Centre for Evaluation & Monitoring (2009), Average YELLIS test scores for Year 10 testing cohort

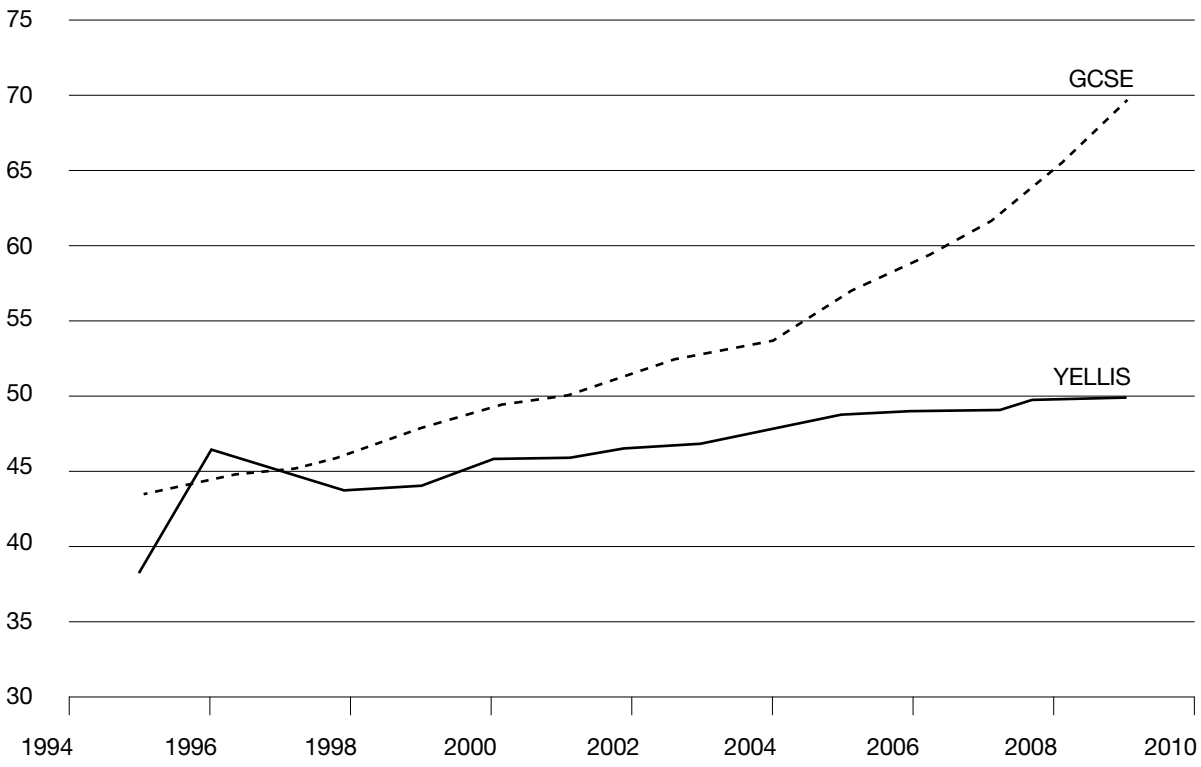


Figure 6 shows that between 1995 and 2009 the number of pupils achieving 5 or more A* to C grade GCSEs increased by 60 per cent, whereas YELLIS performance increased only gradually.[75] This would indicate that the same GCSE grade now corresponds to a lower level of performance.

71 Coe, R. (2007), *Changes in standards at GCSE and A-level: Evidence from ALIS and YELLIS*.
72 www.yellisproject.org.
73 Coe, R. (2007), *Changes in standards at GCSE and A-level: Evidence from ALIS and YELLIS*.
74 Percentage of UK cohort achieving five or more A*-C GCSEs or equivalent against average YELLIS test scores for Year 10 testing cohort from the preceding year.
75 Joint Council for Qualifications (2009), *GCSE, Applied GCSE and Entry Level Certificate Results Summer 2009*; Centre for Evaluation & Monitoring (2009), Average YELLIS test scores for Year 10 testing cohort.

3
The importance of academic education

The nature of the 21st century society and economy means that every citizen will need a basic level of academic competency to be able to play a full role, be that engaging with government, re-skilling to change career or just being able to do one's job properly. Fulfilling the needs of the 21st century economy, and being able to play a full and active role in society, will require all children to develop academic skills.

The new workforce

A good academic education forms the basis of the most successful elements of the UK economy. Sir Stuart Rose, who runs Marks & Spencer, complained recently that British education is producing people who are "not fit for work" and said of some school leavers that: "They cannot do reading. They cannot do arithmetic. They cannot do writing." Tesco's Sir Terry Leahy has said that "standards are still woefully low in too many schools".[76]

Economic developments are fuelling an ever increasing need for academic ability.[77] There is demand for a more educated society and a higher level of personal capability.[78] The Leitch Review of Skills projected a 50 per cent increase in the share of highly skilled occupations, such as managers and professionals, and a decrease in low skilled occupations, by 2020.[79] The real value of academic excellence is shown by the Government's immigration points system, which places a very high value on master's degrees, PhDs and other academic qualifications above their vocational rivals.[80]

In the modern economy employers need school leavers to have developed the ability to think and reason beyond basic literacy and numeracy. Businesses are placing greater emphasis on capabilities of the mind onto which they can add specialist training.[81] Professions such as nursing also require the adaptive, critical and problem-solving skills that academic training can deliver. *Reform's* previous research has shown that employers consistently value the ability to think and the transferable academic abilities that enable people to learn new skills, over and above specific vocational training.[82] Vocational skills can be developed on the job; it is the academic grounding that needs to be in place.

Despite the impact of the recession on graduate recruitment, modern economies will have to continue to expand participation in higher education.[83] The UK will need more graduates, not fewer; the earnings premium for graduates has held up despite increasing numbers.[84] The academic route remains by far the most successful path for school leavers to follow.

The economic costs of discouraging academic training

By encouraging individuals to make limited educational decisions, the bias against academic training contributes to the labour market phenomenon of occupational segregation (where different people become concentrated in different jobs, irrespective of their actual abilities).[85] This segregation of people into different occupations (or roles within occupations) introduces rigidities into labour markets that interfere with the allocative efficiency of these markets. This not only means that the right person is not allocated to the right job, but that the supply of skilled workers in the economy is discouraged more generally.

These problems in the labour market damage, in turn, prospects for economic growth. Encouraging individuals to make limited educational decisions leads to them under-investing in (particular types of) human capital, discourages entrepreneurship and creates an opportunity cost of foregone GDP and productivity (as people are discouraged from acquiring human and financial capital).

