What's in the CAPS package?

Mathematics

UMALUSI
Council for Quality Assurance in
General and Further Education and Training

What's in the CAPS package?

A comparative study of the

National Curriculum Statement (NCS) and the

Curriculum and Assessment Policy Statement (CAPS)

Further Education and Training (FET) Phase

Mathematics

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June 2014

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ACKNOWLEDGEMENTS

This Mathematics report includes the findings emanating from the comparative analysis of the Further Education and Training (FET) National Curriculum Statement (NCS) and the Curriculum and Assessment Policy Statement (CAPS) for Mathematics as well as a summary of findings from Part 2 of the CAPS research. Part 2 of the research determined entry level requirements and expected learner attainment on exit level. A summary of the exit level outcomes for these subjects also appears in the Overview report.

This project was envisaged and conceptualised by Dr Celia Booyse, Manager: Curriculum, Umalusi. The project was co-managed by Dr Booyse and Dr Sharon Grussendorff, who provided much of the constructive commentary on the original subject reports and prepared all the spreadsheets for the transfer of data. Dr Grussendorff also helped to adapt the research instruments for the comparative analysis of the NCS and the CAPS, used in determining entry-requirements and exit-level outcomes, as well as the instrument used for international benchmarking (reports to follow).

Dr Grussendorff, a respected researcher, Physics lecturer and consultant to many educational initiatives, has been involved with Umalusi's curriculum research since 2006. In 2012, she was approached by Umalusi's Qualifications, Curriculum and Certification (QCC) unit to co-manage the CAPS quality assurance research. In addition to her management role, Dr Grussendorff has also been team leader for the Physical Sciences team in the FET Phase. Her experience in teacher-support and training in curriculum interpretation with JET Education Services have contributed invaluably to the present research as well.

Dr Booyse has managed the CAPS evaluation with her usual immaculate planning, thorough preparation and gentle humanity. The evaluation teams will attest to the fact that they are properly briefed and given the means to do their work well. Dr Booyse almost intuitively, it seems, manages that fine balance that Jerome Bruner writes about between a safe, loving environment and sufficient challenge that allows for the best learning.

Dr Booyse has been steadily supported by her colleagues in the QCC unit: Ms Elizabeth Burroughs, Senior Manager: QCC; Mr Duma Sithebe, Assistant Manager: Curriculum; Mr Mohau Kekana, Administrative Assistant; and Mr Mohlahledi Nkadimeng, Administrative Assistant.

Mr Sithebe ably assisted in constituting the evaluation teams, dealing with communication and undertaking the greater part of the document search for the comparative research, each of these a considerable undertaking.

The teams undertaking these evaluations have far exceeded the call of duty, and for that we at Umalusi thank them. Their unstinting hard work and willingness to be stretched by challenges requires grateful recognition. The positive attitude within the teams and the in-depth discussions and collaboration are commendable. It has been satisfying to see that we have all learned from one another's expertise and that all who have participated in the process go out with an enriched understanding of the importance of curriculum and its appropriate implementation. It is to be hoped that the accumulat-

ed knowledge and wisdom emanating from the project will have positive repercussions in schools, provincial departments, the national Department of Basic Education and in higher education too.

It is worth referring to Annexure A in the Overview report to fully appreciate the wealth of experience and commitment this project has been privileged to draw upon. The team who contributed to this Mathematics report is:

Dr Lynn Bowie - Team leader for the Mathematics team and Mathematics Education coordinator for Olico

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Prof Poobhalan Pillay – Professor, Mathematics and external moderator for Umalusi

This report was edited by Dr Claire Kerry. Her work requires grateful recognition.

IeCommunications was responsible for the final design, layout and printing of the report. Their willingness to help when deadlines were tight is gratefully acknowledged.

Without the sustained work of the Umalusi teams and the detailed, extensive reports written by the people duly acknowledged above, the Overview report and this Mathematics report could not have been written. Sincere appreciation for every contribution made to the research and to make the reporting on findings possible.

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ACRONYMS AND ABBREVIATIONS

AS	Assessment Standards
CAPS	Curriculum and Assessment Policy Statement
DBE	Department of Basic Education and Training
Doc	Document
DoE	Department of Education
FAL	First Additional Language
FET	Further Education and Training
GET	General Education and Training
Gr	Grade
HESA	Higher Education South Africa
HL	Home Language
ICT	Information and Communications Technology
IT	Information Technology
LO	Learning Outcome
n.d.	Not dated
NCS	National Curriculum Statement
NSC	National Senior Certificate
OBE	Outcomes-based Education
p	page
pp	pages
SBA	School-based Assessment
QC	Quality Council
QCC	Qualifications, Curriculum and Certification

1. OVERVIEW: A COMPARATIVE ANALYSIS OF THE NCS AND CAPS FOR THE FET PHASE

1.1 BACKGROUND

Umalusi undertook a project in 2013, the core intention of which was to establish the quality of the Curriculum and Assessment Policy Statement (CAPS) as amended version to the National Curriculum Statement (NCS) of 2008. The work done in 2013 is not only an extension of research to further the understanding of the National Senior Certificate (NSC) qualification, but is similar to the comparative research done in 2008. The research such as this not only develops an understanding of the strengths and weaknesses of the subject curricula, but also assists in building bigger picture of the nature of the qualification itself – what its strengths might be and what challenges might arise for the institutions where it is offered and for the staff implementing it. In short, the research was undertaken with the purpose of ensuring a better understanding of the NSC for all involved.

The current phase of the research is presented in the following reports:

- An overview report of the research process and key findings for subjects and subject clusters
- A series of subject/subject cluster- specific reports for Mathematics, Mathematical Literacy, Languages (English), Social Sciences, Natural Sciences and Business, Commerce and Management.

Initially the reports will be submitted to the Department of Basic Education and Training (DBE). The findings and recommendations have been formulated as guidelines for improvement, in terms of both the national policy and of implementation and assessment. The findings also point to areas that need strengthening in teacher education and professional development. Thereafter, Umalusi, in collaboration with Higher Education Institutions and Higher Education South Africa (HESA), could use this research work towards improving the quality of teacher preparation, not only to equip teachers as field experts, but also as subject methodologists who are able to reflect on their own teaching practice.

1.2 THE RESEARCH QUESTION, RESEARCH METHODOLOGY AND INSTRUMENT

Research question: The research question for the comparative NCS/CAPS research/evaluation is worded as follows:

'What does the comparison between the Curriculum and Assessment Policy Statement (CAPS) for FET Phase (Grades 10 to 12) and the National Curriculum Statement (NCS) reveal about:

a. *the extent to which the NCS curricula were repackaged or rewritten in the formulation of the CAPS;*
b. *the relative depth and breadth of the content covered in the respective curricula,*
c. *the overall design, structure and coherence of the curricula,*

d. *the level of specification of various aspects of the curricula, and*
e. *the guidance provided by the curricula for the teaching and assessment of the subject?'*

Research/evaluation process: The process involved identification of the evaluation teams across all the subjects under evaluation, followed by the refining of an existing instrument to evaluate and compare the NCS and the CAPS. Thereafter two workshops were held with the evaluation teams, in August and November of 2013, in order to brief them about the evaluation and for the teams to work together on the curriculum analysis. Finally, the evaluation teams completed their analysis via e-communication, and the team leaders took responsibility for the completion and submission of the teams' reports.

Instrument: An instrument was customised for this investigation, which required the evaluators to grapple deeply with issues around broad curriculum framing, and concepts such as content breadth and depth, sequencing, progression, coherence and how to determine the weighting and curriculum focus in the documents. All those who participated in the process learned a great deal, and they in turn offered insights from their own expertise which added value to the report.

The evaluation teams were asked to give their opinion on each subject regarding:

- Broad curriculum design – the central design principle;
- The aims/ objectives of the subject;
- The ideal learner envisaged;
- The weighting of each topic in terms of the percentage of time allocated to each;
- The emphasis placed on content and skills;
- The depth of the subject in terms of the extent to which learners could move from a superficial grasp of a topic to a more refined and powerful grasp;
- The degree to which the curriculum of each subject is paced, in terms of the volume to be covered in a specific timeframe;
- The specification of sequencing of topics;
- The progression of topics from Grades 10 to 12 in terms of increase in level of complexity and difficulty;
- The coherence of the curriculum for each subject, in terms of connections and coordination between topics through the levels;
- The degree to which teachers are given explicit guidance regarding pedagogy;
- The degree to which teachers are provided with guidance regarding assessment;
- Format and user-friendliness of the curriculum documentation.

Evaluators were asked to comment on the overall guidance and use of the curriculum and the central values underpinning each curriculum.

In addition, the teams had to substantiate their opinions about the extent to which the CAPS for the subjects mentioned above have been 'repackaged' or been rewritten in this repackaging process. The teams were asked to identify the extent to which the repackaging has extended – or contracted – the content and skills which learners are expected to acquire and teachers to teach. Another point for attention was whether the CAPS provides better guidance to teachers than the NCS.

Lastly the evaluation teams were required to make recommendations, based on their findings regarding all the points above. They were requested to provide recommendations for the strengthening of the CAPS for each subject, where these may still require improvement. Such recommendations will form the basis for subsequent work to be undertaken by the DBE and monitored by Umalusi.

1.3 TRENDS ACROSS THE CURRICULA

Although the Umalusi subject evaluation teams worked towards a common goal of assessing the comparability of the NCS with the CAPS, the individual subject reports offer unique insights, with particular details that are of interest to those involved with teaching the subjects in question. There are, however, overarching trends that can be gleaned from the subject reports. These trends are briefly described below. A more detailed section on the trends across the curricula appears in the Overview report.

1.3.1 The nature of the curriculum documentation

The NCS documents had a great deal of uniformity in style and length across the different subjects, however, the CAPS is somewhat varied between subjects. For some subjects, such as Life Sciences and Physical Sciences, a full teaching programme is provided, with the content and prescribed activities clearly described with definite timeframes. By contrast, the documentation for some subjects, such as History, only provide a list of content to be covered per term, with no time indications for separate topics. The extent of the assessment guidance also varies substantially between subjects, with the Mathematics CAPS containing the shortest guidance on assessment (five pages), while the guidance provided for Mathematical Literacy covers 32 pages. The CAPS documents for English HL and English FAL both contain glossaries, which none of the other subjects have.

The table below (Table 1) illustrates the variation in the length of the subject-related curriculum documents for the CAPS compared with the NCS.

Table 1: Variation in the length of curriculum documents		
	NCS	**CAPS**
Lowest number of pages	139 (Accounting)	48 (Economics)
Highest number of pages	204 (English FAL)	164 (Physical Sciences)
Average number of pages	175	82

This table shows that there is much greater variation in the length of the CAPS documents across the different subjects, ranging from 48 pages (Economics) to 164 pages (Physical Sciences) in length, compared with the collection of NCS subject-related documents, which range from 139 pages (Accounting) to 204 ages (English First Additional Language (FAL)). Each subject varies in terms of the approach taken to the way in which guidance is given to the teacher. This may contribute positively towards the CAPS providing clear and appropriate guidelines within each subject, but it does suggest a lower degree of coherence across subjects in terms of the approach taken within the curriculum documents.

In all subjects, with the exception of Physical Sciences, the **length** of subject-related documents that teachers need to consult has been **reduced** from the NCS to the CAPS. (This does not include the Examination Guidelines document for the CAPS, which may cause the number of pages in the CAPS documentation to exceed that of the NCS in some cases). The reason for the greater length of the Physical Sciences CAPS is that this document has a very detailed level of specification, which will be discussed further under the *Specification* heading.

In all subjects, the evaluation teams deemed the CAPS documents to be more **user-friendly** than the NCS equivalents, mainly due to the number of subject-specific policy documents that had to be consulted in NCS (a minimum of four). The result of this level of documentation meant that lesson preparation became complicated and unwieldy for teachers using the NCS.

The accessibility of the **language** was generally deemed acceptable for both curricula. Some of the evaluation teams commented on the complexity of the educational 'jargon' used in the NCS when describing OBE. This has been reduced in the CAPS, where much simpler language is used to describe the teaching and learning process.

For all subjects except Accounting, there has been an improvement in **alignment** between the documents within each curriculum. Many of the evaluation teams reported that there are contradictions between the various subject-related documents for the NCS. The only evaluation team that did not report alignment problems in the NCS documentation was the Accounting team. As the CAPS has only one subject-related document at the time of the evaluation, meant that the misalignments between documents are no longer an issue.

However, some of the evaluation teams reported alignment issues between the various undated ***versions*** of the CAPS documents which were released during the implementation process. (This caused great confusion among teachers and other education practitioners, who were unsure of whether they had the latest version of the CAPS). In addition, as an Examination Guidelines document has been introduced, it is possible that problems with alignment may occur with the CAPS.

Evaluation teams for all subjects agreed that the **design principle** of the curricula has shifted from outcomes-based in the NCS to content-driven or syllabus-based in the CAPS. Where an outcomes-based curriculum is, by nature, learner-centred and activity-based, a content-driven curriculum involves a more teacher-centred, instructive approach. However, both of the languages evaluation teams (English FAL and English HL) commented that, although the CAPS is teacher-driven, there are some skills-based principles involved, such as text-based approaches, with content-based on topics and themes.

Overall, the evaluation teams concluded that the CAPS documents are an improvement over the NCS in terms of the design and structure of the curricula. The recommendation made in the Department of Education (DoE) report (2009, p 63) for *'consistency, plain language and ease of understanding and use'* has been heeded in the compilation of the CAPS.

1.3.2 Curriculum objectives

The evaluation teams were asked to compare the objectives that are stated for their subjects in the NCS with those in the CAPS. The general finding across the subjects was that the objectives are very similar for both curricula. (These findings are presented in detail in the individual subject reports). Some of the NCS objectives which are related to socio-political and ethical awareness, and sensitivity to cultural beliefs, prejudices and practices in society, have been excluded from the CAPS. In addition, where the NCS addresses the need for the development of skills related to self-employment and entrepreneurial ventures, these skills are not included in the CAPS objectives.

The English FAL evaluation team noted that the CAPS omits objectives that include human experience, aesthetics of language, and social construction of knowledge. They commented that *'the CAPS has removed the explicit recognition of unequal status of languages and varieties - a key specific objective articulated in the NCS'*.

