# Principal Assessor Report 2007

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|---|---|
| **Assessment Panel:** | **Mathematics and Statistics** |

**Qualification area**

| | |
|---|---|
| **Subject(s) and Level(s) Included in this report** | **Applied Mathematics : AH** |

## Comments on candidate performance

### General comments

There was a slight increase in number to 285 (+5 on 2006).
In 2007 the mean mark was 61.8 compared with 55.7 in 2006. This increase was due mainly to higher marks in Section B.

| | Number | Mean in A | Mean in B | Overall |
|---|---|---|---|---|
| Statistics | 130 | 37.17 | 21.08 | 58.25 |
| Mechanics | 140 | 42.74 | 22.41 | 65.15 |

As in previous years, the Statistics candidates performed less well than the Mechanics candidates.

### Areas in which candidates performed well

Section B (pure mathematics)

### Areas which candidates found demanding

None apparent.

### Advice to centres for preparation of future candidates

Please study the detailed question by question comments as well as the model solutions.

**X202 Section A Statistics – 2007**

On the whole, every question proved to be totally accessible to a pleasing number of candidates. There is still considerable vagueness in the use of statistical language and the stating of model assumptions.

**A1: Probability**
Many candidates could not interpret the meaning of the given conditional probabilities. There was much misuse of formulae and many tree diagrams which did not reflect the given information. On the other hand many candidates scored full marks.

**A2: Sampling Methods**
Many candidates knew the names of the different methods but could not identify the appropriate ones. There is still much confusion between stratified and cluster sampling.

**A3: z-test**
Part (a) was generally well done but the interpretation of part (b) was found to be taxing by many candidates.

**A4: Sign test**
The most successfully answered question in this section, as expected. Some candidates stated unsatisfactory conclusions after correct statistical calculations.

**A5: Confidence Intervals**
Calculations were generally accurate but many fell down in the usual areas ie stating assumptions and stating what can be deduced from statistical calculation.

**A6: Poisson Distribution**
Generally well done but a common error of using a standard deviation of 4 rather than 2.

**A7: Bivariate Analysis**
Generally well done but problems as ever with 'State the feature ….' and 'Comment on your answer ...'

**A8: Chi-Squared Test**
Many candidates had difficulty with the statement of the hypotheses, a suitable explanation in part c) and an acceptable conclusion at the end of the test.

**A9: Laws of Expectation and Variance**
This question was found to be the most difficult by the candidates but there was still a good number who scored full marks. There was a clear indication that some centres had not covered this topic.

**X204 Section A Mechanics – 2007**
Overall, the paper seemed accessible to the large majority of candidates, with many excellent scripts. The overall standard of algebra was good.
There was evidence that candidates found it hard to deal with questions that required use of concepts and principles from several parts of the course (see comments on QA9).

**A1: Kinematics, vectors.**

This question was intended to be a straightforward start and so it proved. Most candidates were able to score well on this question. Some candidates forgot to work out the distance having determined the position vector of the boat when at rest.

**A2: Simple Harmonic Motion.**

This was a relatively straightforward question on this topic and was certainly better attempted than in previous years. Most candidates knew to work out the angular frequency and then to use $v^2 = \omega^2(a^2 - x^2)$, though arithmetical slips crept in at this stage.
In the past, many candidates had not learned the basic formulae for this topic – however there was evidence of a marked improvement this year.

**A3: Conservation of Momentum**

Generally the question was well attempted. Some candidates lost a mark for failing to indicate why the direction of motion of sphere $A$ had been reversed.

**A4: Speed/Time graphs**

This was the first time this topic had appeared in the examination, and it was not as well attempted as the first three questions. Some candidates failed to appreciate that, at the end of the race, the athlete did not decelerate to rest! Finding the area under the graph proved a challenge to a number of candidates and many arithmetical slips appeared.

**A5: Projectiles**

Most candidates made very good attempts at this question, with many scoring full marks. Curiously, a few candidates tried to use (or derive) the formula for the range of a projectile!

**A6: Work, Power, Resolving forces**

Generally this was a well-attempted question. Most candidates accessed the first 2 marks readily, but some had difficulty correctly working out the driving force for the car travelling up the inclined plane.

**A7: Resolving forces, friction, Newton 2**

A well-attempted question. Some candidates failed to realise that the brick was accelerating down the plane and was not in equilibrium.

**A8: Relative Motion**

This question divided candidates into two fairly well defined groups. The candidates who set up the mathematical model successfully usually made very good progress. The other candidates struggled with this question. The problem is demanding as no diagram is given and candidates need to formulate the model (and notice that the speed needs to be included as a parameter). It was therefore pleasing to see the good number of excellent solutions. Although the geometry is relatively simple, the presence of the parameter for the speed adds to the level of demand in the algebra required to solve the problem.