76 Armitstead, L. (2009), "Sir Stuart Rose: Schools are not providing workers with the right skills", *The Daily Telegraph*, 24 November.
77 Barro, R. (2001), "Human capital and growth", *The American Economic Review,* Vol. 91 No.2.
78 Haldenby, A. et al. (2008), *The mobile economy*, *Reform*.
79 Leitch, S. (2006), *Prosperity for all in the global economy – world class skills*.
80 UK Border Agency (2009), www.ukba.homeoffice.gov.uk.
81 CBI (2007), *Shaping up for the future: The business vision for education and skills*.
82 Bassett, D. et al. (2009), *A new level*, *Reform*.
83 Haldenby, A. et al. (2008), *The mobile economy*, *Reform.*
84 Walker, I. and Zhu, Y. (2008), "The college wage premium and the expansion of higher education in the UK", *Scandinavian Journal of Economics*, Vol. 110 No. 4.
85 Fortin, N. and Huberman, M. (2002), "Occupational Gender Segregation and Women's Wages in Canada: An Historical Perspective", *Canadian Public Policy*, Vol. 27 No. 1. Occupational segregation has horizontal and vertical components. Horizontal segregation occurs when different people are segregated into occupations with similar educational and other requirements but in different fields of study or endeavour (e.g. teachers vs. engineers). Vertical segregation refers to segregation along hierarchical levels of work associated with different levels of education, experience and skills.

The new divide

The continuing move away from academic qualifications could lead to a new cultural divide developing, entrenching privilege and further impacting on the UK's poor social mobility.[86] A number of grammar and the best comprehensive schools are already encouraging their pupils to follow more rigorous routes such as the three separate science GCSEs, while independent schools are increasingly offering well-regarded qualifications like the International Baccalaureate and International GCSE.[87] Meanwhile the most disadvantaged children are deprived of opportunities for rigorous academic study, and are instead pushed to follow non-academic qualifications that boost league table results. Only 0.2 per cent of individuals progress from non-academic routes into higher education, meaning this vital door of social mobility is closed to these children deprived of choice.[88]

The key to participation in society

"Education is fundamentally implicated not only in a country's economic and social development, but also in the personal development of its citizens", according to the 2007 TIMSS report.[89] A century ago a small elite participated in and ran society. Today we expect everyone to be able to participate. Indeed, a mark of a civilised nation is that the majority of the population are able to participate in politics and society. As Schumpeter (1942) and Lipset (1960) argued, a better education correlates strongly with a belief in democratic values and support of democratic practices.[90]

86 Bosanquet, N. et al. (2008), *Shifting the unequal state: From public apathy to personal capability*.
87 Curtis, P. (2009), "Government bars state schools from offering International GCSE", *The Guardian*, 4 November.
88 The Panel on Fair Access to the Professions (2009), *Unleashing Aspiration*.
89 National Centre for Education Statistics (2007), *Trends in International Mathematics and Science Study 2007*.
90 Schumpeter, J. (1942), *Capitalism, Socialism and Democracy*; Lipset, S. (1960), *Political man: The social bases of politics*.

4
Conspiracy, not cock-up

The difference in the culture and the expectations of English education for 16 year olds is no accident. It lies in a series of policy decisions over the last 25 years which have sought to restrict access to academic qualifications and move a sizeable proportion of children into non-academic routes.

The capability myth

At the root of this direction of policy is the idea that not everyone is suited to an academic education and that for some people studying at the vocational level is the most suitable course of action.[91] This "capability myth" is damaging the most disadvantaged children, who are suffering from what Professor E. D. Hirsch of the University of Virginia calls "the soft bigotry of low expectations".[92]

This attitude has been repeatedly demonstrated by educational policymakers, who have made attempt after attempt to create durable and effective vocational routes despite the failure of successive vocational initiatives. The Tomlinson Report said that the new qualification should "place all learning in a single framework, which emphasises the equally valid, but different, academic and vocational learning".[93] Lord Leitch's skills review claimed that "parity of esteem of the vocational route [is] needed to achieve world-leading levels of post-16 participation in education and training".[94] The Government's 2005 white paper on 14-19 education argued that "we need a range of qualifications which reward different types of learning".[95]

This culture directly contrasts with the countries examined earlier in this report. Whereas in the UK there is a widespread belief that some children are just "not academic", in these other countries this attitude simply does not exist and there is a prevailing assumption and understanding that almost everyone can and should follow a full programme of academic study to 16.

If it is accepted that not everyone can do this, it becomes necessary to construct an apparatus of non-academic qualifications for the rest of the population to undertake. This explains the calamitous history of vocational qualifications since the mid-1980s, in which central government has introduced, reintroduced and scrapped qualification after qualification.

A brief history of 14-16 education over the last 25 years

	Academic changes	Vocational changes
1986	GCSEs introduced, replacing O-levels and CSEs	NVQs introduced
1992		GNVQs introduced
1994	A* grade introduced for GCSEs	
1990s	GCSEs moved from three tiers to two (except maths)	
1995		Beaumont Review recommended improvements in specifications and assessment of NVQs
1996		Dearing Review recommended creation of a Key Skills qualification and a national framework for qualifications
1997	Introduction of Key Skills	

91 For example, Curtis, P. (2009), "Don't say I was wrong", *The Guardian*, 12 May. Former Chief Inspector of Schools Chris Woodhead argues: "I think it would be unlikely that large numbers of grammar school kids would come from those disadvantaged areas – the genes are likely to be better if your parents are teachers, academics, lawyers, whatever … If we had had a system whereby those young people were able to follow practical educational courses that gave them a sense of worth, a sense that they weren't dull and less intelligent than others, it would have been much better for them." Another example of this view is Murray, C. (2008), "We Can't All Make the Grade", *Standpoint*, October: "Many children are just not gifted enough to learn to read and write at more than a rudimentary level, far short of the level required by a GCSE, and the schools can only tweak their performance at the margins. An educational system that serves all the children must begin by recognising that truth."