The Mathematics evaluation team noted that there is *'a de-emphasis in the CAPS of the more explicit transformatory agenda that is articulated in the NCS'*. This is perhaps appropriate, given the historical timing of the two versions of the curriculum, with the NCS being introduced during a time when *'the notion of a national curriculum was a new concept that coincided with the birth of a new democracy'* (DoE, 2009, p 11) and the CAPS, after more than a decade of democracy.

1.3.3 Breadth and depth of content

One of the areas that is repeatedly highlighted in the DoE report (2009) is that of finding a balance between breadth and depth in the content of the curricula. It has been shown that less breadth of content covered in more depth ensures a greater chance of future success in the discipline (Schwartz *et al.*, 2008). With this in mind, the evaluation teams compared both the breadth and the depth of the NCS and the CAPS in order to determine any shifts that may have taken place in these areas.

The Economics and Mathematics evaluation teams reported an **increase in the breadth** of content across the FET Phase in the move from the NCS to the CAPS. The English HL, Accounting, Business Studies, and History evaluation teams concluded that the **breadth across the FET Phase is similar** for the NCS and the CAPS. The Physical Sciences, Life Sciences, Geography and English FAL evaluation teams reported a **reduction in the breadth of content** across the FET Phase in the CAPS compared with that in the NCS.

1.3.4 Depth

An **increase in depth** from the NCS to the CAPS was noted for Economics and Mathematics. The Accounting, Business Studies, Geography and Physical Sciences evaluation teams reported a **similarity in the depth** required across the FET Phase for the NCS and the CAPS, whereas the English FAL and Life Sciences evaluation teams reported a **reduction in overall depth** from the NCS to the CAPS.

The English HL evaluation team could not comment on depth, since this is left to the discretion of the teacher in terms of the length and complexity of texts that are selected. They made the comment that, although some guidance is given in the CAPS around the selection of appropriate texts, this is insufficient to ensure a common understanding of the level of depth that is required.

The History evaluation team could not compare the depth of the curricula because of the structure of the content outline provided in the NCS, which does not give sufficient detail to provide any form of guidance on the level of depth required. The evaluation team commented on the depth of the CAPS itself, that *'the CAPS manages the tensions between breadth and depth as well as is possible, although there is probably a greater emphasis on breadth than depth'*.

The Mathematical Literacy evaluation team could not compare the depth of the curricula because the NCS defines depth in terms of the mathematical processes involved, whereas the CAPS defines depth in terms of the level of problem-solving required within the selected real-life situations or contexts. Hence, although in one sense the NCS has greater depth than the CAPS, since it contains topics that require application of more complex mathematical skills, the evaluation team noted that the CAPS goes into greater depth than the NCS in almost every topic, since learners are expected to know more about the topic and to understand the complexity of the authentic real life situation.

1.3.5 Specification of content

The curriculum specification, or degree to which knowledge is broken down for stipulation, was compared for the NCS and the CAPS. On the whole, it was found that the level of specification of content is higher in the CAPS than in the NCS. More detail is provided in the CAPS on the exact scope and depth of the content that is to be taught and assessed, than in the NCS. However, three of the evaluation teams, namely those for Economics, English HL and English FAL, did not report an increase in specification of content in the CAPS.

In terms of satisfying the recommendation made in the DoE Report (2009, p 62) that curricula should provide *'clear, succinct and unambiguous'* statements of learning, the majority of the CAPS subject documents satisfy these criteria. Nevertheless, particular attention must be paid to the level of clarity provided in the two English language curricula, to ensure that these provide the necessary guidance to teachers. In addition, many of the subject evaluation teams reported that the CAPS documents require a thorough edit, as there are numerous errors that appear throughout the documents, which may lead to confusion and erroneous interpretation of the curricula.

1.3.6 Pacing

All of the evaluation teams, with the exception of Mathematical Literacy, agreed that the **level of stipulation of the pacing** is greater in the CAPS than in the NCS, since more explicit guidelines on time frames are provided in the CAPS. The Mathematical Literacy evaluation team found that the work schedules in the CAPS do not provide sufficient detail about the actual content to be taught or the resources needed for the teaching to allow for a clear sense of pacing. They also found discrepancies between the suggested work schedules, which specify broad content for each week (Mathematical Literacy CAPS, pp 16-20), and the summary of the number of weeks to be spent on each topic (Mathematical Literacy CAPS, p 15).

The evaluation teams were asked to comment on the **actual level of the pacing** for each of the curricula as it would be experienced by learners in the FET Phase. The pacing was difficult to judge in the NCS due to the low level of specification, and the flexibility granted to teachers to determine the pace in response to the varying needs of learners. In spite of this lack of specification, however, some of the evaluation teams were able to make broad judgements on the levels of pacing, based on the breadth of content stipulated within the overall time frame for each grade. On this basis the **Physical Sciences, Ac-**

counting, Economics, English FAL and **Geography** evaluation teams indicated that the pacing of the NCS was likely to be experienced as fast. The remaining evaluation teams were either unable to comment on the pacing, or considered the pace to be moderate.

For the CAPS, evaluation teams for all subjects except for **Geography, Mathematical Literacy** and **Life Sciences** commented that pacing is likely to be experienced as fast, since the time allocation for teaching the content does not allow for a sufficient depth of engagement with the content as specified. The Geography evaluation team concluded that the pacing is carefully considered and realistic in the CAPS. The Mathematical Literacy evaluation team deemed the pacing to be moderate, based on their overall impression of the material to be covered. The Life Sciences evaluation team considered the pacing to be fast for Grades 10 and 11, and commented that *'the experience of teachers is that they have to rush through the curriculum to complete it in the year'*. They considered the pacing to be moderate for Grade 12, but mentioned that the pacing is uneven, in that *'too much time is allocated for some topics, and too little for others'*.

1.3.7 Sequencing and progression

In general, the evaluation teams found the **degree of specification of the sequencing** to be higher in the CAPS than in the NCS. This is to be expected from a curriculum which has been designed to provide a structured learning programme, as does the CAPS, in contrast to the approach taken by the NCS, which is to allow teachers the flexibility to design their own learning programmes.

The evaluation teams were asked to make a judgement on whether **progression within each grade** is evident in the NCS and the CAPS. Interestingly, although there is no expectation in the **NCS** that teachers follow the sequence of topics as they are laid out in the curriculum, many of the evaluation teams found that the order in which the topics are laid out in the curriculum offer an inherent sense of progression. However, a wide range of interpretations of the sequencing of topics by textbooks, provincial departments and other interpreters of the curriculum meant that this inherent progression was not always followed through in practice. For the **CAPS**, no clear trend is evident across the subjects in terms of the sequence of topics allowing for progression within each grade. The reasoning behind the sequencing of content is not always clear, and in some cases does not appear to have been designed with progression in mind. An example of this is in Physical Sciences, where the Grade 10 CAPS interrupts the flow of certain chemistry topics with the insertion of unrelated physics topics, causing a break in the flow and hence conceptual progression for learners. The Accounting, Economics, Business Studies and Mathematical Literacy evaluation teams all reported strong evidence of progression within each grade.

With regard to the **progression across the grades**, the evaluation teams generally found that progression across the grades in the NCS is clearly evident through the way in which the Assessment Standards (ASs) are expressed, with clear increase in the cognitive demand indicated in the way in which these are described for each grade. Progression in terms of the content across the grades was reported as strong by all evaluation teams except for Physical Sciences, Geography, History, English HL and Mathematical Literacy, where evaluation teams reported either a clear lack of progression, with uneven degrees of complexity across the grades, or a lack of guidance regarding the required level of complexity for the specified topics.

For the CAPS, all of the subjects, with the exception of the language evaluation teams, reported a clear progression across the grades. The English FAL evaluation team made the comment that *'the CAPS offers almost no specification as to the expected depth of topics to be covered in each successive grade, and no indication of progression across the phase'*. The English HL evaluation team reported that the CAPS offers guidelines only as to how progression should take place, but does not give sufficient guidance to teachers to ensure that a clear increase in the level of complexity or difficulty is realised in the learning process. The lack of specification of the length and complexity of texts to be used exacerbates this.

1.3.8 Assessment guidance

Both the NCS and the CAPS provide generic guidance to teachers on the purpose, forms and methods of assessment. In addition, subject-specific guidelines are given for each subject in the various subject-related documents.

The **types** of assessment outlined in the NCS are baseline, diagnostic, formative and summative assessment. In addition, a distinction is made between formal and informal assessment. In contrast, the CAPS outlines only two types of assessment, namely formal (*'assessment of learning'*) and informal (*'assessment for learning'*). It is noteworthy that the CAPS has conflated firstly, formative and informal assessment, and secondly, summative and formal assessment. In addition, no mention is made in the CAPS of assessment as an aid to diagnosing or remediating barriers to learning.

The NCS describes three **methods** of assessment, namely self-assessment, peer assessment and group assessment. The CAPS narrows this down to self- and peer assessment.

The **methods** of recording assessment in the NCS include rating scales, task lists or checklists and rubrics. The method of recording assessments in the CAPS is based on marks.

With regard to the formal assessment tasks for each subject, most of the evaluation teams reported that the **number of formal assessment tasks** prescribed per grade is equivalent for the NCS and the CAPS, with exceptions being English FAL and English HL, where the number of formal assessment tasks has been reduced, and Life Sciences, where the number of tasks has increased in the CAPS.

In all of the subjects there is a strong **emphasis on tests and examinations** in terms of the overall summative assessment mark in the CAPS. The final mark for each grade in the CAPS is made up of 25% classwork and 75% end-of-year examination. The 25% classwork mark is made up of a high proportion of marks from tests and the June examination. Hence, the minimum contribution of tests and examinations towards the Grades 10 and 11 marks is 80%, and towards the final Grade 12 mark is 85%. This leaves a maximum of 20% representation for projects, practical investigations, assignments and other forms of assessment in Grades 10 and 11, and a maximum of 15% representation of these in Grade 12. While this emphasis may be necessary for assessments to be reliable, it is prejudicial for learners who perform better at tasks that are not test- or examination-based.

The Assessment chapter of the NCS Subject Statements includes a full set of competence descriptors for each level of achievement for each grade, ranging from Level 6 (Outstanding) to Level 1 (Inadequate). In practice, these descriptors were never used, as it was unclear how they should be applied. No such descriptors appear in the CAPS document.

Clearly an attempt has been made in the CAPS to simplify the fairly elaborate approach taken in the NCS. Although this has been necessary in order to reduce the complexity and administrative load caused by assessment under the NCS, it does raise the question of whether valuable insights available through the more nuanced NCS approach to assessment, may have been lost in the process.

1.3.9 Curriculum integration

All of the evaluation teams, without exception, found the l**evel of integration between subjects in the FET Phase** to be low for the CAPS, with little or no explicit mention of reference to fields of learning in other subjects. In the NCS the explicit mention of integration between subjects was only marginally greater than in the CAPS in History, English HL and English FAL. In all other subjects the NCS showed a similarly low level of integration with other subjects, in spite of the stated intention of cross-subject integration.

No clear trends were evident from the findings regarding the level of integration **between the subjects and the everyday (general) knowledge of learners** at their stage of development and in their contexts, since the subjects have varying degrees of applicability to everyday life. Some subjects, such as Mathematical Literacy and Accounting, have a natural link with the everyday world, and these evaluation teams hence reported a high level of integration with learners' everyday lives for both the NCS and the CAPS. Other subjects, namely Economics, Physical Sciences, Life Sciences, English FAL and English HL, reported a drop in the level of integration with everyday knowledge from the NCS to the CAPS. The only visible trend in the findings was that none of the subject evaluation teams reported an increase in the level of integration with everyday life in the move to the CAPS.

The evaluation teams found that the CAPS subject documents as having much clearer discipline-boundaries than those of the NCS. This satisfies the recommendation in the DoE report (2009) for *'statements which are clear, succinct, unambiguous, measurable, and based on essential learning as represented by subject disciplines'* (p 49).

1.3.10 Curriculum coherence

The evaluation teams found that the NCS shows clear evidence of an intention for **horizontal coherence**, in its description of integration and its definition of subjects: *'Integration is achieved within and across subjects and fields of learning. The integration of knowledge and skills across subjects and terrains of practice is crucial for achieving applied competence ... In an outcomes-based curriculum like the NCS, subject boundaries are blurred. Knowledge integrates theory, skills and values. Subjects are viewed as dynamic, always responding to new and diverse knowledge, including knowledge that traditionally has been excluded from the formal curriculum'* (DoE, 2003, pp 8, 11). However, this horizontal coherence was not achieved in practice in the NCS, as is evidenced by the lack of explicit guidance for teachers on how to achieve this integration across subjects. Instead, most of the subject evaluation teams commented on the strong discipline-based approach to knowledge in the NCS, which suggests a vertically aligned curriculum structure. This shows a lack of coherence between the stated intention and the actual course structure of the NCS.

The low level of integration between subjects in the CAPS, as mentioned previously, indicates that horizontal coherence is not a design feature of the CAPS documents. The CAPS has a strong discipline-based approach to knowledge within the subjects, as reported by all of the evaluation teams except English FAL and Mathematical Literacy. (It is appropriate that these two subjects are not strongly discipline-based, as they are both subjects which aim to develop literary competence in their respective fields, rather than being disciplines in their own right.) It can therefore be inferred that the CAPS shows a clear and coherent **vertical alignment**, which is evidenced by the clearly demarcated subject boundaries, and the strong discipline-based approach within the subjects. This brings clarity for teachers and learners regarding the exact terminology, content and skill requirements within each discipline. This will lead to a more rigorous induction into the discourse of each discipline for teachers and learners than a more horizontally aligned curriculum would allow. A vertically aligned curriculum does not bring about an explicit development of the ability of a learner to transfer concepts and skills between subjects and into the everyday world.

1.4 IMPLICATIONS FOR THE SOUTH AFRICAN CONTEXT

The majority of the evaluation teams agreed that the structured outline of content and activities in the CAPS is more likely to facilitate the development of sound knowledge and skills than the more open, non-prescriptive approach of the NCS. The CAPS is therefore, on the whole, a more suitable curriculum for the current South African educational context. However, the English FAL evaluation team noted that: *'The CAPS is based on conflicting assumptions about teacher expertise. The overt assumptions are that teachers cannot, or should not have to, develop their own teaching plans, and thus they are provided with these. This suggests that the CAPS assumes that teachers do not have the expertise (or time) necessary to develop their own teaching programmes. However, there are so many gaps in the teaching plan, and there is so little specification about depth or progression, that it would require a highly skilled and competent teacher to identify such gaps and failures of logic, and take steps to mediate the plans to address these problems'*.

