VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2003 Mathematical Methods GA 2: Examination 1

GENERAL COMMENTS

The number of students who sat for the 2003 examination was 17 620, slightly fewer than the 17 728 who sat in 2002. Almost 18 per cent of students scored 90 per cent or more of the available marks (compared with 12 per cent in 2002) and 365 received full marks (compared with 263 in 2002).

The overall quality of responses was similar to that of recent years. There were many very successful responses and it was rewarding to see the substantial number who worked through to obtain full marks on questions. However, the percentage who scored very few marks and who appeared to attempt little or nothing in Part 2 continues to be disappointing. There seems to be little evidence that failure to attempt Part 2 is due to lack of time. It was noticeable that many students only answered Question 6 on Part 2, the probability question, yet attempted little else.

Students should be familiar with instructions that appear on the examination booklet. In particular, the following should be noted:
'**In questions where more than one mark is available, appropriate working must be shown.**'
'A decimal approximation **will not be accepted** if an exact answer is required to a question.'
'Where an exact answer is required to a question, appropriate working must be shown.'
'Where an instruction to **use calculus** is stated for a question, you must show an appropriate derivative or anti-derivative.'

Students should be made aware that the instruction to show working will be applied rigorously in the marking of papers. In questions where working is required, failure to show appropriate working will result in full marks not being awarded. Where only an answer is given in responses to a question, only answer marks may be awarded. Similarly, a decimal approximation will not be accepted if an exact answer is required. Stating how the calculator was used to obtain the 'exact' answer to a certain number of decimal places is not an appropriate response.

As noted in previous reports, there were problems associated with poor algebraic skills, poor setting out and poor use of mathematical notation, especially with regards to brackets, which proved to be significant in Questions 3, 4, and 5b. Also students continue to have difficulty in expressing an answer to a specified degree of accuracy.

The discerning use of graphics calculators was an issue. Students need to be aware that an instruction to "use calculus" requires a derivative or anti-derivative to be shown, and an evaluation of an expression on a graphics calculator without showing this will not obtain marks.

Students need to take care to ensure that they have responded to the question asked, rather than what they might prefer it to be by carefully re-reading the question after completion of their response.

SPECIFIC INFORMATION

Part 1 – Multiple-choice

This table indicates the approximate percentage of students choosing each distractor. The correct answer is the shaded alternative.

	A	B	C	D	E
Question		**%**			
1	4	8	6	78	4
2	6	76	7	4	7
3	15	62	5	17	1
4	2	0	1	95	2
5	14	15	11	3	57
6	65	5	12	4	14
7	5	5	81	3	6
8	20	8	2	69	1
9	6	16	5	70	3
10	5	7	70	12	6
11	16	10	65	4	5
12	50	19	15	6	10

13	83	3	7	5	2
14	2	8	39	10	41
15	10	4	16	11	59
16	11	12	68	7	2
17	8	9	2	13	68
18	83	9	3	2	3
19	6	10	5	13	66
20	3	9	61	15	12
21	62	6	26	3	3
22	3	17	20	6	54
23	4	9	10	74	3
24	12	4	7	71	6
25	8	59	10	19	4
26	21	67	9	2	1
27	2	62	5	14	17

Part 2

Question 1

Marks	0	1	2	Average
%	56	11	33	**0.77**

Correct response:

$P(x) = 2x^4 - 3x^3 + 7x + 11$

P (-1) = 2 +3 –7 +11 = 9

Therefore the polynomial is not exactly divisible by (x + 1) since P (-1) ≠ 0

A surprisingly large number of students did not know the remainder theorem. Many used long division and received no marks as they had not responded to the explicit instruction to use the remainder theorem. Others used both without indicating which was the solution to the question asked. P (1) appeared on occasions. Some students found P (-1) and then made no statement as to what this meant.

Question 2

2a

Marks	0	1	2	3	Average
%	40	14	5	41	**1.47**

Correct response:

$\frac{dy}{dx} = 2x - 2$

$2x - 2 = 3$

$x = \frac{5}{2}, y = \frac{1}{4}$

$\left(\frac{5}{2}, \frac{1}{4}\right)$

Many students found $\frac{dy}{dx}$, but then equated it to $3x - 5$, rather than 3. Equating $x^2 - 2x - 1$ to $3x - 5$ was also a common mistake, leading to two points (1, -2) and (4,7). Some of those who found the correct point went on (unnecessarily) to find the equation of the tangent. Some students gave the point, from the calculator, without any working.