92 Hirsch, E. D. (1996), *The schools we need and why we don't have them.*

93 Working Group on 14-19 Reform (2004), *14-19 Curriculum and Qualifications Reform: Final Report*.

94 Leitch, S. (2006), *Prosperity for all in the global economy – world class skills*.

95 Department for Education and Skills (2005), *14-19 Education and Skills*.

A brief history of 14-16 education over the last 25 years

1998		National Qualifications Framework introduced
2000		Vocational GCSEs (VGCSEs) introduced
2004	Requirement to study a modern foreign language and design and technology dropped	Vocational GCSEs now classified as just GCSEs
	Requirement to spend 50% of teaching time on core subjects abolished	Tomlinson Report called for introduction of 14-19 Diplomas
		League tables changed to include all equivalent qualifications, not just GCSEs and GNVQs
2005	First league tables measuring 5 A*-C (or equivalent) including English and maths	
2006	Maths GCSE moved from three tiers to two	Leitch Review called for vocational routes to have "parity of esteem" with academic routes to increase post-16 participation
	Double Award Science replaced with Core Science plus either Applied Science or Additional Science	
2007	Introduction of Functional Skills	GNVQs phased out
2008		First teaching of the Diplomas
		National Qualifications Framework replaced with Qualifications and Credit Framework
2009	Introduction of modular GCSEs	League table measure excluding English and maths dropped
2010	First teaching of new English, maths and ICT GCSEs incorporating functional skills	
2011	First teaching of "academic" Diplomas	

The GCSE: a qualification for all

The GCSE was introduced in September 1986, to replace the O-level and CSE, which had been criticised for creating a two-tier system. It was intended to be a qualification for the masses that would solve the previous problems of segregation in the education system; then Education Secretary Sir Keith Joseph hoped at least 80 per cent of 16 year olds could pass the exam.[96] Students could achieve grades A to G (with A* added later), with a C set to be equivalent to a C grade at O-level or a grade 1 at CSE.

Key Skills

Sir Ron (now Lord) Dearing's 1996 review of 16-19 qualifications recommended that a new Key Skills qualification should be created, to address "concern in all quarters about current standards of achievement in communication and the application of number".[97] He also proposed that the "key skills" within, say, mathematics GCSE, should be awarded their own separate grade.

The key skills were identified as communication, application of number, and ICT. Working with others, improving own learning and performance, and problem solving, were classified as "wider" key skills.[98] The original Key Skills Qualification was introduced in 1997,[99] with a major overhaul in 2004.[100]

From 2007 there was a new emphasis on "functional skills" in English, ICT and maths. A new set of qualifications is being developed to provide these functional skills, and existing GCSE curricula are being re-written to incorporate them.[101]

96 Sofer, A. (1985), "Young idea – and so wrong", *The Times*, 25 November.
97 Dearing, R. (1996), *Review of Qualifications for 16-19 Year Olds*.
98 http://www.direct.gov.uk/en/EducationAndLearning/QualificationsExplained/DG_10039028.
99 http://www.qcda.gov.uk/6566.aspx.
100 http://www.qcda.gov.uk/6455.aspx.
101 http://www.qcda.gov.uk/6062.aspx.

National Qualifications Framework: formalised equivalence

The Dearing Review also recommended the creation of a common national framework for qualifications "to recognise explicitly the equivalence in national terms of the value of achievement".[102] The National Qualifications Framework was introduced in 1998 to fulfil this objective.[103] In introducing a formal national measure of the equivalence of different qualifications, the Government allowed for the first time the "value" of vocational qualifications to be quantified relative to that of academic qualifications.

The conflation of academic and vocational

Sir Mike Tomlinson's 2004 review of 14-19 education proposed the creation of a new Diploma, eventually to subsume GCSEs, A-levels and their equivalent vocational qualifications.[104] The report called for a "unified framework" and a "common format" for all 14-19 education, whether academic or vocational. Although Tomlinson's proposals were not implemented in their entirety, the introduction of the Diploma from 2008 has resulted in the conflation of academic and vocational education.

The Higher Diploma, equivalent to 7 A*-C GCSEs, consists of principal learning (focused on the chosen Diploma subject), additional and specialist learning (additional options) and generic learning (including functional skills and ten days' work experience).[105] At least 50 per cent of all subject content must be "applied learning" and is supposed to be taught in a "work-related environment".[106]

By attempting to provide both academic and vocational study, the Diploma risks delivering neither effectively.[107] Sir Mike Tomlinson's review of 14-19 education, which recommended the introduction of the Diploma, correctly identified many of the problems present in the system, including disengagement, underachievement, the burden of over-assessment, a lack of transparency in the examination process and grade inflation.[108] However the Diploma solves few of these problems and exacerbates others. The vocational focus may undermine the rigorous, academic aspects of the curriculum;[109] insisting on an academic slant and academic assessment for the vocational aspects risks jeopardising the effectiveness of that vocational training.[110]

Parity of esteem

The continuing focus on vocational education has led to another damaging principle: parity of esteem. In an effort to encourage children to undertake vocational qualifications, government has asserted that those qualifications are equal in value to their academic counterparts. This is embodied in the National Qualifications Framework (NQF) which, for example, states that a BTEC First Certificate is equivalent to two GCSEs at A*-C.[111] The NQF is now being phased out and replaced with the Qualifications and Credit Framework (QCF) which is intended to "present qualifications in a way that is easy to understand and measure".[112]

102 Dearing, R. (1996), *Review of Qualifications for 16-19 Year Olds*.
103 Education Act 1998.
104 Working Group on 14-19 Reform (2004), *14-19 Curriculum and Qualifications Reform: Final Report*.
105 http://www.ofqual.org.uk/100.aspx.
106 Bassett, D. et al. (2009), *A new level*, *Reform*.
107 Ibid.
108 Working Group on 14-19 Reform (2004), *14-19 Curriculum and Qualifications Reform: Final Report*.
109 Paton, G. (2008), "Diplomas 'not hard enough' for brightest pupils, claims head", *The Daily Telegraph*, 28 November. Dr Bernard Trafford, head of the Royal Grammar School in Newcastle, argues that "if we really want to produce world-class engineers, sixth-formers need to do a lot of work at 'hard subjects', including maths and physics".
110 House of Commons Education and Skills Committee (2007), *14-19 Diplomas*. The select committee noted that: "Several of those from whom we received evidence warned of the potential for 'academic drift' – i.e., that the practical and applied nature of the curriculum could be downgraded and replaced with more 'classroom-based' and theoretical activity, either through unfamiliarity with vocational teaching and learning methods, and/or as a consequence of a residual belief that 'academic' learning was the 'gold standard'." The Association for College Management in its evidence to the committee said: "We should not fall into the old trap of imagining that the only way to secure parity of esteem is to make the vocational side qualifications resemble academic side qualifications. Indeed we suggest that the parity of esteem debate is unhelpful: let us concentrate on developing first rate qualifications that offer all of our young learners an excellent, modern and accessible education."
111 Qualifications and Curriculum Authority (2006), *The National Qualifications Framework*.
112 Qualifications and Curriculum Authority (2007), *Simplifying qualifications: a guide for employers*. For more see http://www.qcda.gov.uk/19674.aspx.