In addition, some of the evaluation teams expressed concern over the lack of availability of the necessary resources for implementing the CAPS:

- The Economics evaluation team raised the concern that the required learner support materials (such as magazines, newspapers, statistical data and the internet) are not available in all South African classrooms.
- Both of the experimental science subjects, namely Physical Sciences and Life Sciences, quoted statistics that fewer than 5% of South African schools have equipped, functional laboratories (Equal Education, 2012). Both evaluation teams raised the concern that the CAPS is unlikely to be able to be fully implemented in the vast majority of South African schools, given the specialised nature of the equipment required for the prescribed classroom activities in the CAPS.

1.5 RECOMMENDATIONS

Each of the subject evaluation teams made specific recommendations for the CAPS for their subject. The following general recommendations are made with the intention of strengthening the CAPS:

- The silence on the role of the teacher in the CAPS documents is concerning. The **place of the teacher** in the learning process needs to be clearly acknowledged and articulated in the CAPS documents.
- Since there has been an implicit shift in the **underlying pedagogy** from a learner-centred to a teacher-centred approach, explicit guidance should be given on what this shift means in terms of the choice of teaching strategies.
- The findings of the evaluation teams show that three of the curricula require **urgent attention**:
    - o The **Mathematics** CAPS is deemed by the evaluation team to be significantly

more demanding than the NCS, since the CAPS content exceeds that of the NCS in both breadth and depth. This is of great concern, since the NCS Mathematics was already experienced as challenging for a significant portion of the learners. The Mathematics document therefore requires revision to ensure that there is appropriate provisioning of Mathematics for all learners wanting to take Mathematics in the FET Phase.

- o The **English FAL** CAPS is problematic, since not all of the topics mentioned in the content overview in the CAPS are represented in the teaching plans that are provided. The evaluation team made the comment that *'there are so many gaps in the teaching plan, and there is so little specification about depth or progression, that it would require a highly skilled and competent teacher to identify such gaps and failures of logic, and take steps to mediate the plans to address these problems'*. This is a consequence of the unrealistic breadth of content that is outlined in the content overview. The selection of content in the overview therefore needs revision. The teaching plans require reworking, to ensure internal consistency in the CAPS, and to prevent superficial or incoherent implementation of the curriculum. Special attention needs to be paid to the 'Language Structures' section, which, in particular, has major gaps and fails to progress logically.
- o The **English HL** evaluation team found that the clarity of guidance provided in the CAPS is undermined by the lack of guidance regarding the texts to be selected, and the relegation of the teaching of language structures and conventions to an appendix in the CAPS document. It is recommended that, in order to provide clearer guidance to teachers, the teaching plans be revised as follows:
  - More explicit guidance should be provided on the nature and complexity of texts to be selected.
  - The teaching of language structures should be integrated as part of the teaching plan.

- The CAPS documents require a **thorough edit**, as many of the subject evaluation teams reported that there are numerous errors that appear throughout the documents, which could lead to confusion and erroneous interpretation of the curricula. Many of the evaluation teams also commented on typographic and spelling errors in various places throughout the document which require a thorough language edit.

1.6 CONCLUDING IDEAS

In the move from the NCS to the CAPS there has been a clear shift in the underpinning educational approach, from the OBE of the NCS, described as encouraging *'a learner-centred and activity-based approach'* (DoE, 2003, p 7), to the approach in the CAPS which is described as *'an active and critical approach to learning, rather than rote and uncritical learning of given truths'* (CAPS subject statements, 2011, p 4). In addition, the CAPS has narrowed its focus to a more clearly discipline-specific approach, with the exclusion of principles such as integration, portability and articulation, and with the re-establishment of subject boundaries (as evidenced by the omission of any discussion around the definition of the term 'subjects', and the omission of the NCS's stated intention of blurring of subject boundaries).

There has also been a shift from the strong focus on group work that the NCS adopted, to a focus on the learner taking individual responsibility for his/her learning, as evidenced by the inclusion of the clause 'work as individuals' in the description of the type of learner envisaged (CAPS subject statements, 2011, p 5).

Where the NCS explicitly states the teacher's role as being (amongst other roles) the interpreter and designer of learning programmes and associated classroom activities, the design of the CAPS shifts this role, since the CAPS is itself a pre-designed learning programme, with prescriptive classroom activities. This, together with the silence in the introductory pages of the CAPS regarding the teacher, suggests that the role that the teacher plays has become greatly diminished in the CAPS. The implication is that teachers operate at the level of implementers of a predetermined learning programme, rather than having much flexibility in the design and adaptation of this learning programme to the varying needs of learners.

The findings of the Ministerial Task Team, laid out in the DoE Report (2009), showed that the expectation that teachers design their own learning programmes was strongly resisted by teachers and other respondents. Instead, the suggestion was that a more clearly structured teaching plan be provided to enable teachers to 'devote their energy to delivering quality instruction' (p 19). In this sense, the CAPS satisfies the recommendations made in the report.

The findings of the subject evaluation teams show that, for the majority of subjects, the content covered in the CAPS does not differ significantly in breadth or depth from the content in the NCS. Exceptions to this are the following subjects:

- **Mathematics:** The evaluation team found that the CAPS content exceeds that of the NCS in both breadth and depth, and is thus likely to be experienced as *'significantly more demanding than the NCS'*.
- **Life Sciences:** The evaluation team found that, although the curriculum content has been mostly repackaged in the transition from the NCS to the CAPS, there has been some reduction in both breadth and depth of the content in the CAPS.

Most of the evaluation teams concluded that the CAPS documents are an improvement over the NCS with regard to providing *'statements which are clear, succinct, unambiguous, measurable, and based on essential learning as represented by subject disciplines'*. Exceptions to this are the following subjects:

- **English FAL:** The content that is outlined in the content overview in the CAPS (pp 10-48 of the English FAL CAPS) is very broad, and consequently has led to a set of teaching plans (pp 53-76 of the English FAL CAPS) which have not incorporated all of the content in the teaching time available. As a result, there is a difference between the topics which are included in the content overview and those represented in the teaching plans. This is likely to lead to confusion for teachers, and probable variations in interpretations of the curriculum.

- **English HL:** Although the evaluation team's overall comment on the CAPS was favourable, in that the *'core topics are fundamental to any course or syllabus intending to teach literacy, and include the development of writing, reading, listening and grammatical skills'*, the evaluation team indicated that the clarity of the guidance provided by the CAPS is undermined by the lack of guidance regarding the texts to be selected, and the relegation of the teaching of language structures and conventions to an appendix in the CAPS document, rather than integrating this as part of the teaching plan.

The move from OBE has also resulted in a shift from a cooperative, discovery-based learning, where the learner is a participant in the learning process, as a negotiator of meaning, to content-driven learning, where the learner is a recipient of a body of pre-determined knowledge.

Based on the findings of the subject evaluation teams, it can be concluded that the CAPS documents have a much more detailed level of specification of content than the NCS documents. A consequence of this increased level of specification is that there has been a shift in terms of the level at which the curriculum is aimed. According to the schema of curriculum levels discussed in the overview report, the NCS is set at the 'macro' level, since it focuses mainly around attainment levels, and the construction of the actual educational programme is left to the teacher, while the CAPS has shifted to the 'meso' level, and even, to some extent, the 'micro' level, in that its structure is that of an instructional programme, with a detailed description of content, sequencing and pacing.

2 MATHEMATICS: A COMPARISON OF NCS AND CAPS FOR THE FET PHASE

2.1 INTRODUCTION

All learners in the FET phase are required to take either Mathematics or Mathematical Literacy. Learners who intend to pursue careers in scientific, economic and technical fields are encouraged to take Mathematics. Those learners who want to study mathematics further at tertiary level also need to study Mathematics rather than Mathematical Literacy.

Mathematics is studied both as a discipline in its own right as well as for its application to problem-solving in other disciplines, in the workplace, recreation and domestic activity. The CAPS document describes the subject of Mathematics in the following way: *'Mathematics is a language that makes use of symbols and notations for describing numerical, geometric and graphical relationships. It is a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena and between mathematical objects themselves. It helps to develop mental processes that enhance logical and critical thinking, accuracy and problem solving that will contribute in decision-making. Mathematical problem solving enables us to understand the world (physical, social and economic) around us, and, most of all, to teach us to think creatively.'* (Doc 1.1, p 8: See Section 2.2 for references)

Prior to the implementation of the NCS Mathematics in 2008 concern about both the breadth of the curriculum and the preparedness of teachers, led to a review of the NCS Mathematics and Mathematical Literacy curricula by a Ministerial task team. Following the work of the task team selected topics in Learning Outcome 3 (Space, Shape and Measurement) and Learning Outcome 4 (Data Handling and Probability) were omitted from the core Mathematics curriculum. Thus the Subject Assessment Guidelines for Mathematics initially published in 2006 designated certain assessment standards from the NCS as core and others (Euclidean geometry, probability, work with bivariate data and some aspects of descriptive statistics) as optional. The core assessment standards were examined in Papers 1 and 2 of the NSC Mathematics examinations, which were taken by all learners enrolled for Mathematics. The optional assessment standards were examined in Mathematics Paper 3 in the NSC and learners enrolled for Mathematics could choose whether or not to write this examination, it being an optional extra. The enrolment for Mathematics Paper 3 was small with only 3.8% of the Grade 12 Mathematics learners writing the paper in 2008 (van Putten, Howie and Stols, 2010). In contrast, all sections of the CAPS for Mathematics are examinable.

Since the core parts of the NCS Mathematics formed the *de facto* curriculum which the vast majority of Mathematics learners were following, in this report the core parts of the NCS are compared with the CAPS. Throughout the report, references to the NCS will mean the core parts of the NCS Mathematics.

2.2 LIST OF DOCUMENTS REFERENCED

The evaluation team consulted four documents relating to the NCS and three documents that define the CAPS. These are listed in Table 2. Each document is given a reference code which is used when referring to the document throughout the rest of this report.

TABLE 2: REFERENCED DOCUMENTS	
1 NATIONAL CURRICULUM STATEMENT	
Department of Education. 2003. National Curriculum Statement for Grades 10-12 (General): Mathematics.	Doc 1.1
Department of Education. 2008. National Curriculum Statement for Grades 10-12 (General): Learning Programme Guidelines: Mathematics	Doc 1.2
Department of Education. 2008. National Curriculum Statement for Grades 10-12 (General): Subject Assessment Guidelines: Mathematics	Doc 1.3
Department of Education. 2009. Examination Guidelines Grade 12: Mathematics	Doc 1.4
2 CURRICULUM AND ASSESSMENT POLICY STATEMENT	
Department of Basic Education. 2011. National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (the CAPS) Further Education and Training Phase Grades 10-12: Mathematics	Doc 2.1
Department of Basic Education. (n.d.) National Policy Pertaining to the Programme and Promotion Requirements of the National Curriculum Statement. Gr R – 12	Doc 2.2
Department of Basic Education. (n.d.) National Protocol for Assessment. Gr R – 12.	Doc 2.3

2.3 BROAD CURRICULUM DESIGN, FORMAT AND USER-FRIENDLINESS OF CURRICULUM DOCUMENTATION

In order to provide an overview of the curriculum and curriculum documentation, the evaluation team examined the extent of the documentation for each curriculum. In addition, the evaluation team made judgements about the the following dimensions-

- the user-friendliness of the documentation in relation to the clarity of the function and structuring of the documents;
- the accessiblitiy of the language in relation to whether the language was plain and direct or complex and obscure;
- the alignment of the document in relation to clarity about how the documents relate to one another and complement one another; and
- the central design principle according to which each curriculum was organised.

These findings are summarised in Table 3.

Table 3: Broad design, format and user-friendliness		
	NCS	**CAPS**
Number of documents (subject-related)	4	3
Total number of pages (in subject-related documents)	91+48+34+21=194	56+40+43=139
User-friendliness (Good/Moderate/Poor)	Poor	Good
Accessibility of language (Good/Moderate/Poor)	Moderate	Good
Alignment (Good/Moderate/Poor)	Poor in that Doc 1.1 was superseded by Doc 1.3 Good in the sense that core assessment standards are aligned perfectly over all the documents	Good
Central design principle (the technical curriculum design aspect that organises the curriculum)	In terms of rationale it has an outcomes based focus, however the detailed specification is content-focused and thus it is a syllabus type curriculum.	Syllabus type curriculum.

Discussion: The NCS documentation is lengthier than that of the CAPS. In addition, in order to understand what to teach, a teacher could refer to any combination of four documents (2008) (Doc 1.1 – 1.4) for the NCS, but currently needs to refer to only one (Doc 2.1) for the CAPS. However some of the documents produced for the NCS were published over time in response to a need to clarify particular issues. It is possible that the number of documents for the CAPS may increase as it is implemented and examined.

As explained in the introduction, the work of the Ministerial Task Team resulted in certain assessment standards present in the original Mathematics NCS (Doc 1.1) being designated as optional. This was presented in the Subject Assessment Guidelines (Doc 1.3). In addition Doc 1.1 of the NCS states that achievement of learning outcomes will be benchmarked against competence descriptors which detail what learners would need to accomplish in order to be placed at one of six levels of competence. This was superseded by a seven point rating scale where each point on the scale is pegged against a range of marks (in percentages) without competence descriptors in Doc 1.3. Thus some of the original prescriptions published in Doc 1.1 were replaced with different prescriptions in Doc 1.3 which poses problems with alignment. Doc 1.3 became the most important document for teachers as it succinctly outlined what the core and optional assessment standards were. The actual content of the core assessment standards are repeated *verbatim* across the documents.

In the CAPS these issues are avoided in that Documents 2.2 and 2.3 are not subject specific and thus all the Mathematics-specific detail is contained in one document (Doc 2.1).

The language and terminology used in the introductory sections of the NCS (Doc 1.1) were unfamiliar to teachers at the time, and potentially confusing, largely because the document is framed in the style of Outcomes-Based Education (OBE), which carries a language of its own. The language used in describing the Mathematics content to be learnt is straightforward, but the OBE terminology is convoluted and confusing. The content to be learned is presented on pp 16-43 and repeated on pp 44-61 with only slight differences in phrasing.