2b

Marks	0	1	2	Average
%	50	16	34	**0.83**

Correct response:

$m = -\frac{1}{3}, y = -\frac{1}{3}x + \frac{13}{12}$

Many students obtained the gradient of the normal, but were unable to proceed further. On occasions the gradient of the normal was itself presented as an equation.

Question 3

Marks	0	1	2	Average
%	45	17	38	**0.92**

Correct response:

$\tan(2\pi x) = -\sqrt{3}$

$2\pi x = \tan^{-1}\left(-\sqrt{3}\right) = -\frac{\pi}{3}$

$2\pi x = \frac{2\pi}{3}, \frac{5\pi}{3}$

$x = \frac{1}{3}, \frac{5}{6}$

This question tended to be answered very well or very poorly. Exact answers were sometimes given as answers expressed to four or five decimal places. Most students were unable to find the principal angle of $\frac{\pi}{3}$. Those that did were usually able to find at least one correct response. Some students left 2π in their answers, rather than completing the division. The addition of 2π in the question seemed to cause confusion for many students.

Question 4

4a

Marks	0	1	2	Average
%	32	17	51	**1.19**

Correct response:

At $(a, 0)$, $2\log_e(a + 3) + 1 = 0$

$\Rightarrow a = e^{-0.5} - 3$

At $(0, b)$, $b = 2\log_e(0 + 3) + 1$

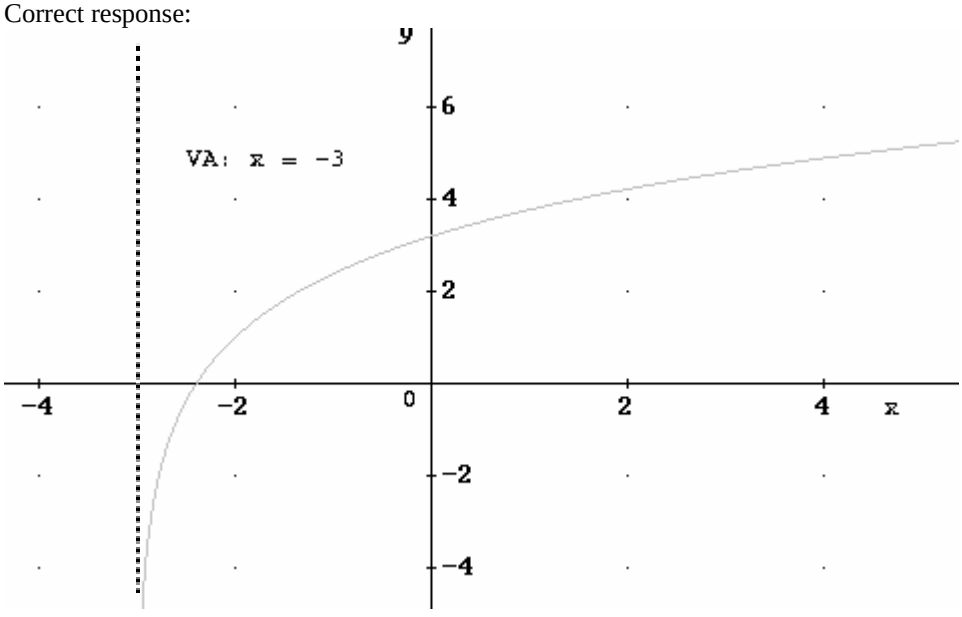
$\Rightarrow b = 2\log_e(3) + 1$

This question was done well, compared to similar questions in previous years. Some students converted their exact answers to decimal approximations, undoing their earlier successful work.

4b

Marks	0	1	2	Average
%	30	19	51	**1.21**

Correct response:

