A Brief Analysis of the Grade 9 CTA in 2005

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Introduction
In this paper we briefly want to focus on certain aspects of the 2005 Grade 9 Common Task for Assessment (CTA) for GET (General Education and Training) Mathematics as it relates to the curriculum. This is in part intended to raise awareness and help to develop a reflective attitude towards external assessment papers set by the National Department of Education. The issues that we highlight address the weighting with respect to the learning outcomes, dealing with activities in suitable contexts, using an appropriate model on which to base questions, and compelling learners to use particular problem-solving strategies.

This paper should be read in conjunction with a copy of the 2005 Grade 9 Common Task for Assessment (CTA) for GET (General Education and Training) Mathematics. For the convenience of the reader some of the questions under discussion were scanned into this paper. We observed that for as long as the Common Tasks for Assessment (CTA) for Mathematics have been in existence, the impression that the 'analytical' reader forms is that the exercises contained in it are almost always selected to fit a particular context. In these CTA tasks the emphasis is on applying mathematics. Mathematics is thus used to solve problems using contexts that learners should be able to recognize or associate with.

It is understandable that not all assessment standards can be dealt with effectively within one particular theme. Consequently, algebraic aspects that are normally deemed more difficult, such as laws of indices, factorisation of algebraic expressions and equations are omitted. We find this a good sign, that is, the focus is on problem-solving that relates to everyday life experiences. It seems certain that this tendency will directly influence mathematics education in the senior phase. This trend will be more readily followed by teachers in their everyday teaching practice.

This CTA of 2005 embraces the Kruger National Park as theme. This should be recognizable for South-African learners in the senior phase, and most should at least have come across the name of the park before. The theme is relevant and it is important to introduce aspects that relate to our heritage and environment to the younger generation. As interested onlookers we would like to make a few comments on the exercises found in this 2005 CTA.

Learning outcomes that are assessed
We have compared the content of the exercises and the mathematical content with the learning outcomes of the NCS in the tables below. The following table presents the full marks that learners could obtain per task and per learning outcome.

Task	LO1	LO2	LO3	LO4	LO5	Total marks
1	3			24		27
2	22				5	27
3			5	12		17
4		25			4	29
Total Marks	25	25	5	36	9	100

LO 1 to LO 5 in the table refer to the five learning outcomes such as 'Number Concept', 'Patterns and Functions', etc. The total marks allocated to each LO appear in the bottom row. The large percentage (36%) of marks allocated for Measurement (LO 4) and the few marks (5) for Shape and Space (LO 3), and only 9 marks for Data Handling (LO 5) is striking and raises queries.

The 'under-exposure' of Shape and Data Handling is regrettable. By means of accurate drawings or constructions, and by making use of similarity one could also calculate the sizes of angles and distances related to the thematic context in the 2005 CTA. Being able to handle arithmetic means and distribution tendencies would be quite relevant and enhance the validity of any CTA. All of these aspects were, however, ignored.

The language aspect of practising mathematics within a particular context
The use of contexts puts much emphasis on the language aspect in mathematics education. This implies that reading through a question, making sense, interpreting and extracting crucial information to solve a problem become quite important. We consider the fact that this was taken into consideration in the CTA as very appropriate. It also needs to be highlighted that in many schools (that we visited while the CTA was administered) where English or Afrikaans were not the learners' mother-tongue, learners struggled to make sense, and teachers had to frequently intervene and assist.

Activity 1.1 (below) for instance has the potential to provoke a class discussion on game reserves in order to explore the context prior to tackling the mathematics contained in it.