The CAPS document (Doc 2.1) is much clearer in this regard. An overview of topics is provided (listed according to 10 main topic areas). These are then described in greater detail in a suggested chronological ordering within and across the grades. In addition, the CAPS document provides a 'clarification' column accompanying each of the sections describing the topic in greater detail. Although this clarification column is useful in some ways, in others it is problematic. The content of this column is relatively idiosyncratic. In some places there appear to be 'teaching tips', e.g., *'It is important to stress that doubling a ratio has a different effect from doubling an angle'* (in trigonometry, Doc 2.1, p 23). In most places there are examples of possible questions, judged to be at different levels of cognitive demands. Although the document is clear that the questions provided in this column are not exhaustive (Doc 2.1, p 16), it does have the inherent danger of these questions receiving undue emphasis in classrooms. In addition using isolated examples to clarify the content means that the principles underlying the choice of content and the scope of that content are insufficiently articulated. Finally some points in the clarification column point to what will be examined e.g. *'The proofs of the sine, cosine and area rules are examinable'* (Doc 2.1, p 37). It is not clear whether other derivations of formulae, rules or facts are examinable or not if they have not specifically been mentioned.

2.4 CURRICULUM OBJECTIVES

Both the NCS and the CAPS incorporate subject-specific objectives in their documentation that indicate the purpose described for Mathematics in the FET phase.

These subject-specific objectives are incorporated into a few sections in both the NCS and the CAPS. Within the NCS the subject-specific objectives occur primarily in two sections. These are the sections on *purpose* (Doc 1.1, p 9) and *scope* (Doc 1.1, p 10). They discuss what *'Mathematics enables learner to do'* (Doc 1.1, p 9) and what learners will *'work towards being able to do'* (Doc 1.1, p 10). In the CAPS the sections on *specific aims* (Doc 2.1, p 8) and *specific skills* (Doc 2.1, p 8) discuss the curriculum objectives.

However, in both curricula there is some unevenness in what is included in the various sections. For example, in the CAPS, developing fluency in computational skills is listed as a *specific aim* (Doc 2.1, p 8) whereas collecting and analysing quantitative data is listed as a *specific skill* (Doc 2.1, p 8) and the skill of algebraic manipulation which features fairly prominently in the more detailed discussion of topics is not included in the specific aims or skills.

Similarly in the NCS, the section on scope incorporates fairly generic skills like 'competently use mathematical process skills such as making conjectures, proving assertions and modelling situations' (Doc 1.1, p 10) as well as some more narrowly content specific detail e.g. 'use and understand the principles of differential calculus to determine the rate of change of a range of simple, non-linear functions and to solve simple optimisation problems.' (Doc 1.1, p 10). In order to streamline the information, the evaluation team has not included the content specific detail in Table 4. However in the discussion that follows the team does refer to it.

Table 4: Subject-specific aims / objectives of the curricula

Objectives	**NCS**	**CAPS**
Communicate using descriptions in words, graphs, symbols, tables and diagrams	Y	Y
Use mathematical process skills to identify, investigate and solve problems	Y	Y
Incorporate mathematical modelling as a focal point of the curriculum to establish connections between Mathematics and the real world	Y	Y
Show Mathematics as a human creation by including the history of Mathematics	Y	Y
Provide the opportunity to develop in learners the ability to be methodical, to generalize, make conjectures and try to justify or prove them	Y	Y
Prepare learners for further education and training as well as the world of work	Y	Y
Participate as responsible citizens in the life of local, national and global communities	Y	Y
Work collaboratively in groups to enhance mathematical understanding	Y	N
Promote accessibility of mathematical content to all learners	Y	Y
Develop problem-solving skills	Y	Y
Develop the correct use of the language of Mathematics	N	Y
Fluency in computation skills	Y	Y
Use available technology in calculations and the development of models	Y	N

Discussion: Although there is a large degree of similarity between the subject-specific aims articulated by the NCS and the CAPS at a broad level, there are some differences in the detail.

One change is a de-emphasis in the CAPS of the more explicit transformatory agenda that is articulated in the NCS. Although the CAPS states as an aim *'participate as responsible citizens in the life of local, national and global communities'* (Doc 2.1, p 9), this is given a greater degree of emphasis in the NCS which states that learners should be able to *'organise, interpret and manage authentic activities in substantial mathematical ways that demonstrate responsibility and sensitivity to personal and broader societal concerns'* and *'engage responsibly with quantitative arguments relating to local, national and global issues'* (Doc 1.1, p 10) and *'use Mathematics to critically investigate and monitor the financial aspects of personal and community life and political decisions'* (Doc 1.1, p 10). In addition, whereas both the CAPS and the NCS argue for realistic contexts, in the CAPS, the range of contexts suggested are *'issues relating to health, social, economic, cultural, scientific, political and environmental issues'* (Doc 2.1, p 8) whereas in the NCS the range suggested is '*contexts that relate to **HIV/AIDS, human rights, indigenous knowledge systems**, and political, economic, environmental and **inclusivity** issues'* (Doc 1.1, p 11) (our emphasis to highlight the more explicit transformation-linked contexts in the NCS).

The aim of promoting collaborative work stated in the NCS is not explicitly stated in the CAPS.

Both the NCS and the CAPS espouse fluency in computational skills as an aim. However, in the CAPS this is specified as needing to be sufficiently developed *'without relying on the usage of calculators'* (Doc 2.1, p 8), whereas in the NCS it was stated as '*with and without calculators'* (Doc 1.1, p 10). In addition, although the NCS specifically mentions the use of available technology (Doc 1.1, p 10), the CAPS does not make reference to technology in its aims.

As mentioned earlier, the NCS runs through the broad topic areas of the curriculum and provides a bullet point in the scope section for each of these topic areas. The CAPS does not do so for each topic area. However a few areas are mentioned. These are the number system, data handling and spatial skills. It is not clear why these are singled out for mention in the *specific aims* and *specific skills* sections when something like producing equivalents for algebraic expressions is not.

In addition, the CAPS includes the following in the specific aims section: 'Teaching should not be limited to 'how' but should rather feature the 'when' and 'why' of problem types. Learning procedures and proofs without a good understanding of why they are important will leave learners ill-prepared to use their knowledge in later life' (Doc 2.1, p 8). This more directly teaching-focussed advice seems out of place in the aims section.

2.5 CONTENT COVERAGE: BREADTH AND DEPTH

In order to get a detailed understanding of the content covered in both curricula the evaluation team divided the content up into 12 broad topic areas (shown in Table 4). Each of these topic areas was then examined and discussed separately in detail. The number of sub-topics in each topic area was enumerated to give an idea of breadth. These detailed lists were compared in order to decide whether that topic area is dealt with at a similar, deeper or shallower level of depth in the CAPS than it has been in the NCS. Finally the detailed discussion of each topic area was used to inform decisions on pacing, sequencing and progression discussed in Sections 2.7 and 2.8.

2.5.1 Coverage (Breadth)

Table 5 shows the number of sub-topics per grade in each of the 12 major topics. The sub-topics are at a detailed level. For example, in algebra the sub-topics provide detail like '*simplification of algebraic fractions using factorization with monomial denominators*' or '*multiplication of a binomial or a trinomial*'. The full details of these sub-topics are provided in Annexure A.

Table 5: Content / skills coverage: Number of sub-topics per topic in the NCS and the CAPS

Topic (content / skill)	Number of sub-topics							
	NCS				CAPS			
	Grade 10	Grade 11	Grade 12	NCS totals	Grade 10	Grade 11	Grade 12	CAPS totals
Functions	17	18	17	52	14	18	17	49
Patterns & sequences	2	1	7	10	2	1	7	10
Finance	4	2	4	10	4	2	3	9
Algebra	16	11		27	18	8	0	26
Calculus	1	1	12	14		1	12	13
Probability					5	7	7	19
Euclidean geometry	6	1		7	15	11	6	32
Analytical geometry	3	3	2	8	4	3	2	9
Trigonometry	4	8	4	16	7	6	2	15
Statistics & data handling	6	9		15	5	6	8	19
Transformation geometry	2	2	2	6				
Linear programming		4	4	8				
Total number of sub-topics	**61**	**60**	**52**	**173**	**74**	**63**	**64**	**201**
Total number of sub-topics per phase	**173**				**201**			

Figure1 summarises the information for Table 5, giving the number of sub-topics per grade for each of the curricula.

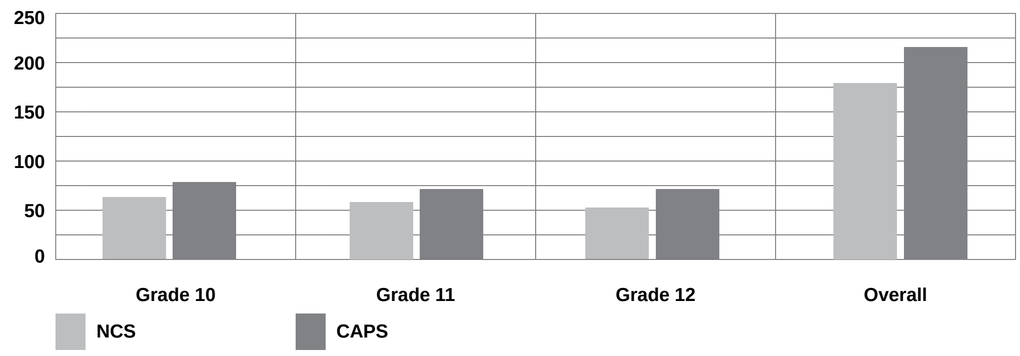

Figure 1: Coverage: Number of sub-topics per grade and overall

Discussion: The CAPS contains more sub-topics in each grade than the NCS. The topics *linear programming* and *transformation geometry* have been dropped in the move from the NCS to the CAPS. However probability has been added to the CAPS and more sub-topics have been added to statistics and data handling in Grade 12 in the CAPS. In addition, Euclidean geometry and measurement, which feature only minimally in Grades of the NCS, are now a substantial portion of the CAPS. The sub-topics added to the CAPS (in particular *Euclidean Geometry* and *Probability*) are cognitively demanding sections which take time to teach and learn. Thus the move to the CAPS is accompanied by an increase in the amount of work to be covered. This increase in breadth could lead to teachers either omitting certain sub-topics or compromising on the depth at which the sub-topics are dealt with.

2.5.2 Depth

In order to make a comparison of the depth at which each of the topic areas is dealt with, the evaluation team discussed each topic area in detail. The team did not attempt to categorise each sub-topic in terms of depth because it was possible to treat many of the topics at varying levels of depth. It is, for example, possible to ask questions at a very superficial level involving factorisation of trinomials, but also to ask questions that combine factorisation with a sophisticated understanding of exponents, making for very cognitively demanding questions. This analysis thus focuses on comparing the sub-topics in the NCS to those in the CAPS and decided whether each topic in the CAPS is overall **more demanding**, approximately the **same** level of demand or **less demanding** than the same topic in the NCS. Where a new topic has been added to the CAPS or removed from the NCS, the evaluation team used their professional judgement to state whether the topic is one of **high demand**, **moderate demand** or **low demand**. These decisions are summarised in the Table 6.

Table 6: Comparison of depth of the CAPS topics relative to the NCS

Topic (content / skill)	Depth of topic in the CAPS relative to the NCS	Brief justification	Table in Annexure A for reference
Functions	Same		A1
Patterns & sequences	Same		A2
Finance	Same		A3
Algebra	Slightly more demanding	A few more sophisticated algebraic computations included.	A4
Calculus	Same		A5
Probability	High demand topic added	Probability requires complex thinking when extended to combinations of events.	A6

Table 6: Comparison of depth of the CAPS topics relative to the NCS (continued)			
Topic (content / skill)	**Depth of topic in the CAPS relative to the NCS**	**Brief justification**	**Table in Annexure A for reference**
Euclidean geometry	High demand topics added [1]	Euclidean geometry tends to demand insight and involves an understanding of proof in theorems and riders.	A7
Analytical geometry	Same		A8
Trigonometry	Same		A9
Statistics & data handling	More demanding	Inclusion of work with bivariate data	A10
Transformation geometry	Low demand topic removed	Only the basics of transformation geometry were dealt with in the NCS	A11
Linear programming	Moderate demand topic removed	Although linear programming requires interpretation of scenarios it is a contained area of work.	A12

A summary of the results presented in Table 6 is shown in Table 7.

Table 7: Summary of comparison of depth comparing the CAPS to the NCS		
Same depth	**More depth (More demanding)**	**Added or removed**
6	2	Added 2 high demand topics Removed 1 low and 1 moderate demand topics

Discussion: The addition of high demand topics like *Euclidean geometry* and *probability* along with the increase in demand in *statistics* and *data handling* as well as a slight increase in demand in *algebra* means that the CAPS is likely to be significantly more demanding than the NCS.

2.5.3 Specification of topics

In order to evaluate how clearly specified the topics in each of the curricula are, the evaluation team examined the curriculum documents in terms of how easy it would be for the user of the curriculum to understand exactly which content / concepts and skills are to be taught, or whether the way in which topics are specified allow for multiple different interpretations of what should be taught. The evaluation of the degree of specification and examples indicating why that judgement was made are provided in Table 8.

[1] Although there was some Euclidean geometry in the NCS it was a very small amount so Euclidean geometry can effectively be viewed as a new topic in the CAPS.

Table 8: Degree of specification of topics		
	NCS	**CAPS**
Degree of specification	Medium	High
Example 1	There are places where the NCS is under-specified. For example, Doc 1.1, p 29 mentions that the point of inflection is required in the sketching of cubic polynomials without indicating whether concavity needs to be explored. Similarly Doc 1.1, p 17 refers to *'any laws of logs needed to solve real-life problems'* and thus it is not clear exactly which laws and in what depth they need to be covered.	Doc 2.1 p 46 clarifies that the 2nd derivative needs to be introduced in order to investigate concavity and determine the point of inflection. Similarly for logs laws (Doc 2.1, p 41) the laws are specified and it is clarified that the manipulation using logs laws will not be examined.
Example 2	However, many places where the original NCS documents are not well-specified, are clarified in the examination guidelines. For example, Doc 1.3, p 20 states *'Derive and use the following compound angle identities (without derivation)'*. This is unclear. However, in Doc 1.4, p18, this is clarified as it is stated that these proofs are NOT examinable but for enhancing the understanding of learners.	The CAPS document tends to provide these clarifications within the documents. For example, Doc 2.1, p 37 states clearly that the proofs of the sine, cosine and area rules are examinable.

