



Institute
and Faculty
of Actuaries

EXAMINERS' REPORT

CM1 - Actuarial Mathematics

Core Principles

Paper B

September 2023

Introduction

The Examiners' Report is written by the Chief Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

For some candidates, this may be their first attempt at answering an examination using open books and online. The Examiners expect all candidates to have a good level of knowledge and understanding of the topics and therefore candidates should not be overly dependent on open book materials. In our experience, candidates that spend too long researching answers in their materials will not be successful either because of time management issues or because they do not properly answer the questions.

Many candidates rely on past exam papers and examiner reports. Great caution must be exercised in doing so because each exam question is unique. As with all professional examinations, it is insufficient to repeat points of principle, formula or other text book works. The examinations are designed to test "higher order" thinking including candidates' ability to apply their knowledge to the facts presented in detail, synthesise and analyse their findings, and present conclusions or advice. Successful candidates concentrate on answering the questions asked rather than repeating their knowledge without application.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Sarah Hutchinson
Chair of the Board of Examiners
November 2023

A. General comments on the aims of this subject and how it is marked

CM1 provides a grounding in the principles of modelling as applied to actuarial work, focusing particularly on deterministic models which can be used to model and value known cashflows, as well as those which are dependent on death, survival, or other uncertain risks.

The worksheets provided to candidates for each question provide a suggested format for part or all of the solution, and the methodology used in the model solutions follow these suggested formats. Candidates are not penalised for using a valid alternative approach. The worksheets are also designed so that the final numerical answers for some questions are to be shown on a specified 'Answers' sheet. Candidates are not penalised for not using these sheets if their final answers are clearly shown on their working sheets.

Candidates may not be awarded full marks where insufficient working is shown.

The exam is not designed to be a test of Excel skills. Thus, some functionality which may be preferred in a real-world work environment is not necessarily required to answer the questions. However, some good practices are useful to the candidate e.g., including variables/parameters the question states will change as inputs rather than hard coding these into formulae.

Where a question specifies a method to use or not use (e.g., *without using a scenario solving tool such as Goal Seek or Solver*) then where a candidate does not follow that instruction, they should not expect to be awarded full marks.

B. Comments on candidate performance in this diet of the examination.

The comments that follow concentrate on areas where candidates could have improved their performance. Where no comment is made, the question was generally well answered. The examiners look most closely at the performance of the candidates close to the pass mark and the comments therefore often relate to those candidates.

Candidate performance this sitting was less than expected.. In the main this was due to Question 4 parts (ii), (iii) and (iv) where 52% of candidates failed to score any marks at all. This question was harder than the examiners had intended. In recognition of this increase in difficulty, the examiners lowered the overall pass mark for CM1.

However, there still appeared to be a large number of insufficiently prepared candidates who had underestimated the quantity of study required for the subject and/or who had insufficient familiarity with Excel to make a meaningful attempt at the CM1B paper.

Candidates should pay attention to any instructions included in questions; failure to do so will inevitably lead to fewer marks being awarded.

C. Pass Mark

The Pass Mark for this exam was 54
1557 presented themselves and 492 passed.

Solutions for Subject CM1B - September 2023

Q1

This question was well answered.

Some candidates attempted to apply the capital gains test to determine the redemption date. This was not possible as the yield was not known in advance. A direct comparison of the redemption payment and the price was sufficient to determine that there was a capital gain at redemption.

Many candidates did not correctly value the income tax and capital gains tax, ignoring the fact that the tax payments took place 3 months after the coupons were paid for income tax and 5 months after redemption for the capital gains tax. Another common error was valuing the annual coupon amount every 6 months.

Q2

There was a slight typographic error in part (i), the question should have asked for the n -year spot rates for time periods 1 to 25 inclusive. Most candidates answered the question in the manner the examiners had intended and were marked accordingly. Where candidates interpreted the question as it appeared on the paper, answers were not penalised.

Part (i) was well answered.

In part (ii) marks were not awarded by not relating one of the three theories of yield curve shape to the shape of the yield curve in this question. Many candidates only described the shape.

Parts (iii) and (iv) were well answered. A common error in (iii) was to value the par yield for a period other than 20 years, often 21 years or for 25 years.

Q3

Many candidates found this question difficult to answer. The question was intended to be a straightforward test of benefits arising under with profits and unitised with profits. With Profits: -

Many candidates did not value the bonuses on the basic sum assured as a simple bonus, instead applying the bonus rate as a compound rate. Only well prepared candidates included all previous bonuses when calculating the bonus-on-bonus amount.

Most candidates did not appreciate that as the death benefit was payable immediately on death, deaths within year t would not receive the bonuses payable at the end of year t . This also meant that there was often no difference between the answers given for the death benefit in the last year and the maturity benefit.

Unitised with profit (UWP): -

This part was complicated by the death benefit being payable immediately on death. This meant a unit fund value needed to be derived at mid-year to be the average death benefit for a particular year. Most candidates did not do this and instead used the year-end value as the death benefit.

Most candidates were able to derive the unit fund correctly. A common error was failing to add the fund at the end of the previous time period to the current year's premium to give the fund at the beginning of the year.

Many candidates did not understand how the UWP terminal bonus should be applied and many candidates did not interpret the minimum death benefit correctly. Some candidates attempted to calculate the non-unit fund, which was not needed to evaluate the death and maturity benefits.

Q4

This question covered a topic that had not been covered in the B paper before but had frequently appeared in the A paper.

Parts (ii) and (iii) were however harder than the examiners had intended. The examiners therefore took a lenient approach when marking these question parts. Overall, this question was well answered. Many candidates did not attempt any part of the question.

Part (i) was generally well answered. A common error was omitting the probability of the policy being in force at the start of each policy year.

In part (ii) many candidates did not allow for the reduction over time of the term assurance portfolio sum assured as claims were paid nor of the portfolio annual annuity as annuitants died. Similarly, many candidates did not allow for the reduction in the premium payable for the term assurance portfolio.

In part (iii) many candidates did not use the method described in the core reading to calculate mortality profit, nor even to calculate the death strain at risk, the expected death strain nor the actual death strain.

[Paper Total 100]

END OF EXAMINERS REPORT



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