Activity 1.1

Groups

Recommended time: 10 min

Marks: 0

Discuss the following and give feed back to the class:

1.1.1 Why is it necessary to have national parks?

1.1.2 How can communities close to parks benefit from their existence?

1.1.3 The location of your school on the map (make a dot).

1.1.4 Which South African National Park is closest to your school?

A further example is task 2 (refer to the insert below) in which the learners were required to read a map, refer to an excursion program, to use a table containing charges (costs), to consult a distance table and familiarize themselves with the regulations for accommodation. This involves quite a large chunk of information and requires quite a variety of skills learners had to apply. Also here, a class discussion is desirable before considering the mathematical aspects that might emerge. It is pleasing to see that the CTA examiners have taken this into account.

Activity 2.3

Individual

Recommended time: 40 min

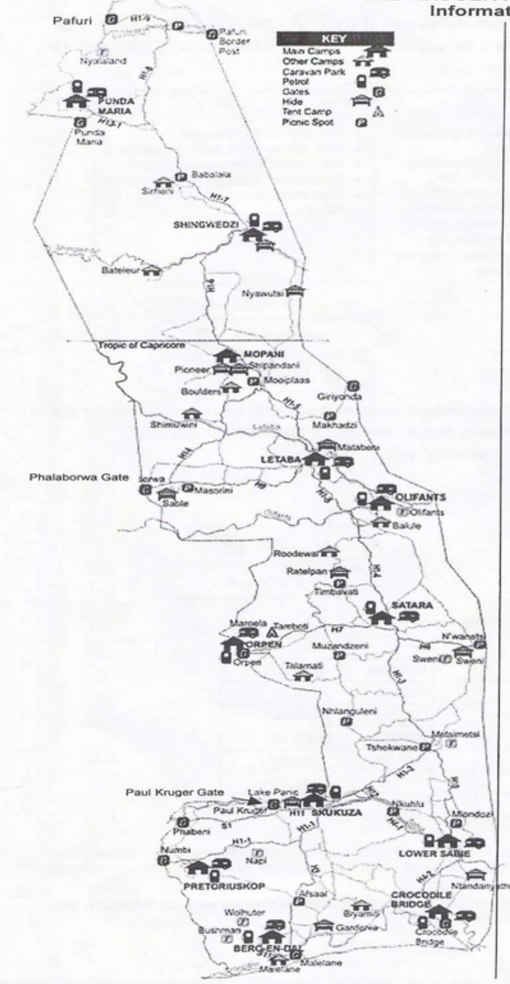
Marks: 9

(Total marks for 2.3.1 to 2.3.4 will be divided by 2 to give the 9 marks)

2.3.1 Use the information on page 8 to find the speed limit on tar roads inside the Park. Use this speed limit to determine at what estimated time the group might have reached Lower Sabie if they had left Skukuza when the gates opened. Give the answer to the nearest minute.

The information that the learners are required to use to solve the problem appears below:

THE KRUGER NATIONAL PARK
Information sheet



Opening and Closing Times				
	Open		Close	
	Camps	Gates	Camps	Gates
January	04:30	05:30	18:30	18:30
February	05:30	05:30	18:30	18:30
March	05:30	05:30	18:00	18:00
April	06:00	06:00	18:00	18:00
May	06:00	06:00	17:30	17:30
June	06:00	06:00	17:30	17:30
July	06:00	06:00	17:30	17:30
August	06:00	06:00	18:00	18:00
September	06:00	06:00	18:00	18:00
October	05:30	05:30	18:00	18:00
November	04:30	05:30	18:30	18:30
December	04:30	05:30	18:30	18:30

Table 4

Kruger National Park - Distance Table

Letaba							
160	Lower Sabie						
35	145	Olifants					
170	57	156	Paul Kruger Gate				
52	212	86	222	Phalaborwa Gate			
67	93	52	104	119	Satara		
160	46	145	12	211	92	Skukuza	
119	42	104	126	170	50	40	Tshokwane

Table 5

(50) speed limit on tar roads

(40) speed limit on gravel roads

INFORMATION, RULES AND REGULATIONS

- Visitors must report at reception in camps where they want to stay overnight.
- Occupancy from 12:00 on day of arrival and vacate before 09:00 on day of departure.
- No disturbance is allowed. No noise is allowed between 21:00 and 06:00.
- No bicycles, roller-skates or skateboards may be used.
- Visitors are not allowed to trade inside the Park.
- Visitors should stay inside their vehicles when outside camps, unless otherwise indicated.
- Obey all traffic rules. Remember animals have the right of way
- Only persons with a valid driver's license are allowed to drive.