Discussion: The original curriculum documents released for the NCS (Doc 1.1, Doc 1.2 and Doc 1.3) state the content to be taught. However, they both lack detail and clarity in certain parts. The Examination Guidelines (Doc 1.4) provides further clarification. This clarification helps to specify the expectations of the NCS in greater detail. This kind of clarification has been extended in the CAPS document.

In addition, within the NCS, some of the phrasing implies a possible broader curriculum. For example in Doc 1.1, p 22, the list of functions learners are asked to explore is preceded by the word 'including' possibly implying that a broader list of functions should/could be studied. In contrast in the CAPS, the functions listed are talked about as the 'prescribed' functions (Doc 2.1, p 24).

The CAPS document provides detailed information about what is to be taught and what will be assessed. Each curriculum statement is accompanied by clarification statements which provide further detail and examples of the kind of mathematical activities/questions that could be tackled.

However there are a few instances in the CAPS (Doc 2.1) where there is potential for ambiguous interpretations. For example, in Doc 2.1, p 42, the curriculum statement lists the compound angle identities, but it is not clear whether the derivation of the formula $\cos(\alpha-\beta)=\cos\alpha\ \cos\beta-\sin\alpha\ \sin\beta$ is examinable. This relates to the uneven nature of the kind of comments included in the clarifications column of Doc 2.1 discussed in Section 2.3 above.

In addition, the evaluation team reiterated the caution around the use of particular examples of mathematical activities/questions in the CAPS (Doc 2.1) as this might imply that these are the core/key exemplars of problem-types to be tackled. For example, there are a variety of problems exemplified for Grade 11 *circle geometry* (Doc 2.1, pp 34 - 36) but only one example for Grade 12 *Euclidean geometry* (Doc 2.1, p 48) which might suggest a reduced focus in Grade 12 *geometry.*

2.5.4 Comments on Content / Skill Coverage

The CAPS provides a clearer and more succinct statement of what needs to be learnt than the NCS does. Both the NCS and the CAPS are well-aligned to the discipline of Mathematics (and incorporate aspects of the discipline of statistics). Core mathematical skills related to problem-solving, conjecture and proof are presented differently. The NCS mentions these processes specifically in the assessment standards. The CAPS is more content-focused in its main body. However, it specifies that certain proofs will be examinable. The degree to which these process skills must be developed in the classroom is unclear.

There are a number of instances in the CAPS (Doc 2.1) where corrections or clarifications need to be made. These are:

- Doc 2.1, p 23: The teaching sequence starts with definitions of the *trigonometric ratios in right-angled triangles.* This is followed by the statement to extend the definitions to angles between 0 and 360 degrees. This move is not a trivial one and is a very demanding concept for learners to deal with in Grade 10. Thus perhaps some guidance on the definitions to use might be appropriate.
- Similarly the definition of function and the level of formality required is not apparent. The clarification comment in Doc 2.1, p 24 suggests that greater formality than the definition provided on that page will be required in Grade 12. However the definition given in Doc 2.1, p 23 is a formal one and it is thus not clear what is expected in Grade 12.
- The notion of relations are not dealt with in the CAPS. *Linear graphs* are discussed only in terms of functions. However the relation x=k is required as asymptotes of other prescribed functions.
- Typographic errors are confusing, for example in Doc 2.1, p 15 (in Grade 11 trigonometry, the Pythagorean identity has sin repeated in place of cos), Doc 2.1, p 32 (sin is repeated in point 3 instead of tan) and Doc 2.1, p 40 (it appears as if 0,9999 = 1 is stated instead of 0,9999… = 1).
- In Doc 2.1, p 42 the clarifications column for *trigonometry* starts with point 2. Has point 1 unintentionally been omitted?

- The fact that triangles drawn between parallel lines with equal base have equal area is needed in the proportionality theorems for Grade 12, but is not covered in previous grades.

2.6 CURRICULUM WEIGHTING AND EMPHASIS

2.6.1 Curriculum emphasis within the phase (Subject time allocation)

Both the NCS and the CAPS specify the number of hours of classroom time allocated to each subject in each week. Table 9 shows the number of hours allocated to Mathematics and gives this as a percentage of the total classroom time (27.5 hours) to provide an indication of the weighting of Mathematics in the FET phase.

Table 9: Subject time allocation

	NCS	CAPS
Total classroom time allocated for Mathematics in the phase	4.5 hours per week	4.5 hours per week
% of total classroom time	16%	16%

Discussion: There has been no change from the NCS to the CAPS for time allocated to Mathematics.

2.6.2 Curriculum emphasis within the subject (Topic Weighting)

A comparison of the relative weighting of topics was made by examining the suggested allocation of marks to the topics in examinations in each grade and overall. The overall weighting in terms of marks was calculated by adding together the marks allocated to that topic out of 200 in Grade 10 and 300 in each of Grades 11 and 12 and dividing the total (out of 800) by 8 to get the percentage of marks over all three grades allocated to this topic. This is shown in Table 10 below.

Table 10: Weighting per topic by percentage of marks								
Topic (content / skill)	NCS (Percentage of marks)				CAPS (Percentage of marks)			
	Grade 10	Grade 11	Grade 12	Overall	Grade 10	Grade 11	Grade 12	Overall
Functions	17.5	16.7	11.7	15.0	15.0	15.0	11.7	13.8
Patterns & sequences	10.0	11.7	10.0	10.6	7.5	8.3	8.3	8.1
Finance	10.0	8.3	5.0	7.5	5.0	5.0	5.0	5.0
Algebra	12.5	8.3	6.7	8.8	15.0	15.0	8.3	12.5
Calculus	0	0	11.7	4.4	0	0	11.7	4.4
Probability	0	0	0	0	7.5	6.7	5.0	6.3
Euclidean geometry	5.0	3.3	0	2.5	15.0	16.7	16.7	16.3
Analytical geometry	10.0	11.7	13.3	11.9	7.5	10.0	13.3	10.6
Trigonometry	12.5	16.7	20.0	16.9	20.0	16.7	13.3	16.3
Statistics & data handling	10.0	11.7	8.3	10.0	7.5	6.7	6.7	6.9
Transformation geometry	7.5	6.6	8.3	7.5	0	0	0	0
Linear programming	0%	5.0	5.0	3.8	0	0	0	0

The NCS does not provide suggested times for teaching each topic, so these are not included in this report. The CAPS does lay out time for teaching each topic, and these are shown in Table 11 below.

Table 11: Weighting per topic by percentage of time				
Topic (content / skill)	CAPS (Percentage of marks)			
	Grade 10	Grade 11	Grade 12	Overall
Functions	16.1	12.5	20.0	15.9
Patterns & sequences	3.2	6.3	12.0	6.8
Finance	6.5	6.3	8.0	6.8
Algebra	22.6	18.8	0	14.8
Calculus	0%	0%	12.0	3.4
Probability	6.5	6.3	8.0	6.8
Euclidean geometry	16.1	12.5	8.0	12.5
Analytical geometry	6.5	9.4	8.0	8.0
Trigonometry	16.1	18.8	16.0	17
Statistics & data handling	6.5	9.4	8.0	8.0

Figure 2 compares the overall weighting of topics (that is, for Grades, 10, 11, and 12) in the CAPS in relation to the percentage of total time allocated to that topic with the weighting of the topic in relation to the percentage of total marks allocated to that topic.

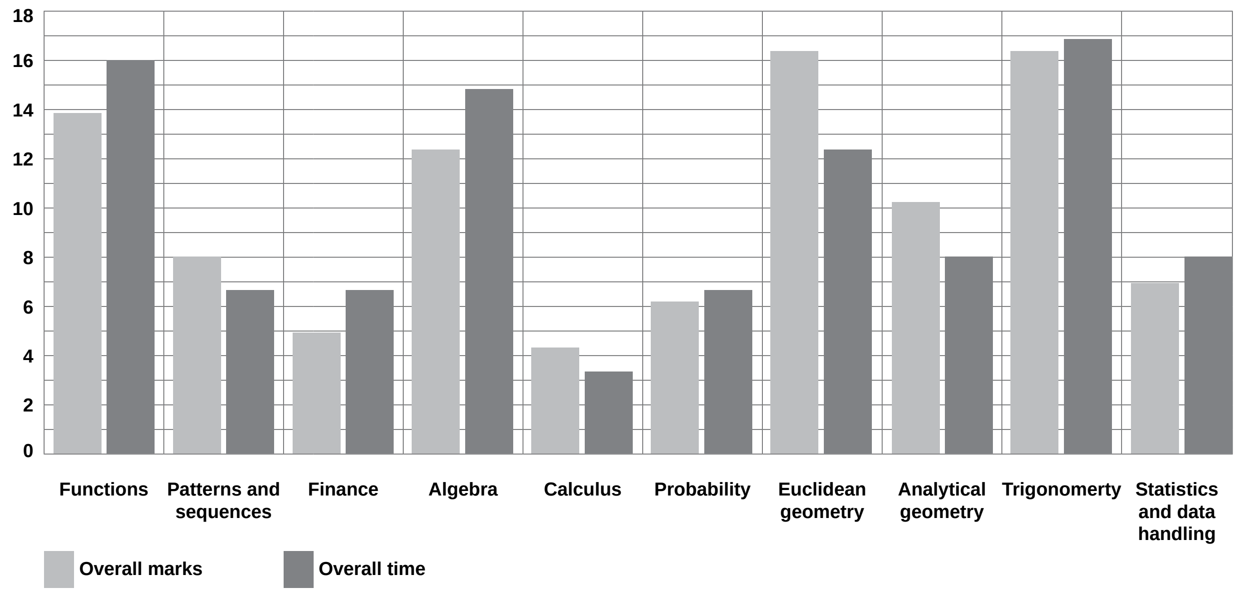

Figure 2: Weighting: Overall percentage of marks and time for each topic in the CAPS.

Discussion: When comparing Table 10 and Table 11, and using the summary provided in Figure 2, it can be seen that within the CAPS there is a reasonable degree of alignment between the weighting of the topic according to marks overall and the percentage of time allocated to that topic. The only exception to this is that of *Euclidean geometry* which gets only 12.5% of class time, but counts for 16% of the weighting in terms of marks. The large proportion of time spent on algebra in Grades 10 and 11 (see Table 10) is justified in that algebraic skills are applied in other topic areas.

In order to compare the weighting of topics in the NCS and the CAPS, the information from Tables 5, 6 and 10 was considered, including aspects of coverage, level of demand and mark weighting for each of the topics in the CAPS relative to that topic in the NCS. The relative weighting for the various topics is shown in Table 12. For ease of comparison, those topics weighted more heavily in the CAPS than in the NCS are indicated with dark shading, those topics weighted similarly in the two curricula with light shading, and those weighted less heavily in the CAPS than in the NCS are left unshaded.

Table 12: Comparison of coverage, level of demand and weighting of topics in the CAPS relative to that in NCS			
Topic (content/skill)	**Number of sub-topics**	**Level of demand**	**Overall weighting in terms of marks**
Functions	Similar	Same	Similar
Patterns & sequences	Same	Same	Less
Finance	Similar	Same	Less
Algebra	Similar	Slightly more demanding	More
Calculus	Similar	Same	Same
Probability	More	High demand topic added	More
Euclidean geometry	More	High demand topics added	More
Analytical geometry	Similar	Same	Similar
Trigonometry	Similar	Same	Less
Statistics	More	More demanding	Less
Transformation geometry	Less	Low demand topic removed	Less
Linear programming	Less	Moderate demand topic removed	Less

Key for Table 12:

- Topics weighted more heavily in the CAPS than the NCS
- Topics with similar/ same weighting in terms of marks between NCS and CAPS
- Topics with less overall weighting in the CAPS than in the NCS

Table 12 demonstrates that there are three topics weighted more heavily in the CAPS than in the NCS. All three of these topics are high demand topics. Those topics with similar weighting in the two curricula are similar both in terms of number of sub-topics and level of demand. Of those topics that receive less weighting in terms of marks, the evaluation team has identified a low demand topic and a moderate demand topic that have been removed. *Trigonometry, finance and patterns,* although similar in breadth and depth in both curricula, are weighted less heavily and statistics, which has increased in both breadth and depth in the CAPS, is weighted less heavily.

2.7 CURRICULUM PACING

The evaluation team considered two aspects in relation to pacing, which is the time frames for covering content. The first of these was the degree to which the curriculum documents clearly stipulate what topics are to be covered in what time frame. The second was whether the pace required to cover the curriculum is fast for learners, appropriate for learners or slow. These findings are summarised in Table 13 below.

Table 13: Pacing

	NCS	CAPS
Level of specification of pacing	Low	High
Rationale/ justification	Examples are provided in Doc 1.2, pp 33-48. These are merely illustrative and not prescriptive.	Pace setters are provided for the teacher. Doc 2.1, pp 17 -20
Level of pacing itself	Moderate	Fast
Rationale/ justification	Fewer topics are covered (no Euclidean Geometry and no probability)	Assuming that there are 41 weeks available for curriculum then the pace is moderate to fast. This curriculum allows 4.5 hours per week. In reality 41 weeks are not available, often schools take two weeks reach maximum pace and as a result, a fast pace is required.

Discussion: In the NCS, the Learning Programme Guidelines (Doc 1.2) present examples of year plans suggesting pacing. But ultimately it was left to the teacher's discretion to use these or not. In the CAPS, there is a strong prescription of pacing. In addition, the detail of the content to be covered in the CAPS is laid out according to a year plan which shows both the sequencing and pacing of topics across Grades 10, 11 and 12. Although the CAPS states '*The order of topics is not prescriptive*' (Doc 2.1, p 16), the pages that follow show an allocation of teaching time (Doc 2.1, p 17), a table showing the sequencing and pacing of topics (Doc 2.1, pp18 – 21) and a table giving the details of content to be studied, laid out in the order in which topics should be taught in each term and the number of weeks each topic should be taught for (Doc 2.1, pp 21 – 50). Thus the CAPS does strongly suggest a prescribed pacing and sequencing. This could be problematic, particularly if the suggested pacing and sequencing is enforced. For example it may be necessary for a teacher in a school where learners are underprepared for Grade 10 to teach at a slower pace initially.