Figure 7: The National Qualifications Framework and the Qualifications and Credit Framework
Source: Edexcel[113] and Department for Children, Schools and Families[114]

	NQF (being phased out)		QCF (phasing in up to September 2010)		
Level	**Qualification title**	**GLH[115]**	**Qualification title from September 2010**	**Credits**	**Equivalent to**
Level 2 Higher Diploma and BTEC Firsts					
2	Higher Diploma	800	Higher Diploma	*	7 GCSEs (A*-C)
	Level 2 BTEC First Diploma	360	Level 2 BTEC Diploma	60	4 GCSEs (A*-C)
	Level 2 BTEC First Certificate	180	Level 2 BTEC Extended Certificate	30	2 GCSEs (A*-C)
		90	Level 2 BTEC Certificate	15	1 GCSE (A*-C)
Level 1 Foundation Diploma, BTEC Introductory and FLT					
1	Foundation Diploma	600	Foundation Diploma	*	5 GCSEs (D-G)
	Level 1 BTEC Introductory Diploma	variable	Foundation Learning Tier	variable	1 GCSE (D-G)
	Level 1 BTEC Introductory Certificate	variable	Foundation Learning Tier	variable	1 GCSE (D-G)

*Diplomas have not yet been allocated a credits value on the QCF

This quantification of the "equivalence" of different qualifications has a dual effect. On the one hand, it persuades students to undertake vocational qualifications. On the other, it acts as a strong incentive for schools to enter students for vocational qualifications, since they count disproportionately towards success in performance tables. A school could claim, for example, that all of their students had achieved five GCSEs at A*-C if they passed one GCSE at grade C and achieved one BTEC First Diploma, requiring no formal external examination.

Fully 70 per cent of elite graduates on the Teach First scheme felt that their school's leadership encouraged pupils to choose courses that would benefit the school's league table results rather than meeting each pupil's long term needs.[116]

BBC education correspondent Mike Baker has argued that "the sad reality is that the British have always looked down on vocational education".[117] The truth is that employers, universities and students know the difference. 60 per cent of leading Russell Group universities, for example, have said that they will not accept Diploma for entry, despite it being technically equivalent to three and a half A-levels.[118]

As the tables below show, academic quantitative analysis of the relative value of academic and vocational qualifications shows that academic qualifications have a substantial and demonstrative upward impact on average earnings.[119] The returns from vocational qualifications can be negligible or even negative.[120] Professor Alison Wolf has found that: "We have some recent, quite robust information on current returns to low-level vocational qualifications in the UK. Analyses have been carried out on a number of data sets, and for samples drawn from across the whole economy. Obtaining a low-level vocational qualification generally has little or no impact on someone's earnings and may even be associated with a reduction in earnings compared with matched employees."[121]

113 http://www.edexcel.com/quals/BTEC/why-btec/Pages/Equivalences-progression.aspx.
114 http://www.dcsf.gov.uk/14-19/documents/Guide_to_Diplomas_wallchart.pdf.
115 Guided learning hours.
116 Teach First (2009), *Lessons from the Front 2009*.
117 Baker, M. (2001), "Beating the 'British disease'", BBC News Online, 27 January.
118 Lipsett, A. (2009), "Diplomas invalid for many top university courses", *The Guardian*, 6 May.
119 Blundell, R. et al. (2004), *Evaluating the Impact of Education on Earnings in the UK: Models, Methods and Results from the NCDS*.
120 Dearden, L. et al. (2004), *An In-Depth Analysis of the Returns to National Vocational Qualifications Obtained at Level 2*.
121 Wolf, A. (2007), "Round and Round the Houses: the Leitch Review of Skills", *Local Economy*, Vol. 22 No. 2.

Figure 8: Percentage wage gain to academic qualifications
Source: Blundell, R. et al. (2004), Evaluating the Impact of Education on Earnings in the UK: Models, Methods and Results from the NCDS

O-levels/GCSE A*-C vs. no qualifications	14.8
A-levels vs. O-levels/GCSE A*-C	6.4
HE vs. A-levels	23.5
HE vs. any lower qualification	28.7

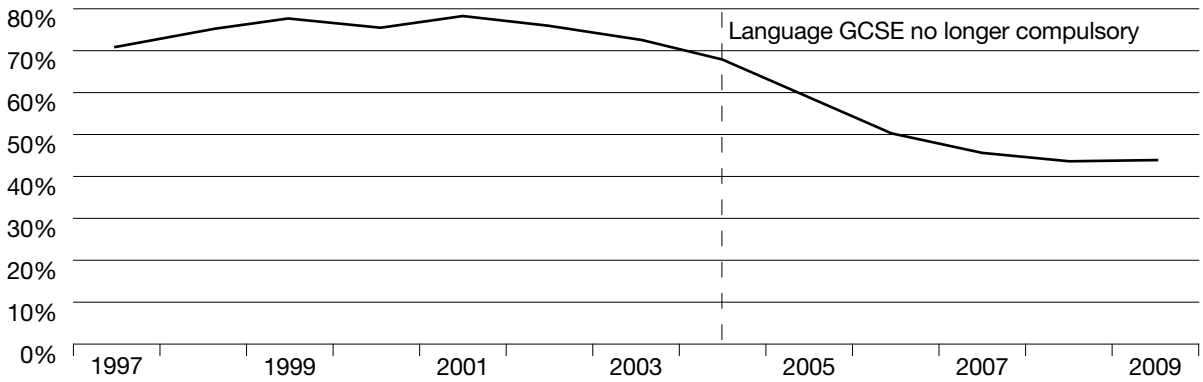
Figure 9: Percentage wage gain to NVQ level 2 qualifications (vs. no qualifications or level 1 only)
Source: Dearden, L. et al. (2004), An In-Depth Analysis of the Returns to National Vocational Qualifications Obtained at Level 2

	Males	Females
All	-0.054	-0.008
Obtained at college	-0.116	-0.009
Employer-sponsored	0.018	0.017
Government training	-0.225	-0.166

The result: a decline in the core

We have seen the impact that these policy decisions have had on the international league tables and on the quality of English exams compared with those of our leading competitor countries. But there is clear evidence to show that academic qualifications have suffered at the expense of the Government's pro-vocational agenda.

Figure 10: Percentage of Key Stage 4 pupils entered for at least one language GCSE in England
Source: CILT (2009), GCSE languages by Key Stage 4 pupils – all schools in England, 1994-2009



As the chart above shows, the proportion of pupils studying language GCSEs has dropped from around 70 per cent to around 45 per cent in the five years since this was dropped as a compulsory requirement.[122] A vicious circle may be created, as fewer students take the subjects, causing fewer schools to offer them, thereby depriving the opportunity to even more pupils. In history, for example, almost 1,500 schools did not enter any pupils for the GCSE in 2007, the vast majority of which were amongst the 3,500 state secondary schools in England.[123] This suggests that around a third of all schools are not offering history from age 14. The result is that only around 31 per cent of pupils now study history GCSE.[124]

122 CILT, the National Centre for Languages (2009), *GCSE languages by Key Stage 4 pupils – all schools in England, 1994-2009*.
123 Henry, J. (2007), "A third of schools ditch history for GCSE", *The Daily Telegraph*, 11 February.
124 Paton, G. (2009), "Fewer taking history GCSE as pupils abandon traditional subjects", *The Daily Telegraph*, 26 May.