Help to conserve the environment

- No animal, plant or bird may be fed, disturbed or removed.
- Fire kills. Do not start any fire through negligence.

Important

- No domestic animals are allowed.
- Littering is prohibited.
- Fire arms must be declared on arrival at the gates.
- The Park is situated in a malaria infested aria. Visitors should take the necessary anti-malaria medication which is also available at the gates and main camps.

(courtesy www.SANparks.org)

Demonstrate and copy

The following section involves a brief discussion on how certain algorithms were demonstrated, which learners were then expected to imitate. Exercise 1.2.1 (and also 1.2.2) for instance has the following outline:

scale	distance measured on map	actual distance
1 mm is 1 km	50 mm	$\frac{50\ mm}{1 mm} \times 1\ km = 50\ km$
1 mm is 10 km	28 mm	1.2.1 ……….

The suitability of advocating one specific method of finding a particular solution in this exercise needs to be questioned. We find it regrettable that an "example" calculation is provided. It may ultimately result in assessing the learner's ability to reproduce a recipe (not comprehended by the learners?) which would hopefully lead to a correct (but possibly not understood) answer. In our opinion that would ultimately lead to a "pseudo" result (or answer). Dealing with a context normally challenges learners to translate the problem into mathematics. It provides the opportunity to show one's capability and skills to practise mathematics with understanding. This skill needs to be assessed as well.

There is another disadvantage involved when we try to direct a learner’s thoughts in a particular direction. The approach in the example does not necessarily correspond to the learner's way of thinking or how he or she would be tackling a problem of this nature. For learners that are used to solving this kind of problem by means of another method, the example would be an obstacle rather than a help. Does the example given imply that the examiner prefers this method or does it reflect a stance that learners would not be able to solve it (using a different method) without assistance? Furthermore, this practice might also create the impression that the examiner’s method is the only acceptable or valid method possible to solve the problem.

Dealing with the degree of accuracy

Task 2 deals with travelling times and distances. In the memorandum 55,2 minutes is rounded off to 55 minutes and 357 minutes to 6 hours. Therefore it is strange that 33 minutes is not rounded off to half an hour. Consistency in this regard needs to be maintained.

Task 4 deals with the elephant population. Although it is clearly stated that the numbers used are estimates, the calculations with these numbers are accurate. The memorandum allocates extra marks for learners who take the three leap years, from 1980 to 1989, into consideration. Amongst the numbers 1,3 million and 200 elephants per day, an approximation of 3500 would be suitable for the number of days in a decade. According to the memorandum calculations should be made using 3646 days. Working with contexts also implies that a learner can or should be allowed to critically consider his/her results (solutions to problems).

Choosing an appropriate model

In the same task 4.1, (see facing page) only the death rate of 200 elephants per day is taken into consideration. A linear relation is presented in which the number of elephants decreases. Fortunately there is a birth rate provided as well. On the one hand learners should conclude in task 4.1 that the number of elephants decreases. On the other hand they were required to draw a line of best fit in task 4.2 and conclude that the number of elephants increased.

Working with contexts implies that learners should evaluate their results against the degree of reality within the given context. In this case a learner with the ability to solve the problem, might be confused by the nature or context of the exercise itself.

It is customary to provide the birth and death rates of a population in percentages. That 200 elephants would die daily, irrespective of whether the population consists of 1,3 million, or of just a few elephants, is highly unlikely. It is more realistic to assume that the relation is exponential rather than linear. The linear formula that is finally expected to be found is definitely not a suitable model for the context used in the problem. According to this model there would be a negative number of elephants until 1942. If this model is accurate at all, then it is only so as from 1988 onwards. It would have been easier not to choose dates as a variable, but rather the years counted from 1988. This would also simplify the formula considerably.