2.8 CURRICULUM SEQUENCING AND PROGRESSION

2.8.1 Specification of sequence

In relation to curricula, sequencing refers to the order in which topics and sub-topics are to be taught. The team evaluated the degree to which this was specified in the NCS and the CAPS. The results are shown in Table 14. Thereafter particular issues and potential problems relating to the specified sequencing the curricula are highlighted.

Table 14: Specification of sequencing

	NCS	CAPS
Level of specification (High / Moderate / Low)	High across grades Low within grades	High across grades and within grades
Rationale / justification	Assessment standards which need to be covered in each grade are clearly indicated. However the order in which assessment standards need to be covered within grades is not specified.	The CAPS Mathematics clearly lays out an ordering of topics and sub-topics, both across the grades and within each grade (Doc 2.1, pp 21 – 50).

Discussion: Although both the NCS and the CAPS specify the sequencing of topics across the grades, only the CAPS provides specification of the order in which topics should be taught within each grade. In general, the sequencing across grades in both curricula is sound. The sequencing within grades provided by the CAPS is also generally sound and appears to be designed to ensure that topics are dealt with in 'chunks', and work that will be examined in each of the two papers are done in both halves of the year. For example, in Grade 11 *trigonometry* is dealt with in a four week chunk in the first half of the year and a further two week chunk in the second half of the year. (Doc 2.1, p 19). This 'chunking' is generally logically sequenced. For example, in Grade 10, *Euclidean geometry* is dealt with in term 2, it is followed by *analytical geometry* at the beginning of term 3 which can be used to reinforce some of the concepts learnt in *Euclidean geometry* which is then revisited and consolidated at the end of term 3.

There are some issues in terms of sequencing highlighted by the evaluation team:

- In the NCS in Grade 10, the definition of the trigonometric ratios are dealt with only in the right-angled triangle and yet learners are expected to draw graphs of these function on unrestricted domains. This has been remedied in the CAPS in that learners will deal with trigonometric ratios for angles between 0° and 360° in both their work on trigonometry and in drawing the graphs of the trigonometric functions. However the extension of work in trigonometry beyond the right-angled triangle in Grade 10 is challenging.
- In the CAPS the work with trigonometric graphs is extended to a domain from -360° to 360°, but learners are expected to work with general solutions to trigonometric equations. This makes it difficult to link the work done in finding solutions to trigonometric equations to the graphical representation of that process.

- In analytic geometry in the CAPS in Grade 10, learners are asked to identify parallel and perpendicular lines from their gradients. It is not clear why this is separated from the inclination of a line which is done in Grade 11.
- In the CAPS in *Euclidean geometry*, the work on similarity in Grade 12 is a more natural development of the work in Grade 10 and the formalisation of work on similarity done in Grade 9. It is unclear why *circle geometry* was placed in Grade 11.
- The evaluation team raised concerns about the lack of clarity on the move from exploration in geometry to more formal methods of establishing geometric fact. For example, in the CAPS learners need to *revise basic results established in previous grades regarding lines, angles and triangles* (Doc 2.1, p 25). Learners would have established properties of quadrilaterals in previous grades but now prove conjectures about their properties in Grade 10. It is not made clear what constitutes an appropriate way of establishing geometric facts as in some instances the informal methods of previous grades appear sufficient and in other instances the facts established in that way now need to be proved. As the move from informal to formal geometry is a difficult transition for learners, the evaluation team suggests that it would be useful to revisit the sequencing and clarification of the sub-topics in *Euclidean geometry* to provide clearer specification on this issue.

2.8.2 Indication of progression

The team considered the level of complexity with which topics were dealt with, both within and across the grades and made a judgement whether the each of the curricula provided a strong, moderate or weak indication of progression.

Table 15: Indication of progression within and across grades

		NCS	CAPS
Within grades	**Level of indication**	Moderate	Moderate
	Rationale/ justification	No formal sequencing of topics within grades is provided in the NCS, apart from the ordering of the LOs	Some of the sequencing within grades is to ensure a spread of topics across the year. However topics build on one another and thus work becomes more complex
Across grades	**Level of indication**	Strong	Strong
	Rationale/ justification	Topics dealt with in a grade build on work in a previous grade and thus become more complex	Topics dealt with in a grade build on work in a previous grade and thus become more complex

Discussion: The nature of Mathematics means that concepts build on one another and thus, if there is a logical sequencing, then there tends to be a progression in terms of complexity.

2.9 SPECIFICATION OF PEDAGOGIC APPROACHES

The team evaluated the degree to which a pedagogic approach was specified in each of the curricula. In making this evaluation, there was an assessment of whether each of the curricula specified or implied a particular approach to pedagogy (e.g. learner-centred pedagogy, problem-based approach to learning and so on) and the extent to which this was unpacked in the curriculum. This is summarised in Table 16 below.

Table 16: Specified pedagogic approach		
	NCS	**CAPS**
Subject-specific pedagogic approach (Description)	In Doc 1.2, pp 11 – 12, an attempt is made to unpack the required learner-centred pedagogic approach. In Doc 1.1 detailed descriptions are provided in the introductory sections and then discussed further in the content. Doc 1.5, which addresses training, describes pedagogy in detail.	In Doc 2.1 a brief summary is provided of the principles underlying the pedagogic approach (Doc 2.1, pp 4-5, 8-9). Where the detailed mathematical content is provided, there are clarifications by examples accompanied by descriptions of cognitive demand.
Level of indication (High/Moderate/Low/None)	High	Low

Discussion: In the NCS an attempt is made describe the required pedagogic approach (Doc 1.2, pp 11 - 12; Doc 1.1). The general pedagogic approach advocated is learner-centred (Doc 1.1, p 2). In the subject-specific discussion an approach that values mathematical process skills (e.g. investigating, conjecturing, proving) is advocated alongside a balance between Mathematics as a discipline and the applications of Mathematics (Doc 1.2, p 11). Within the specification of content in the assessment standards the use of phrases such as *'investigate, generalise and apply the effects of the following transformations'* or *'investigate and use instantaneous rate of change of a variable when interpreting models of situations'* further suggests how this might be achieved.

In the CAPS, the principles underlying the pedagogic approach appear in an abbreviated form (Doc 2.1, pp 4-5, 8-9). Clarifications of the content focus less on a principled discussion of a teaching approach and instead provide examples of the kind of questions that could be asked on that topic, together with an indication of the level of cognitive demand that answering the question requires.

2.10 ASSESSMENT GUIDANCE

Both the NCS and the CAPS provide teachers with guidance on the way in which learners should be assessed. Table 17 summarises the number and type of assessment tasks indicated in each curriculum and the degree of specificity and clarity of the information provided about assessment.

Table 17: Assessment tasks

	NCS Grades 10 and 11	NCS Grade 12	CAPS Grades 10 and 11	CAPS Grade 12
Number of assessment tasks specified	7 tasks and one end of year exam per year	7 tasks and one end of year exam per year	7 tasks and one end of year exam per year	7 tasks and one end of year exam per year
Types of assessment specified	2 tests 2 exams 2 investigations 1 project 1 assignment	2 tests 3 exams 1 investigation / project 2 assignments	4 tests 2 exams 1 investigation/ project 1 assignment /test	3 tests 3 exams 1 investigation/ project 1 assignment
Examples of dominant types of assessment specified	No dominant form – equally tests, exams, investigations, project or assignments	Still quite evenly split but slightly more skewed to tests and exams	Tests and exams	Tests and exams
Specificity of assessment guidance (General/ subject-specific/ Both)	**Both**		**Both** Doc 2.3 describes in detail how recording and reporting needs to be done. This is provided at a generic level for all subjects. Doc 2.1 provides Mathematics-specific information about assessment.	
Clarity of assessment guidance (High/ Moderate/ Low)	**Moderate** The types of assessment tools are not described e.g. 'investigation' is just given as a term and no guidance is given as to what that might be. Similarly the nature and scope of a test is not described. There is no specification whether formula sheets should be used or not.		**Clarity is high**. The types of assessment are described and length and mark allocation of tests is suggested. It is specified that formula sheets should not be provided in Grades 10 and 11. Details, for example, exemplar rubrics are not provided, but it is questionable whether a curriculum document needs to incorporate this.	

Discussion: Both the NCS and the CAPS provide general and subject specific guidance in terms of assessment.

The weighting of school-based assessment (SBA) to end-of-year examination is the same in both NCS and the CAPS (25% SBA, 75% external examination). The nature of the formula sheet that accompanies the Grade 12 examination is not discussed in either the NCS or the CAPS.

Although there are the same number of assessments tasks in the NCS and the CAPS, there has been a shift away from investigations, assignments and projects towards more tests and examinations (although these investigations, assignments and projects are still included).

Within the CAPS (Doc 2.1), the various types of assessment tasks are defined whereas in the NCS (Doc 1.3) the nature of a project, investigation or assignment would be subject to the teacher's own interpretation.

Although the weighting of topics and levels of cognitive demand in the examinations is specified in both the NCS (Doc 1.4) and the CAPS (Doc 2.1), the CAPS document make it clear that formula sheets should not be provided in Grades 10 and 11, and the nature of tests both in terms of length and marks is specified.

2.11 CURRICULUM INTEGRATION

2.11.1 Integration between subjects

The team evaluated whether integration of the work done in Mathematics was discussed in relation to other subjects. They looked for explicit reference to integration with other subjects in the curriculum in order to make this judgement. The results are summarised in Table 18.

Table 18: Integration between subjects

	NCS	CAPS
Level of integration	Low in terms of specific reference	Low in terms of specific reference

Discussion: The Mathematics covered in the FET phase can clearly be applied in other school subjects. However this is only mentioned in the NCS in a generic statement about '*integration and applied competence*' (Doc 1.1, p 3), in discussion of mathematical models as an important part of problem-solving (Doc 1.1, p 10) and in a statement which says that learners should '*connect space, shape and measurement to other Learning Outcomes within Mathematics and where possible to other subjects*' (Doc 1.1, p 14). No examples are given as to how this might be done, and within the specification of content, links to other subjects are not mentioned. In the CAPS, although there are comments about modelling (Doc 2.1, p 8), there is no specific discussion of integration with other subjects.

2.11.2 Integration with the everyday world and knowledge of learners

The team evaluated the degree to which learners' world and knowledge, the world of work and communities were referenced and formed part of the knowledge specified in the curriculum. The results are indicated in Table 19 along with examples of places where that integration can be seen.

Table 19: Integration between subject and everyday knowledge		
	NCS	**CAPS**
Level of integration	Moderate	Moderate
Example 1	In financial mathematics learners are asked to understand the *'implications of fluctuating foreign exchange rates (e.g. on the petrol price, imports, exports, overseas travel)'* (Doc 1.1, p 20 and Doc 2.1, p 27)	
Example 2	Modelling is discussed as an important part of the curriculum and 'Use mathematical models to investigate real-life contexts' is an assessment standard (Doc 1.1 p 26)	In statistics, learners are asked to work with bivariate data to make 'meaningful comments on the context' (Doc 2.1, p 48)

Discussion: In both the NCS and the CAPS, whilst there is acknowledgement of the importance of Mathematics as a discipline in its own right, there is also stress laid on the applicability of Mathematics to everyday life and other disciplines. In both the NCS and the CAPS mathematical modelling is mentioned as important. Thus both the NCS and the CAPS suggest situations where learners can see the applicability of Mathematics to the real world.

2.12 CURRICULUM OVERVIEW

2.12.1 Curriculum coherence

Both the NCS and the CAPS encompass orientations to Mathematics as a discipline in its own right and applicable to problem-solving in other disciplines and everyday life. Both also stress that mathematical practices (e.g. conjecturing, generalising and proof) are important skills. Finally, both allude to the importance of Mathematics for responsible citizenship, although the NCS lays more stress on a transformatory agenda. In both curricula, these orientations are more apparent in the introductory sections (where the definition and aims of the subject are described) than in the content specific sections. In particular in the CAPS the specification of topics to be taught (Doc 2.1 pp 21 - 50) is quite specifically content focused so it is unclear where and how some of the specific aims and skills mentioned (Doc 2.1 pp 8 - 9) should be realised. Thus, although there are no specific contradictions in terms of coherence, there is a danger that a focus on the content-specific sections only might lead to a neglect of some of the aims.

It was noted that aims like allowing learners to see Mathematics as a human creation are difficult to realise and assess and thus will be neglected unless specifically supported.

In relation to proof, the NCS Doc 1.3 states that only 6 marks of the 300 (2%) are allowed for testing proofs (Doc 1.3, p 12). This is in conflict with the stress on mathematical practices suggested. In the CAPS the upper limit has been raised to 18 marks out of 300 (6%) (Doc 2.1, p 10).

2.12.2 Implications for South African context

Performance of learners on the NSC Mathematics examinations based on the NCS suggest that Mathematics is a very challenging subject. Approximately half of those registered for Mathematics scored less than 30% in the NSC examination each year between 2008 and 2012 and there has been a declining proportion of learners electing to take Mathematics as a subject. This evaluation indicates that the CAPS contains both *more content* and *more demanding* content than the NCS. Thus the CAPS Mathematics is likely to be very difficult for the majority of learners. However, the evaluation team was not of the opinion that this makes the curriculum inappropriate, as problems in teaching and learning cannot be addressed solely by the written curriculum. Much work needs to be done to address the teaching and learning of Mathematics in classrooms and a curriculum for Grades 10 – 12 Mathematics has to rely on foundational knowledge from previous years. However, the team did express some concerns that the CAPS Mathematics, like the NCS Mathematics, is aiming to prepare learners who want to continue with mathematical studies at tertiary level, as well as provide an exit level school qualification for learners who might not intend to study Mathematics further. The evaluation team are concerned that in trying to meet the needs of both groups of learners the Mathematics curriculum might be imposing too high a level of demand for some learners and insufficient rigour for those who will study Mathematics further at university.

2.12.3 Assumptions regarding teacher expertise

The CAPS provides far greater guidance to teachers in terms of the sequencing and pacing of curriculum content than the NCS. In addition, the CAPS tends to provide greater detail and more clarity on the content to be covered. This is both a strength and a weakness of the CAPS. The guidance provided on sequencing and pacing will certainly be welcomed by many teachers and will help ensure coverage. However, if it is too rigidly enforced it could prevent teachers from being responsive to the needs of their learners and might stifle creativity and innovation in experienced teachers. In contrast the NCS provides information about how teachers might go about drawing up their own learning programmes for Mathematics (Doc 1.2). Such an activity relies on expert judgement from the teachers involved, but also means that the sequencing and pacing of topics can be tailored for those teachers' context.