5
Core business

What is needed is to turn the prevailing wisdom on 14-16 education on its head. Since the mid-1980s, and under governments of both parties, the assumption has been that a large minority of English students are not up to studying academic qualifications. This is despite the evidence of other countries, despite the evidence of the lack of financial return to vocational qualifications and despite the repeated failures to introduce robust vocational qualifications.

In the last five years, the Government has accepted that there should be some "core" academic study. In the 2005 white paper, it argued that the key measure in school performance tables for 16 year olds should include English and maths, and that students should study "functional" English and maths.[125] The first proposal was right since it sends a clear incentive to schools and a clear message to students that English and maths are essential subjects. The second was wrong since the level of "functional skills" is far below that of GCSEs. At the same time, the quality of GCSEs themselves have declined, and are now weaker than those in comparator countries.

In its most recent white paper, the Government claimed an "absolute priority that every child achieves well in the basics, especially in English and mathematics".[126] That will not be achieved with the current narrow and shallow core of study. The white paper went on to offer a "guarantee" to pupils in regard to their school education (which will go into statute via the new Children, Schools and Families Bill). But the guarantee provides only a guarantee of choice of routes of learning rather than a broad core of high quality study.

Two key reforms are necessary: introducing a strong academic core for all pupils, and putting academics and subject experts in charge of GCSEs to ensure that the qualifications are rigorous and fit for purpose. These reforms are consistent with *Reform's* previous recommendations to increase the academic rigour of A-levels.[127]

125 Department for Education and Skills (2005), *14-19 Education and Skills*.
"Achieving functional skills in English and maths must be at the heart of the 14-19 phase. These skills are essential to support learning in other subjects and they are essential for employment. Achieving level 2 (GCSE level) in functional English and maths is a vital part of a good education. In order to ensure more young people achieve that grounding:
> we have already reduced the amount of prescription in the Key Stage 4 curriculum, providing more scope for schools to support catch-up in English and maths;
> we are extending the Key Stage 3 Strategy to improve classroom practice, so that it provides support across secondary schools; we will expect more teenagers to achieve 5 A*-C grade GCSEs including English and maths and we will introduce a general (GCSE) Diploma to recognise those who achieve this standard;
> we will toughen the GCSE Achievement and Attainment Tables, showing what percentage of young people have achieved the Diploma standard – ie 5 A*-C grade GCSEs including English and maths. We expect to phase out the existing 5 A*-C measure by 2008;
> we will ensure that no-one can get a C or better in English and maths without mastering the functional elements. Where a teenager achieves the functional element only, we will recognise that separately; and
> we will provide more opportunities and incentives for teenagers who have not achieved level 2 by 16 to do so post-16 and support them in achieving level 1 or entry level qualifications as steps on the way."

126 Department for Children, Schools and Families (2009), *Your child, your schools, your future: building a 21st century school system*.
"Schools are already expected to:
> provide a balanced and broad-based curriculum which gives opportunities to learn and achieve and which prepares all pupils for the opportunities, responsibilities and experiences of later life, and promotes pupils' spiritual, moral, cultural, mental and physical development.
> The new Pupil Guarantee will now also ensure:
> that the curriculum is tailored to every child's needs so that, from September 2011, every primary pupil receives the support they need to secure good literacy, numeracy and ICT skills, learn another language and about the humanities, science, technology and the arts, such as learning to play a musical instrument;
> that every 11-14 year-old enjoys relevant and challenging learning in all subjects and develops their personal, learning and thinking skills so that they have strong foundations to make their 14-19 choices. This will be phased in by September 2010;
> that every learner from 14-19 has the choice of learning route and qualifications from Apprenticeships, Diplomas, the Foundation Learning Tier and GCSEs/A-Levels; this will ensure that they have the opportunity to gain functional skills and increase opportunities to progress to higher education. This will be phased in by 2013;
> that every pupil understands they have, and are encouraged to take up, the opportunity to study at least two science GCSEs and, by September 2014, those who would benefit from a more stretching science curriculum have the opportunity to study triple science GCSE (physics, chemistry and biology);
> that every pupil aged 14-19 has the opportunity to undertake community service and high-quality work-related learning, by September 2009; and
> that every young person is participating in education or training up to the age of 17 from 2013 and up to the age of 18 from 2015."

127 Bassett, D. et al. (2009), *A new level*, *Reform*.

All pupils should study an academic core

The current core curriculum as defined by DCSF is not adequate. The emphasis on functional skills and the lack of a requirement to follow rigorous academic qualifications (exemplified by the decline of science GCSEs) demonstrate that vital academic education is not available to all students.

Every 14-16 year old should have the opportunity to study an "academic core", a minimum level of rigorous academic study to prepare them for whatever they want to do after 16. This should consist of five rigorous academic GCSEs – maths, English and any three other academic subjects such as sciences, languages, history or geography.

The subjects from which the academic core is taken should be:

- English Language
- English Literature
- Mathematics
- Physics
- Chemistry
- Biology
- Modern Foreign Languages
- History
- Geography

These subjects represent a sensible choice for the core for several reasons: they are commonly considered to be "core" in terms of subject knowledge; they are widely available and taught in most schools; and any of these subjects with a rigorous curriculum and exam should be an appropriate vehicle for teaching the key academic skills such as critical thinking and problem solving.

Combined science GCSEs should not count towards the academic core.

League tables should drive attainment in the core

School league tables should be changed to measure attainment only in the academic core. Rankings should be based on the number of pupils to successfully complete five of the core GCSEs including maths and English. This will ensure that, while pupils will retain the opportunity to pursue vocational or practical options alongside, there will no longer be an incentive for schools to encourage them to do so at the expense of academic education. League tables would also then provide a much more accurate guide as to which schools were best equipping their pupils for future success.

GCSEs should be led by subject experts with the academic guardianship of universities

It is essential that, for qualifications to properly fulfil their required functions, their development is led by the appropriate people, who deal with the "output" from the qualifications. Universities, as the academic custodians of the British education system, should play the lead role in maintaining academic standards.

In *A new level*, *Reform* proposed charging university Heads of Department with the quality assurance of A-levels, through groupings such as Heads of Department of Mathematical Sciences and the Council for College and University English.[128] These groups should also be entrusted with responsibility for academic GCSEs. For GCSEs, these academics should enlist senior subject teachers, such as school heads of department, to lead the development of GCSE curricula and examinations.

This means that Ofqual and the QCDA should give up their responsibilities for GCSE standards. The funding that those organisations currently spend on these responsibilities should be redistributed to schools, who would pay exam boards, as at present, for the examinations that their students sit. The exam boards would then pay a levy to the academic group for each subject to fund their work.