In conclusion

From the type, and depth of questions that appear in the CTA of 2005 it seems that the examiner(s) in certain instances paid little attention to some of the assessment standards (Learning outcomes) contained in the National Curriculum Statement (NCS) that concern formal mathematics. Perhaps it is understandable that not all assessment standards can be assessed at the same time. The practice of “demonstrate and copy”, referred to previously, still points to the influence of behaviouristic tendencies of “do as I do”, or follow my example, as opposed to constructivism (allowing learners to explore and construct their own knowledge or strategies).

Generally, we are pleased with the quality and format of the CTA assessments up till now. We sincerely hope that teachers and textbook writers for the senior phase likewise would endeavour to select mathematical contexts that are recognizable and interesting for learners. This would be to everyone's benefit. The numerous learners who will unfortunately drop out of school at the end of grade 9, would have been afforded the opportunity to be exposed to and learn meaningful mathematics. Hopefully they would have acquired skills and knowledge, and be adequately equipped for confronting problems in everyday life that deal with numbers, three-dimensional shapes, measurements and data handling. Learners, who continue through to grade 10, similarly should have a good basis which would facilitate understanding and conceptualisation of the more abstract mathematics to follow. Those who would choose to do Mathematical Literacy would by now have developed good problem-solving skills.

TASK 4 **ANIMAL MANAGEMENT AND CONTROL**

Recommended time: 55min | Marks: 17

In this task you will be assessed on your ability to:

- Generate linear patterns
- Collect data and interpret data from different sources
- Work with percentages and ratios
- Draw and interpret different types of graphs
- Solve equations
- Substitute and perform operations

Activity 4.1 | Pairs

Recommended time: 25 min | Marks: 6

The article below looks into the plight of the elephants in Africa from 1979 to 1989.

Elephant Poaching in Africa

By Sam Browning, Class of 2001

There has been recent international focus on the plight of the elephant, endangered by poaching. Elephants today occupy scattered regions throughout West, Central, and South Africa. Three hundred years ago, elephants occupied these same regions, but not in scattered places. They were spread evenly throughout. Since that time the encroachment of man and poaching slowly began to limit their living space and lower their numbers. It was not until the 1970's, however, that a poaching frenzy began - 200 elephants on average were slaughtered per day. In 1979, there were an estimated 1,3 million elephants in Africa. A decade later, that number had dropped to an estimated 600 000 animals. (Peter Hawthorne, *The Horns of Plenty*. (Time Magazine 9 June 1997).

4.1.1 Use the information above to complete Table 9.

(Please note: "×" is the multiplication sign and "x" is the symbol representing a variable in algebra)

Estimated number of elephants	Days	Estimated number slaughtered	Elephants remaining
1,3 million	1	200	1,3 million - …….. = …………
1,3 million	10	…… × 200 = ……..…	1,3 million - …….. = …………
1,3 million	118	…… × …….=……….	…………………
1,3 million	x		………………
An equation that gives the relation between the days (x) and the elephants remaining (y) will be			y = ……………………………

Table 9

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4.1.2 Use your equation to determine the number of elephants that might have remained after one year (365 days) if slaughtering went on unchecked. (2)

4.1.3 Use the formula to determine the number of elephants that might have remained after a decade and compare it with the number in the article. Explain these differences in the answers? (4)

References

2005. Common Task for Assessment Grade 9. (Learner's Book). Mathematical Literacy, Mathematics and Mathematical Sciences. GET. Department of Education: Republic of South Africa.

2005. Common Task for Assessment Grade 9. (Teacher's Guide). Mathematical Literacy, Mathematics and Mathematical Sciences. GET. Department of Education: Republic of South Africa.