Despite the assistance provided in sequencing and pacing in the CAPS, a high level of teacher expertise will still be required to enact the curriculum. For example, the curriculum specifies that the teacher should define the trigonometric ratios in right-angled triangles in Grade 10 and then should extend the definitions to angles between 0° and 360°. No suggestions are provided for how this should be done. Similarly formal proof in geometry is done for the first time in Grade 10. The CAPS does not discuss how one might deal with this or the relationship between facts 'established' informally in the General Education and Training (GET) Phase and dealt with more formally in this phase. However, the evaluation team is not necessarily arguing that such information should be provided in a curriculum document. Rather, the team is simply pointing out that providing the content and a suggested sequencing and pacing thereof does not mean that teacher expertise is not needed or that further discussion and clarification of aspects of the curriculum are not required.

2.13 CONCLUDING REMARKS

The CAPS Mathematics represents more than a simple repackaging of the NCS Mathematics. The inclusion of *Euclidean geometry*, *probability* and further statistics work in the CAPS and the exclusion of *linear programming* and *transformation geometry* from the CAPS means that there has been a significant change in content. These new topics in the CAPS represent a weighting of about 20% in marks during the FET phase and thus can be seen to be more than a minor amendment in content. These shifts in content (together with some more minor shifts in other topic areas) have meant that in Mathematics, the CAPS covers more sub-topics and that it is overall more demanding in terms of the level of challenge of the content than the NCS was. This is a potential cause for concern given the poor performance of most learners in NSC examinations based on the NCS Mathematics.

The multiple documents of the NCS have been streamlined into a single document in the CAPS. The language and structure of the CAPS document (Doc 2.1) is more straightforward than that of the NCS (Doc 1.1). This makes the CAPS more user-friendly. However the evaluation team feels that the clarification column presented in the detailed discussion of content in the CAPS could have been better used. The type of comments presented there at times appear almost idiosyncratic and the use of exemplar questions does not give sufficient guidance about the rationale, direction or possible teaching approaches for topics and sub-topics.

The CAPS specifies the content to be taught reasonably clearly and specifies the sequencing and pacing of topics both across grades and within grades. This sequencing and pacing was left to the teacher's discretion in the NCS. Although the assistance with sequencing and pacing provided by the CAPS is useful, it is dangerous if it becomes unnecessarily prescriptive and stifles the ability of teachers to respond to their contexts, or for the curriculum to be adaptable and for teachers to be innovative.

Both the NCS and the CAPS provide details about the nature of assessment required and the weighting of such assessment. The nature of individual assessment types is described more fully in the CAPS. In the move from the NCS to the CAPS, a greater emphasis is placed on test-type assessments whereas in the NCS there was more scope to use projects, assignments and other types of assessment.

Finally the strong transformatory agenda present in the introductory sections of the NCS Mathematics is less overt in the CAPS.

2.14 RECOMMENDATIONS

On the basis of this evaluation, three key recommendations are made in relation to the CAPS Mathematics.

The first of these relates to the clarification column in the specification of curriculum topics, the second to concerns that the increase in breadth and depth of Mathematics might make it inaccessible to many learners and the third to the level of prescription in implementation.

a) Recommendations in relation to the clarification column in the specifications of curriculum topics

The evaluation team recommends that in any future editions of the CAPS, the clarifications column be revisited so that the type of information provided there gives more principled guidance on the content to be taught. It should help teachers understand the depth at which content should be taught and give a sense of how the topic progresses through the grades. The team considered that some of the elements used in the senior and intermediate phase the CAPS documents might be useful here. These elements included statements like *'What is different to Grade x'* (where x is the previous grade) and some discussion of what learners need to understand and what they might find difficult.

b Recommendations in relation to the increased depth and breadth of the CAPS Mathematics

The increase in breadth of the CAPS is of concern. The evaluation team recommends that this be carefully monitored during implementation and consideration be given to reducing the amount of content.

Given the low pass rate in Mathematics that exists in the NSC examinations and the increase in both depth and breadth of the CAPS, there is concern that the CAPS Mathematics might prove too difficult for many learners and thus they will not take Mathematics. This will shut off a route into further study and job opportunities in technical and scientific fields. Some of the tensions in the CAPS arise from trying to meet the needs of learners who intend to study Mathematics further at university level as well as learners who need to show competency in school Mathematics.

It might be necessary to allow for differentiated strands of Mathematics in order to meet both these needs. Recommendations of the way in which the strands might be differentiated are beyond the scope of this report, but could be in terms of curriculum coverage and/or depth, through differentiated examination or through differentiated pace.

c) Recommendations in relation to the levels of prescription in terms of implementation

Although the team acknowledged that the suggested sequencing of the curriculum is sound and recognised that the annual teaching plan recommending pacing would be very useful for many teachers, it should not become mandatory for teachers to follow it. Where a teacher has a sound alternative annual teaching plan, adapted to meet the needs of their context or allow for different approaches to introducing particular concepts, this should be allowed. Similarly examples of assessment tasks provided in the curriculum should not be seen as prescriptive.

3 MATHEMATICS: EXIT-LEVEL OUTCOMES FOR THE FET PHASE CAPS

Table 20 shows the Mathematics topics across the phase and the exit-level outcomes associated with each topic.

Table 20: Exit-Level Outcomes for Mathematics Topics in the CAPS

FET Phase topic (CAPS)	Exit-level outcomes for FET (content/skills/competencies)
Functions	Know the concept of a function and inverse function
	Identify the features of a function, including domain, range, intercepts with the axes, asymptotes, symmetry, intervals of increase and decrease, average gradient
	Be able to convert flexibly between representations of functions as tables, graphs, words and formulae where the functions are $f(x)=x$, $f(x)=x^2$, $f(x)=1/x$, $f(x)=b^x$, and of functions of the form $y=af(x+p)+q$ where $f(x)$ is one of the functions listed in this block.
	Be able to convert flexibly between representations of functions as tables, graphs, words and formulae where the functions are $f(x)=\sin x$, $f(x)=\cos x$, $f(x)=\tan x$ and of functions of the form $y=afk(x+p)+q$ where $f(x)$ is one of the functions listed in this block.
	Determine and sketch the graph of the inverses of $y=ax+q$, $y=b^x$, $y=ax^2$
	Sketch cubic polynomials showing turning points and points of inflection
	Use different representations of functions to model and/or solve contextual and mathematical problems
Number patterns, sequences, series	Investigate number patterns: linear, quadratic and geometric
	Find the general terms of arithmetic, quadratic and geometric sequence
	Derive the formula for the sum of arithmetic and geometric series
	Convergence and divergence of geometric series
	Apply the formulae for the sums of arithmetic and geometric series, including sum to infinity.
	Read and understand expressions written using sigma notation
Finance, growth and decay	Solve problems on simple and compound growth and decay including nominal and effective interest rates
	Solve problems on foreign exchange
	Solve problems on present value and future value annuities
	Compare investment and loan options
Algebra	Recognise and describe numbers as real or non-real, and as belonging to one or more subset of real numbers
	Accurately compare and order numbers as well as round, estimate and approximate in the context of computations
	Factorise integers
	Read and understand algebraic expressions
	Transform algebraic expressions by using legitimate algebraic computations including finding products and factors of expressions. Factorisation of polynomials limited to quadratics and simple cubics (where one root is an integer) and expressions that can be reduced to these.

Table 20: Exit-Level Outcomes for Mathematics Topics in the CAPS (continued)	
FET Phase topic (CAPS)	**Exit-level outcomes for FET (content/skills/competencies)**
	Transform algebraic expressions by using legitimate algebraic computations including finding products and factors of expressions. Factorisation of polynomials limited to quadratics and simple cubics (where one root is an integer) and expressions that can be reduced to these.
	Read, understand and solve equations that include linear, quadratic, cubic, rational, and exponential functions
	Read, understand and solve simultaneous equations (limited to two linear equations, or a linear equation and quadratic equation).
	Read, understand and solve linear and quadratic inequalities and represent the solutions on a number line and using algebraic notation.
	Understand the use of cancellation within expressions including equations
	Understand the relations between the sign of a product and the signs of values composing the product
	Use algebra to be able to deduce or extract information about the nature of relations between variables from the form of algebraic expressions and from graphs, for example whether a function is increasing on an interval, establishing direct or indirect proportion, determining the maximum value of a function
	Express relations described in word problems using algebraic expressions, including as equations, and solve such problems using algebra.
Calculus	Understand the intuitive idea of a limit
	Differentiate by first principles the following functions $f(x)=c$, $f(x)=ax^2+bx+c$, $f(x)=ax^3$, $f(x)=a/x$)
	Differentiate expressions involving powers of x using rules (excluding product, quotient and chain rule)
	Find the equation of tangent line to a curve
	Use the second derivative to determine concavity
	Solve problems in context involving optimisation, rate of change and the calculus of motion.
Probability	Understand relationship between relative and theoretical probability
	Determine probability in a variety of ways e.g. using Venn diagrams and tree diagrams
	Use the fundamental counting principle
	Understand what constitutes independent and mutually exclusive events and be able to calculate the associated probabilities.
Euclidean geometry and measurement	Work with geometric definitions and deductive reasons to prove theorems and riders
	Work with the geometry of triangles and similarity and proportionality in the study of triangles deductively
	Work with the geometry of quadrilaterals deductively
	Work with the geometry of circles deductively
	Understand congruency and similarity
	Calculate perimeters, areas and volumes

Table 20: Exit-Level Outcomes for Mathematics Topics in the CAPS (continued)	
FET Phase topic (CAPS)	**Exit-level outcomes for FET (content/skills/competencies)**
Analytical geometry	Given a pair of points in a Cartesian plane to determine the distance between them, the inclination and the equation of and the midpoint of the line segment that connect them.
	Given two lines determine whether they are parallel or perpendicular to each other. Find angles between two intersecting lines.
	Calculate the equations, centre and radii of circles
	Find equations of tangents to circles
	Solve problems geometry using algebra and the results derived above
Trigonometry	Knowing the definitions of sin, cos and tan and their inverses, for angles between -360o and 360o but work only with the sin, cos and tan functions.
	Know how to solve triangles given an appropriate subset of the 6 angles and sides.
	Know the standard identities in trigonometry
	Know how to simplify complex trigonometric expressions using standard trigonometry identities with arbitrary angles that are positive or negative, compound angles and double angle formulae.
	Be able to sketch trigonometry graphs and make deductions from them
	Know how to determine all solutions of (solvable) trigonometry equations
	How to determine lengths and heights of immeasurable quantities like heights of buildings, mountains etc by using measurable quantities like horizontally distances and angles of elevations and depressions
Statistics	Collect, organise and interpret univariate and bivariate data
	Know that data is skewed or symmetrical, determine the type of skewness and interpret this in context
	Calculate measures of central tendency and dispersion by hand or calculator with grouped and ungrouped data and interpret these in contexts
	Represent data using histograms, frequency polygons, ogives and box and whisker diagrams.
	Use scatterplots, regression and correlation to analyse bivariate data and interpret them in context.

The following table presents an analysis of the weighting of cognitive demand for Mathematics in the FET CAPS.

Table 21: Weighting of levels of cognitive demand in the FET CAPS for Mathematics			
Knowledge	**Routine procedures**	**Complex procedures**	**Problem solving**
20%	35%	30%	15%

Discussion: The evaluation team felt that in general the emphasis and weighting of both cognitive skills and content areas is appropriate. The evaluation team did identify some omissions but raise these with a strong caveat against adding further breadth to the curriculum in place of depth. Thus the team's recommendations are intended to strengthen depth and not to add further content to the curriculum. The team would suggest that, if necessary, one could cut back on content to make room for greater levels of depth. The specific omissions identified were:

- The functions to be studied appear to be limited to a restricted list of functions and, in particular to functions given by equations. This makes it hard to develop the full concept of a function and to illustrate clearly the principles underlying the way new functions can be studied using transformations.
- Within *calculus* the notion of the 1st derivative as indicating intervals of increase and decrease is not made clear.
- Within *geometry* the notion of proof is not explicitly discussed. Thus it is not made clear the extent to which learners should develop an understanding of proof and axiomatic systems.
- Within *trigonometry* although general solutions of trigonometric equations are required, the trigonometric functions are only graphed on the domain [-360°; 360°]. This limits possibilities for making coherently links between different representations of the function.

The evaluation team also noted that a number of the specific aims provided in Doc 2.1, pp 8 - 9 of the CAPS were not pulled through explicitly into the main body of the curriculum where the content is listed. The team felt that this could result in important mathematical practices that are highlighted in the aims (e.g. modelling, conjecturing and generalisation, justification and proof) not receiving sufficient attention.

The evaluation team felt that the weighting of levels of cognitive demand suggested in the CAPS as indicated in Table 21 above is appropriate and it would be desirable for both assessment tasks and classroom-based tasks and teaching to reflect this balance. However, the experience of the evaluation team suggests that the focus in many classrooms is on tasks requiring *knowledge* or the *execution of routine procedures* and thus a considerable amount of work needs to be done for the specified weighting to be realised in practice.