128 Ibid.

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Appendix: International exams at 16

Mathematics

Germany

Brandenburg State Year 10 2008

Question **(12 points)**

3 In ancient Egypt between 2630 BC and 1640 BC when a Pharaoh or his queen died, the mummified bodies were buried in the pyramids. The Pyramid of Cheops was the biggest stone building in the world and the oldest of the Seven Wonders of the Ancient World. Today the edges are 232 m long and it is 148m high.

a) Show this quadratic pyramid in a three dimensional sketch to scale.

($q = \frac{1}{2}$ and $\alpha=45°$)

Indicate the scale used.

b) The pyramid is made from stone block with an average mass of 2800kg. An ancient unit of measurement is the talent. One talent is 29.196kg.

Determine the mass of a block of stone in talents.

c) Some scientists think that due to decomposition only 91.3% of the pyramid left today.

Determine the original size of the pyramid.

d) In the professional literature one find the following statement.

"The circumference of the base of the Pyramid of Cheops is equal to the circumference of a circle with radius h, where h is the height of the pyramid.

Examine the truth of that statement by means of a calculation

e) Calculate the angle of inclination of the sides the pyramid to its base.

f) Paul rebuilt the Pyramids of Cheops in a 3-D model to scale. The height of the model is 0.74 m

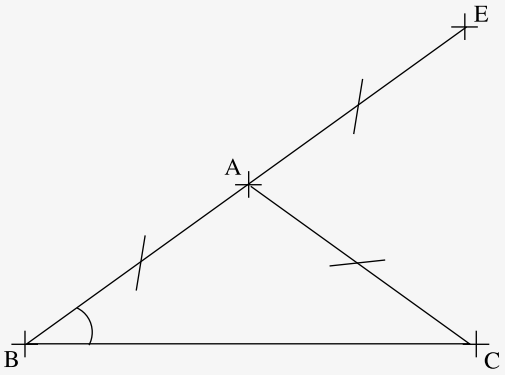
Decide whether the model can be erected on a base with the length of 1.20 m.

Justify your answer.

France

National Brevet Diploma 2009

Question



2 In this question, we will be considering this diagram where:
- ABC is the isosceles triangle such that AB=AC=4cm
- E is the mirror of B with relation to A

Part 1
Consider the specific case where the angle ABC is 43 degrees.
1 Construct the figure in real size.
2 What is the nature of the triangle BCE? Justify your answer.
3 Prove that the angle EAC is 86 degrees.

Part 2
Consider now the case where the angle ABC is unknown.
Jean affirms that whatever the value of the angle ABC, the angle EAC=2x the angle ABC.
Is Jean right? Outline your method on your answer booklet.

Japan

Japanese Middle School examination question

Question

Factorise the following:

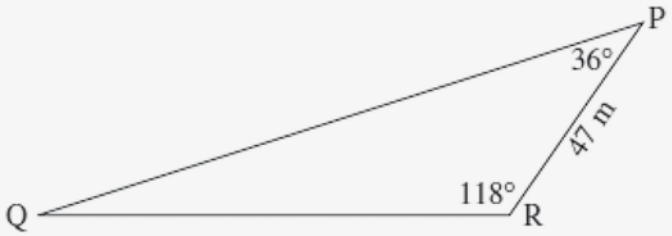
(1) $10x^2 - 25x$
(2) $15ab - 9ab^2$
(3) $x^2 - 64$
(4) $25a^2 - 16b^2$
(5) $x^2 - 10x - 24$
(6) $x^2 + 6x + 9$
(7) $x^2 + 10xy + 25y^2$
(8) $x^2 - 9x + 20$
(9) $x^2 - 6x - 27$
(10) $25x^2 - 30x + 9$
(11) $a^2x - 9ax + 8x$
(12) $y - x^2y$

Canada

British Columbia Principles of Mathematics 10 Form A 2008

Question

49 Determine the length of QR to the nearest metre.

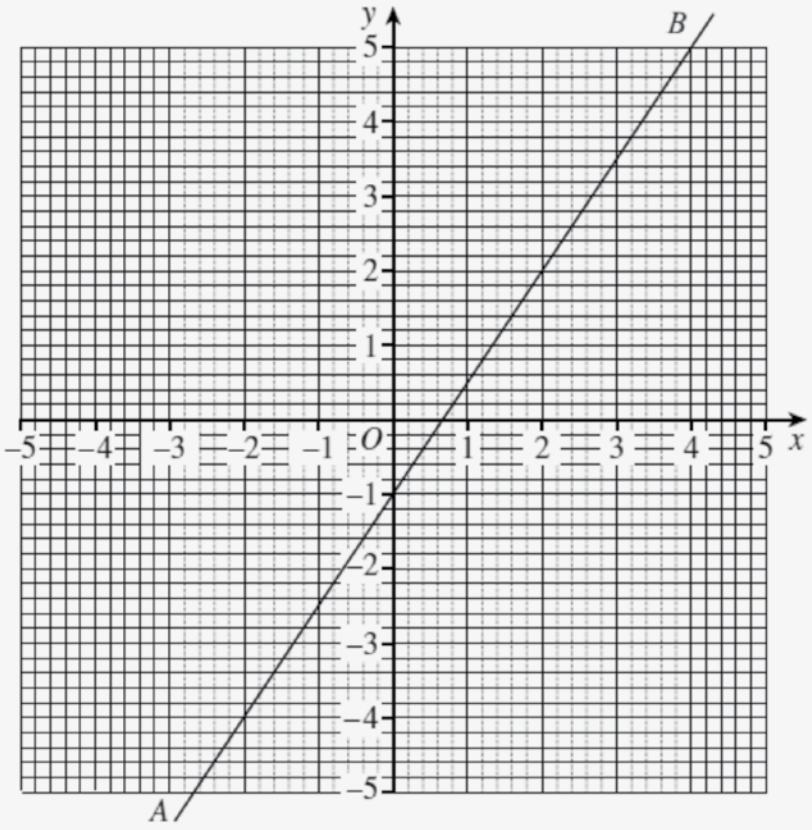


England

AQA GCSE Specification A Higher Tier Paper 2 June 2008

Question

14 The graph shows a line AB.



Work out the gradient of the line AB. (2 marks)
Write down the equation of the line AB. (1 mark)
Write down the gradient of a line perpendicular to AB. (1 mark)
Write down the equation of the line perpendicular to AB passing through (0, 8). (1 mark)

Massachusetts

MCAS Grade 10 Mathematics Test Spring 2009

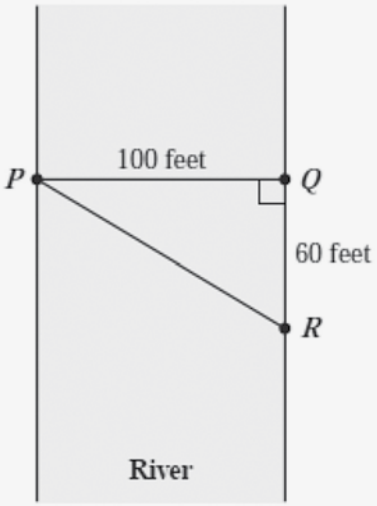
Question

40 Triangle PQR in the diagram below represents Pam's trip across a river.

In the diagram, PQ represents her planned trip across the river, and PR represents her actual trip across the river.