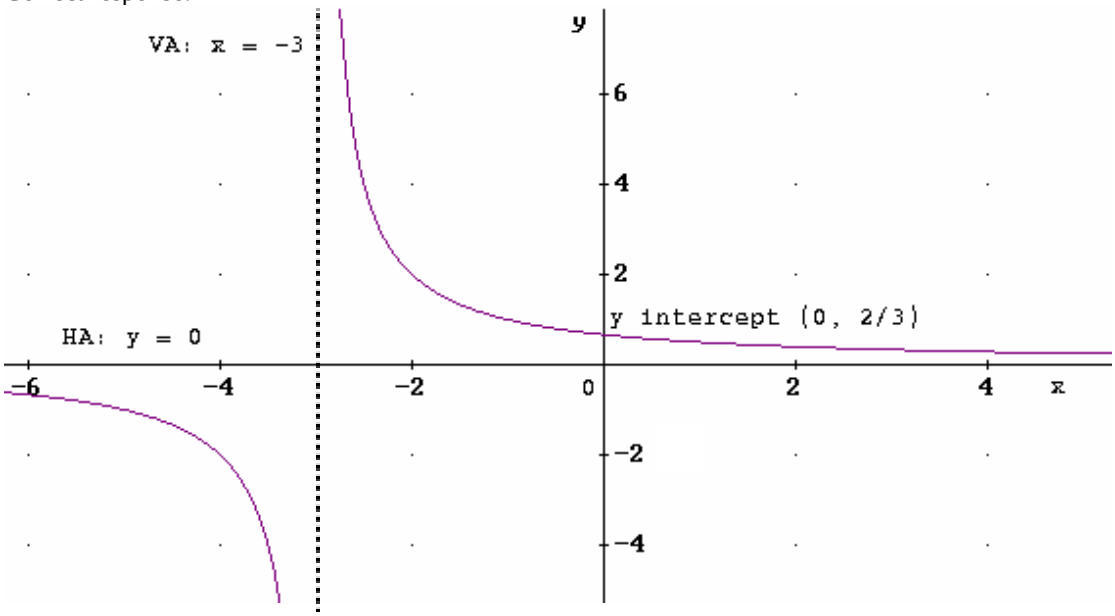


Despite the 'hence' in the question often values of *a* and *b* from part a. were not used. The most common mistake was labelling the asymptote $x = 3$, or having no asymptote (indicating the graph had likely been obtained from the calculator without due consideration of possible asymptotic behaviour).

4c

Marks	0	1	2	Average
%	57	30	13	**0.55**

Correct response:



Those students who basically had the graph correct, lost marks for failing to label the required components or including the other branch of the hyperbola. As in previous years, inverses and reflections in either axes were common mistakes.

Question 5

5a

Marks	0	1	Average
%	38	62	**0.62**

Correct response:

$x = 0.567$

Many students did not know what was required in the question. It was common to see the point of intersection, rather than the x co-ordinate. Quite a few students also tried to solve algebraically and got into difficulty quickly. It was expected that students would use their graphics calculator to find the required value.

5b

Marks	0	1	2	3	Average
%	38	17	11	34	**1.41**

Correct response:

$$\text{Area} = \int_0^{0.567} -x+1-\left(1-e^{-x}\right)dx$$

$$= \int_0^{0.567} -x+e^{-x}dx$$

$$= \left[-e^{-x}-\frac{x^2}{2}\right]_0^{0.567}$$

$$= 0.27$$

Despite the instruction to ‘use calculus’ many students failed to show an anti-derivative and simply used their calculator to obtain an answer. No further marks, other than the initial mark for correctly setting up the expression with correct limits, were awarded. Many students who were unable to answer part a. did have the correct limits in part b. Missing brackets and the inability to handled negative signs also caused problems. Students who obtained the correct answer without any working, or incorrect working were not awarded marks for the answer. The calculator should have been used to check the answer, not obtain it.

Question 6

6a

Marks	0	1	2	Average
%	33	22	45	**1.11**

Correct response:

Small: 0.0228 [Pr (0<*X*<10)]
Medium: 0.9545 [Pr (10<*X*<30)]
Large: 0.0228 [Pr(*X*>30)]

The number of rounding off errors and the number of probabilities that did not sum to 1 (or approximately 1), were disappointing. Facility with rounding is essential for probability questions, especially as answers are typically decimal values between 0 and 1. Students need to be encouraged to indicate a method for any probability question. If they use their calculators they need to state the attributes they are using and in what capacity. A diagram always helps.

6b

Marks	0	1	2	Average
%	43	18	39	**0.96**

Correct response:

$E(X) = 100 \times (0.0228 \times 1.50 + 0.9545 \times 2.50 + 0.0228 \times 4.00)$
$= \$251.17$
$= \$251$

Most students realised they needed to find $\Sigma x\Pr(x)$. However, many neglected to multiply by 100, including those students who had otherwise perfect or near perfect papers.