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ANNEXURE A: MATHEMATICS

TOPICS AND SUB-TOPICS COVERED IN THE NCS AND THE CAPS

Table A1: Functions						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Informal concept of function	Y			Y		
Formal concept of function			Y			Y
Convert between representations of functions as tables, graphs, words and formulae	Y	Y	Y	Y	Y	Y
Point by point plotting of $y = x^2$, $y = 1/x$ and $y = b^x$	Y			Y		
Investigate the effect of a and q on graph $y = af(x)+q$ *on* $y = x$, $y = x^2$, $y = 1/x$ and $y = b^x$	Y			Y		
Point by point plotting of sin, cos, tan graphs on domain 0o to 360 o				Y		
Investigate the effect of a and q on trig graphs	Y			Y		
Sketch graphs of form $y = af(x)+q$ where $f(x) = x$ or x^2 or $1/x$ or b^x	Y			Y		
Find equations of given graphs of form $y = af(x) + q$ where $f(x) = x$ or x^2 or $1/x$ or b^x	Y			Y		
Investigate effect of p $f(x) = a(x+p)2 + q$ on $y = x2$, $y = 1/x$ and $y = bx$		Y			Y	
Sketch graphs of form $y = af(x+p) + q$ where $f(x) - x$ or x^2 or $1/x$ or b^x		Y			Y	
Find equations of given graphs of form $y = af(x+p) + q$ where $f(x) = x$ or x^2 or $1/x$ or b^x		Y			Y	
Investigate average rate of change between 2 points	Y	Y			Y	
Point by point plotting of sin, cos, tan graphs (no restriction on domain discussed)	Y	Y				
Point by point plotting of sin, cos, tan graphs on domain -360º to 360º					Y	
Investigate effect of k on $y = sin/cos/tan(kx)$		Y			Y	
Investigate the effect of the p on $y = sin/cos/tan(x+p)$		Y			Y	
Sketch graphs of a $sin/cos/tan\ k(x+p)$ (at most 2 parameters at a time)		Y			Y	
Find equations of graphs of form a $sin/cos/tan\ k(x+p)$ (at most 2 parameters at a time		Y			Y	
Concept of inverse function			Y			Y
Restrictions on domain of function to create inverse function			Y			Y
Graph of inverse function			Y			Y
Determine and sketch the graph of the inverses of $y = ax+q$			Y			Y
Determine and sketch the graph of the inverse of $y = ax^2$			Y			Y
Determine and sketch the graph of the inverse of $y = bx$			Y			Y
Domain and range	Y	Y	Y	Y	Y	Y
Intercepts with axes	Y	Y	Y	Y	Y	Y
Turning points and maxima and minima	Y	Y	Y	Y	Y	Y
Asymptotes	Y	Y	Y	Y	Y	Y

Table A1: Functions (continued)						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Shape and symmetry	Y	Y	Y	Y	Y	Y
Average gradient	Y	Y	Y		Y	Y
Intervals of increase and decrease	Y	Y	Y		Y	Y
Discrete or continuous (given context)	Y	Y	Y	Y	Y	Y
Apply factor and remainder theorem to cubic polynomials			Y			Y

Table A2: Patterns and sequences						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Investigate number patterns leading to those where there is a constant difference between consecutive terms, and the general term (without using a formula) is therefore linear.	Y			Y		
Investigate number patterns leading to those where there is a second constant difference between consecutive terms.		Y			Y	
Arithmetic sequences	Y		Y	Y		Y
Geometric sequences			Y			Y
Arithmetic series			Y			Y
Geometric series			Y			Y
Sigma notation			Y			Y
Derivation and application of the formulae for the sum of arithmetic series			Y			Y
Derivation and application of the formulae for the sum of geometric series			Y			Y

Table A3: Finance						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Use simple and compound growth formula	Y			Y		
Apply the formula to solve problems including interest, hire purchase, inflation, population growth and other real life problem	Y			Y		
Use simple and compound decay formula to solve problems		Y			Y	
Understand different periods of compounding, effective and nominal interest rates.		Y			Y	
Calculate the value of n in the compound increase / decrease formula.						Y
Apply knowledge of geometric series or formulae to solve annuity and bond repayment problems			Y			Y

Table A3: Finance (continued)						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
Apply the formulae to solve sinking funds			Y			
Exchange rates	Y			Y		
Understanding the impact of fluctuating foreign exchange	Y			Y		
Critically analyse different loan options			Y			Y

Table A4: Algebra						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
Identify rational numbers and convert between terminating and recurring decimals and the form a/b, a,b integers	Y					
Demonstrate an understanding of error margins	Y					
Understand that real numbers can be rational or irrational				Y		
Understand that not all numbers are real		Y				
Establish between which two integers a given simple surd lies.	Y			Y		
Round real numbers to an appropriate degree of accuracy.	Y			Y		
Multiplication of a binomial by a trinomial	Y			Y		
Factorisation to include types taught in grade 9 and trinomials	Y			Y		
Factorisation to include types taught in grade 9 and grouping in pairs	Y			Y		
Factorisation to include types taught in grade 9 and sum and difference of two cubes				Y		
Simplification of algebraic fractions using factorization with monomial denominators.	Y					
Simplification of algebraic fraction using factorization with binomial denominators		Y				
Simplification of algebraic fractions using factorization with denominators of cubes (limited to sum and difference of cubes).				Y		
Revise laws of exponents learnt in Grade 9	Y			Y		
Use the laws of exponents to simplify expressions and solve equations, accepting that the rules also hold for m, n an element of Z.	Y					
Use the laws of exponents to simplify expressions and solve equations, accepting that the rules also hold for m, n an element of Q.		Y		Y		
Exponential equations of the form $ka(x+p) = m$	Y			Y		
Simplify expressions and solve equations for rational exponents where $xp/q = q^{th}$ root of xp		Y			Y	
Add, subtract, multiply and divide simple surds.		Y			Y	
Solve simple equations involving surds.		Y			Y	
Revise the solution of linear equations	Y			Y		
Solve quadratic equations (by factorisation).	Y	Y		Y		
Solve simultaneous linear equations in two unknowns	Y			Y		

Table A4: Algebra (continued)						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
Solve word problems involving linear, quadratic or simultaneous linear equations				Y		
Solve literal equations (changing the subject of a formula).				Y		
Solve linear inequalities	Y			Y		
Graphical representations of linear inequalities	Y			Y		
Quadratic inequalities in one variable and interpret the solution graphically.		Y			Y	
Quadratic equations: completing the square.		Y			Y	
Quadratic equations: by factorisation and by using the quadratic formula.		Y			Y	
Equations in two unknowns, one of which is linear and the other quadratic.		Y			Y	
Quadratic equations: the nature of the roots.					Y	

Table A5: Calculus						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
Understanding limits intuitively			Y			Y
Use limits to define the derivate of a function			Y			Y
Differentiation from first principles of functions of the form *f(x) = b; x; x2; x3 ;1/x*			Y			
Differentiation from first principles of functions of the form *f(x) = b; ax2+ bx+c; ax3 ;a/x*						Y
Use the following rules for differentiation:						
Dx[k] =0			Y			Y
Dx[a^n] = anxn-1 for any real number n			Y			Y
Dx[f(x) ±g(x) = Dx[f(x)] ±Dx[g(x)]			Y			Y
Dx[k.f(x)] = k. Dx [f(x)]			Y			Y
Find equation of tangents to a curve			Y			Y
Sketch graphs of cubic functions			Y			Y
Determine the coordinates of turning points and point of inflection			Y			Y
Second derivative and concavity of a function						Y
Determine the x intercepts of the graph using factor theorem			Y			Y
Solve practical problems concerning optimisation , rate of change including calculus of motion			Y			Y

Table A6: Probability						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
The use of probability models to compare the relative frequency of events with theoretical probability				Y		
The use of Venn Diagrams to solve problems. Deriving if two events A and B in sample space S				Y		
$p(A+B)=p(A) + p(B)- p(A \text{ and } B)$				Y	Y	Y
A and B are mutually exclusive if $p(A \text{ and } B)=0/$ sum rule $p(A or B)=p(A) +p(B)$				Y	Y	Y
$p(A) + p(B) =1$ then $p(B) = p(\text{not } A)=1-p(A)$				Y	Y	Y
Identify dependent and independent events: product rule $p(A \text{ and } B)=p(A) \times p(B)$					Y	Y
Venn diagrams to solve probability problems Set A,B and C in sample space S					Y	Y
Use of tree diagrams for probability of consecutive/simultaneous events not necessarily independent					Y	
Probability using a two way contingency table					Y	Y
Fundamental counting principle						Y

Table A7: Euclidean Geometry						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
Revise Line Geometry				Y		
Revise Angles				Y		
Revise Similarity of triangles/polygons				Y		Y
Revise Congruency of triangles				Y		
Investigate midpoint theorem				Y		
Define isosceles, equilateral, right-angled triangles	Y					
Define the 5 special quadrilaterals	Y			Y		
Investigate and make conjectures about the properties of these quadrilaterals.	Y			Y		
Prove these conjectures	Y			Y		
Solve riders by parallel lines				Y		
Solve riders by triangles properties				Y		
Solve riders by quad properties				Y		
Investigate and prove line centre- perpendicular to chord					Y	
Investigate & prove perpendicular bisector of chord passes through centre					Y	

Table A7: Euclidean Geometry (continued)						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Investigate & prove angle at centre theorem					Y	
Investigate & prove angles at circumference from same chord					Y	
Investigate & prove opposite angles of cyclic quadrilateral					Y	
Investigate & prove two tangents from a point to circle					Y	
Investigate & prove alternate segment theorem					Y	
Riders on the circle geometry and their inverses						Y
Prove proportional intercept theorem						Y
Prove similarity on equiangular triangles						Y
Prove triangles with prop sides to be similar						Y
Prove Pythagoras by similar triangles						Y
Revise Volume of prisms and cylinders				Y	Y	
Revise Area of Prisms and cylinders	Y			Y	Y	
The effects of x Volume and area by k	Y			Y	Y	
Volume & area of spheres, pyramids and cones		Y		Y	Y	

Table A8: Analytical Geometry						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Derive and apply the formulae for calculating:						
• The distance between two points	Y			Y		
• The gradient of the line between two points	Y			Y		
• The gradient of parallel and perpendicular				Y		
• Co -ordinates of the midpoint of the line between 2 points	Y			Y		
Derive and apply:						
• The equation of the line through two given points		Y			Y	
• The equation of the line through one point and parallel/perpendicular to a line		Y			Y	
• The inclination of a line where tan θ is the gradient of the line [0°; 180°]		Y			Y	
• The equation of a circle with radius r and centre (r;b)			Y			Y
Determination of the equation of a tangent to a given circle			Y			Y

Table A9: Trigonometry						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Define the trigonometric ratios sin θ, cos θ and tan θ, using right-angled triangles, understanding similarity is fundamental to this	Y			Y		
Extend the definitions of sin θ, cos θ and tan θ for 0° ≤ θ ≤ 360°		Y		Y		
Define the reciprocals of the trigonometric ratios cosec θ, sec θ and cot θ, using right-angled triangles (these three reciprocals should be examined in grade 10 only)				Y		
Derive values of the trigonometric ratios for the special cases (without using a calculator) θ □ {0; 30; 45; 60; 90}		Y		Y		
Solve two-dimensional problems involving right-angled triangles	Y			Y		
Solve simple trigonometric equations for angles between 0° and 90°	Y			Y		
Use diagrams to determine the numerical values of ratios for angles from 0° to 360°		Y		Y		
Derive and use the identities *tan x = sin x / cos x, x not k.90, k an odd integer; and sinx + cosx = 1*		Y			Y	
Derive and use reduction formulae to simplify: *(a) sin(90 +/- x); cos(90 +/- x); (b) sin(180 +/- x); cos(180 +/- x); tan(180 +/- x); (c) sin(360 +/- x); cos(360 +/- x); tan(360 +/- x); (d) sin(- x); cos(- x); tan(- x).*		Y			Y	
Prove and apply the sine, cosine and area rules.		Y			Y	
Solve problems in two dimensions using sine, cosine and area rules.		Y			Y	
Determine for which values of a variable an identity holds.					Y	
Determine the general solutions of trigonometric equations. Also, determine solutions in specific intervals.		Y	Y		Y	
Compound angle identities: *cos (a +/- b) = cos a.cos b -/+ sin a.sin b; sin (a +/- b) = sin a.cos b +/- cos a.sin b; sin 2a = 2 sin a.cos a; cos 2a =cos2 a - sin2 a; cos2a = 2cos2a - 1; and cos 2a = 1 - sin2 a.*			Y			Y
Solve problems in three dimensions.			Y			Y
(Not to be examined, can be assessed internally by means of a project) Demonstrate an appreciation of the contributions to the history of the development and use of geometry and trigonometry by various cultures through a project.	Y	Y	Y			

Table A10: Statistics and Data Handling						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Identify potential sources of bias/error/misuses in stats &charts	Y					
Revise measures of central tendency in ungrouped data	Y			Y		
Measures of central tendency in grouped data	Y			Y		
Revision of range as a measure of dispersion extension to include						

Table A10: Statistics and Data Handling (continued)						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
percentiles/quartiles/interquartiles & semi interquartile range	Y			Y		
Five number summary and box and whisker diagram		Y		Y		
Use of statistical summaries and graphs to analyse and meaningful						
comment on the context associated with the given data	Y	Y	Y	Y		
Represent data effectively choosing from bar/compound bar/						
pie chart/ line and broken line/histogram/frequency polygon	Y					
Line of best fit description		Y				
Histograms			Y		Y	
Frequency polygons			Y		Y	
Ogives		Y			Y	
Variance and standard deviation		Y			Y	
Symmetric and skewed data		Y			Y	
Identification of outliers					Y	
Revise symmetric and skewed data						Y
Statistical summaries						Y
Scatter plots		Y				Y
Regression{least squares}						Y
Correlation						Y
Meaningful comments on the context associated with bivariate						Y
Data including interpolation & extrapolation and discussions on skew-ness						Y
Drawing a suitable sample from a population for effective mean & standard deviation			Y			

Table A11: Transformation geometry						
	NCS			CAPS		
	Gr 10	Gr 11	Gr 12	Gr 10	Gr 11	Gr 12
Investigate, generalise and apply effect of horizontal and vertical translations on points	Y					
Investigate, generalise and apply effect of reflections in axes and line y = x on points	Y					
Investigate, generalise and apply effect of rotation about origin through 90º or180º on points		Y				
Investigate, generalise and apply effect of enlargement through the origin on vertices of polygon by factor of k		Y				
Use compound angle identities to generalise effect on coordinates of point of rotation about origin through any angle			Y			
Demonstrate knowledge that rigid transformations produce congruent shapes, enlargements similar shapes			Y			

Table A12: Linear programming						
	NCS			**CAPS**		
	Gr 10	**Gr 11**	**Gr 12**	**Gr 10**	**Gr 11**	**Gr 12**
Solve by optimising in two variables		Y	Y			
Subject to 1 or more linear constraints		Y	Y			
Numerical search along boundaries of the feasible region		Y				
Establish optima by search line			Y			
Compare the gradients of objective function & linear constraints			Y			
Solve the system of linear equations to find vertices		Y				

NOTES

NOTES

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