**A9: Conservation of energy, circular motion, projectiles**

This was the first of the long questions and combined a number of different areas of the course. The question was, however, highly structured, but this did not seem to help many candidates. This question was by far the most poorly attempted in the paper, with a significant number being unable to even offer any attempt to parts (b), (c) and (d).
There were many correct solutions to part (a), which required a relatively straightforward application of conservation of energy.
Overall, (b) was poorly attempted. From those candidates who attempted part (c) there were good solutions.
Part (d) proved demanding with few correct solutions, even from otherwise very good candidates.
This question highlights the need for candidates to practise with problems that integrate various aspects of the course.

**A10: Differential Equations**

This topic continues to cause significant difficulty for weaker candidates, though on the whole, this question was better attempted than in previous years. The question contained a buoyancy force, though this did not

seem to unduly discourage candidates. Again, candidates tended to score either very well on this question or very poorly. A significant number had no idea even how to start solving the differential equation. It was pleasing to see a number of candidates who had otherwise failed to score on (a) and (b), picking up the 3 marks in (c).

**A11: Force balance, Inverse square law, circular motion**

The context of part (a) was rather unusual, but was well handled by those who attempted the question. Some candidates correctly derived the quadratic equation, but then failed to attempt to solve it! Candidates should be aware that they must indicate why they are discounting a solution of an equation were one solution is unphysical.
Part (b) really consisted of a modified piece of bookwork – unfortunately, some failed to notice the modification! That is, that the radius is $3R$ and the mass $4M$! On the whole, the question was well attempted.

**X202/203/204 Section B (Pure Mathematics Unit)**
On the whole, candidates did well on these questions.

**B1: Integration by parts**
Most candidates recognised the method that they had to use and set about it well. Whilst many succeeded, a disturbing number failed with the integration of $\sin 3x$ and $\cos 3x$, work that is within the Higher course.

**B2: Binomial expansion**
This was done well. The main fault that occurred was to lose track of the negative sign. Sadly, a number thought that $(x^3)^4$ was $x^7$, a serious misunderstanding.

**B3: Parametric differentiation**
Most candidates showed that they knew what was needed. The algebra was moderately complicated and many slips were seen.

**B4: Matrices**
Generally done well. Errors were nearly always slips rather than not knowing what was needed.

**B5: First order differential equation**
Many candidates knew what was required. Most were able to work out the integrating factor but a significant number lost the minus sign. This lead to an integration which was much more challenging but some managed it!

**B6: Partial fractions and integration**
A high proportion were successful in obtaining the partial fractions. The integration proved to be a challenge but correct answers were common. (Not all candidates put the answer in as simple a form as possible. This was not a requirement but is good practice.)

## Statistical information: update on Courses

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|---|---|
| **Number of resulted entries in 2006** | 280 |

| | |
|---|---|
| **Number of resulted entries in 2007** | 285 |

## Statistical Information: Performance of candidates

### Distribution of Course awards including grade boundaries

| Distribution of Course awards | % | Cum % | Number of candidates | Lowest mark |
|---|---|---|---|---|
| Maximum Mark - 100 | - | - | - | - |
| A | 40.7 | 40.7 | 116 | 73 |
| B | 16.1 | 56.8 | 46 | 60 |
| C | 13.7 | 70.5 | 39 | 48 |
| D | 5.3 | 75.8 | 15 | 42 |
| No award | 24.2 | 100.0 | 69 | - |

**General commentary on passmarks and grade boundaries**

- While SQA aims to set examinations and create mark schemes which will allow a competent candidate to score a minimum 50% of the available marks (notional passmark) and a very well-prepared, very competent candidate to score at least 70%, it is almost impossible to get the standard absolutely on target every year, in every subject and level
- Each year we therefore hold a passmark meeting for each subject at each level where we bring together all the information available (statistical and judgmental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the senior management team at SQA
- We adjust the passmark downwards if there is evidence that we have set a slightly more demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- We adjust the passmark upwards if there is evidence that we have set a slightly less demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- Where the standard appears to be very similar to previous years, we maintain similar grade boundaries
- An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions are different. This is also the case for exams set in centres. And just because SQA has altered a boundary in a particular year in say Higher Chemistry does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related as they do not contain identical questions
- Our main aim is to be fair to candidates across all subjects and all levels and maintain standards across the years, even as arrangements evolve and change.