Based on the dimensions in the diagram, which of the following is closest to the length of PR?

A. 104 feet B. 117 feet C. 120 feet D. 160 feet

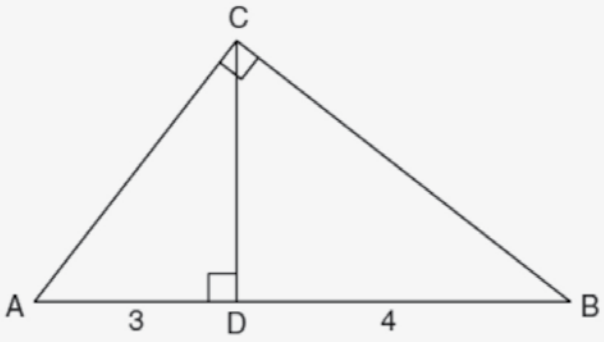


New York

Regents Examination in Geometry Fall 2008

Question

29 In the diagram below of right triangle ACB, altitude CD intersects AB at D. If AD = 3 and DB = 4, find the length of CD in simplest radical form.

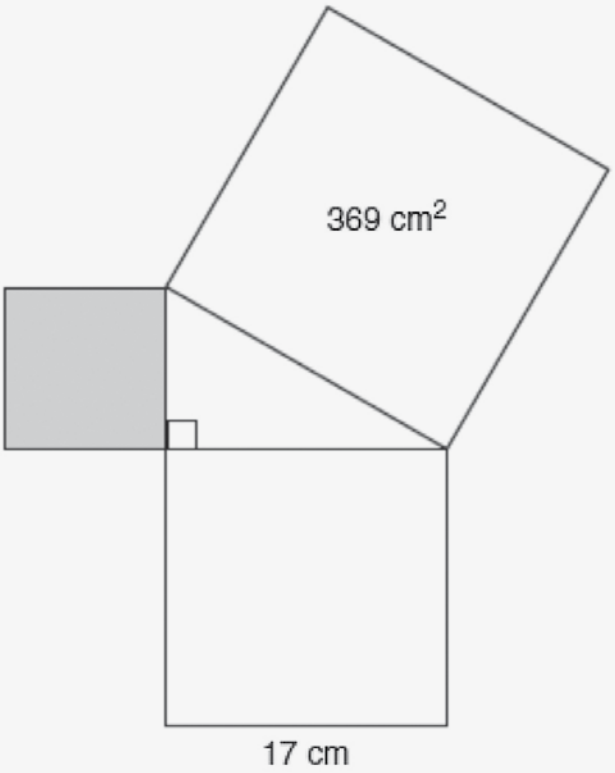


Texas

TAKS Grade 10 April 2009

Question

49 The three squares shown below are joined at their vertices to form a right triangle.



What is the area of the shaded square?

A. 80 cm^2
B. 352 cm^2
C. 2 cm^2
D. 658 cm^2

Science

Massachusetts

MCAS Grade 10 Chemistry Test Spring 2008

Question

44 Carbon (C) reacts with bromine (Br) to form carbon tetrabromide (CBr_4).

a Draw the Lewis dot structures for carbon (C) and bromine (Br).

b Draw the Lewis dot structure for carbon tetrabromide (CBr_4).

c Identify the shape of the CBr_4 molecule as predicted by valence-shell electron-pair repulsion (VSEPR) theory and explain why CBr_4 has this shape.

Texas

TAKS Grade 10 Science April 2009

Question

$\_\_Fe + \_\_O_2 \rightarrow \_\_Fe_2O_3$

32 Iron reacts with oxygen in the air to form iron oxide. The unbalanced equation for this reaction is shown above. What are the coefficients when this equation is balanced?

F 2, 2, 1
G 2, 3, 1
H 4, 3, 2
J 4, 2, 2

Germany

Bavaria Realschulen Physics Final Examination 2008

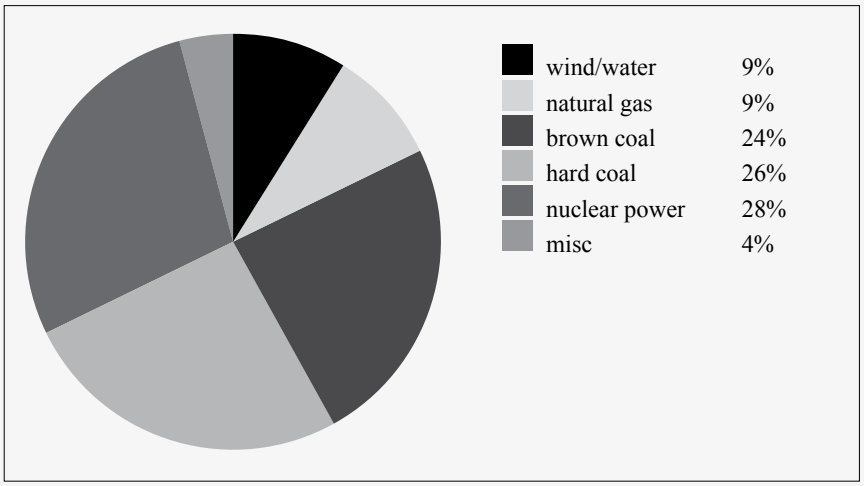
Question

A 4.1.0 When burning fossil fuels the following CO_2-emissions result per megawatt hour of electric energy:

Fuel	hard coal	brown coal	fuel oil	natural gas
CO_2 Emission in $\frac{t}{MWh}$	0.96	1.19	0.80	0.57

A 4.1.1 Which one out of the four fossil fuels should be preferred due to consideration for climate protection? Justify your answer.

A 4.1.2 Currently 6,0 x 108 MW/h are required in Germany per year. The chart below shows the distribution of the different sources of energy being used. Immediately pulling out of nuclear energy would require for the energy to be produced from other sources of power. Calculate the additional CO_2 emissions if nuclear power plants are replaced by brown coal power plants.



A 4.1.3 For one megawatt hour of electricity 0.34 t of hard coal have to be burned.
Calculate the level of efficiency of a hard coal power plant. Fuel value of hard coal: 8.1 $\frac{MWh}{t}$

France

National Brevet Diploma Physics/Chemistry 2009

Question

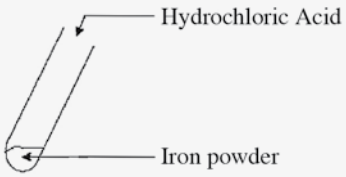
Walk on a beach
Chemistry section, 8 points:

Numerous beaches situated on the edge of cliffs are polluted by objects from the sea or left behind by walkers. We can therefore find a multitude of different rubbish. Volunteers regularly clean these beaches and sort the waste collected.

1 During one of these collections, they discovered an open can still containing some soda. Describe a simple test which would show that the can's metal does not contain any iron.

2 The can is made of aluminium.
2.1 The aluminium atom contains 13 positive electric charges. Indicate where these charges are located.
2.2 Give the number of electrons in this atom.

3 The soda is an acidic drink. In the can, an iron nail has been eroded by the soda. In the lab, an identical chemical reaction can be recreated in the following manner:



A gaseous emission is given off.

A new solution is formed.

3.1 Give the name of the gas formed.
3.2 Describe a test to identify the gas.

England

OCR GCSE Additional Science B Unit 1 Higher Tier January 2009

Question

9 Chlorine, bromine and iodine are halogens.
The halogens are in Group 7of the Periodic Table.

a) How does the reactivity of the halogens change down the group? ..... [1]

b) Look at the word equation.

chlorine + sodium bromide → sodium chloride + bromine

In this reaction, chlorine **displaces** bromine from sodium bromide solution.

In another experiment, iodine is added to sodium bromide solution.

There is no reaction.

Explain why. ..... [1]

c) Look at the equation.

It shows how a chloride ion, Cl^-, is made from a chlorine molecule.

$Cl_2 + 2e^- \rightarrow 2Cl^-$

This is an example of **reduction**.

Explain why. ..... [1]

[Total: 3]

British Columbia

Science 10 Form A June 2009

Question

40 What type of reaction is represented by the equation?

$2C_8H_{18} + 25O_2 \rightarrow 18H_2O + 16CO_2$

A synthesis
B combustion
C decomposition
D single replacement

Alberta
Grade 9 Chemistry 2006

Question

17 A Chemical Reaction

$$\underset{56\ grams}{Fe_{(s)}} \quad \underset{?}{\overset{?}{\longrightarrow}} \quad \underset{72\ grams}{FeO_{(s)}}$$

The unknown reactant and its mass are
A oxide and 16 g
B oxide and 128 g
C oxygen and 16 g
D oxygen and 128 g

New York
Regents Examination Physical Setting Chemistry

Question

40 What is the mass of NH_4Cl that must dissolve in 200 grams of water at 50°C to make a saturated solution?

(1) 26 g
(2) 42 g
(3) 84 g
(4) 104 g

English (or national language)

Germany

Bavaria Realschulen German Final Examination 2006

Question

2 Four weeks without television and computer – What benefits and downside do you associate with such a sacrifice?

.....

.....

British Columbia

English 10 Release Exam 2008/09

Question

PART C, Writing

1 written-response question **Value: 37% Suggested Time: 50 minutes**

- Write a multi-paragraph composition on the writing prompt below.
- Your writing may be persuasive, narrative and/or descriptive.
- You may agree or disagree with the writing prompt.
- You may use ideas based on your own experience, the experience of others, your reading, your imagination, or from any aspect of your life.
- Plan your ideas in the space provided on the following page.
- Write your response in the Response Booklet using blue or black ink.

Getting Ready to Write

Throughout our lives we learn many lessons. We use some of the insights we gain from these lessons to help us find success in life.

Writing Prompt

31 The lessons we learn affect our future.

Massachusetts

MCAS Grade 10 English Language Arts Test Spring 2009

Question

Writing Prompt

Works of literature often feature characters whose pride or selfishness creates problems.

From a work of literature you have read in or out of school, select a character whose pride or selfishness creates problems. In a well-developed composition, identify the character, describe how the character's pride or selfishness creates problems, and explain how the character's experience relates to the work as a whole.

France

National Brevet Diploma 2009

Question

Writing **(15 points)**

A few years later...

Ali kept "the child under the bridge" with him and had taken care of her.

A journalist discovers the whole story and is telling it. He also explains the ways in which Ali's life has changed, and why.

Write this journalist's article. Give it a title and initial it JP.

Criteria for success:

- Presentation of the article
- Proper tone of the article
- Correct reference to the context of the story
- Use of several arguments illustrating the changes to Ali's life and the reasons behind them
- Correct use of language

New York

Regents Examination in English Session One 2008

Question

Part B

Directions: Read the text and study the table on the following pages, answer the multiple-choice questions, and write a response based on the situation described below. You may use the margins to take notes as you read and scrap paper to plan your response.

The Situation: The students in your health class have been asked to produce a monthly newspaper for the school community which will provide information about health threats and suggest how to avoid them by adopting a healthier lifestyle. You have been asked to write an article about the threat of sun exposure and to suggest ways that people can protect themselves from this threat.

Your Task: Using relevant information from both documents, write an article for a monthly school newspaper in which you discuss the threat of sun exposure and suggest ways that people can protect themselves from this threat.

Guidelines:

Be sure to

- Tell your audience what they need to know about the threat of sun exposure
- Suggest ways that people can protect themselves from this threat
- Use specific, accurate, and relevant information from the text and the table to support your discussion
- Use a tone and level of language appropriate for an article for a school newspaper
- Organize your ideas in a logical and coherent manner
- Indicate any words taken directly from the text by using quotation marks or referring to the author
- Follow the conventions of standard written English

Texas

TAKS Grade 10 English Language Arts March 2009

Question

Written composition
Write an essay about a time you depended on someone.

The information below will help you remember what you should think about when you write your composition.

Remember—you should
- write about the assigned topic
- make your writing thoughtful and interesting
- make sure that each sentence you write contributes to your composition as a whole
- make sure that your ideas are clear and easy for the reader to follow
- write about your ideas in depth so that the reader is able to develop a good understanding of what you are saying
- proofread your writing to correct errors in spelling, capitalization, punctuation, grammar, and sentence structure

England

AQA GCSE English A Paper 2 Higher Tier June 2008

Question

Section B: writing to inform, explain or describe
You are advised to spend about 45 minutes on this section.

3 Write a letter to a Minister for Education informing him or her of the things you think should be done to improve education for teenagers. (27 marks)

Remember:
- spend 5 minutes planning and sequencing your material
- about two sides of average sized handwriting should be enough
- spend 5 minutes checking:
  - your paragraphing
  - your punctuation
  - your spelling.

Alberta

Grade 9 English Language Arts 2006

Question

IV. Read the essay "In Praise of Bikes".

24 In this passage, the word "flout" (line 21) means
A. accept
B. violate
C. change
D. improve

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