

WRITTEN EXAMINATION

7 April 2026 (am)

Subject A213 — Contingencies Intermediate Technical

Examination writing time: Two hours and fifteen minutes (includes fifteen minutes of reading time)

Total marks: 100

INSTRUCTIONS TO THE CANDIDATE

Failure to adhere to any of these instructions could incur examination sanctions including disqualification from the examination.

- 1. The question paper is only available on the ASSA Exam Platform and may not be printed.*
- 2. The invigilator will provide you with an answer booklet at the examination venue. You must not use your own examination pad.*
- 3. Write your **Candidate Number**, which starts with “A213-exa-2026-...”, in the space provided on the front of the answer booklet and at the top of each page **during the examination time only**. **Do not use your name and/or member number anywhere on your answer script**. Your candidate number is reflected on your exam permit. **Submissions that are incorrectly labelled or cannot be clearly identified by candidate number may not be marked and may result in forfeiture of the examination attempt.***
- 4. You may not access any file from your computer, use any other computer software (e.g., Email or Excel), or open or use any other browser, collaboration tools or AI tools, including those embedded in MS Word and Adobe AI assistant (e.g. Copilot, ChatGPT etc.) during the examination. Nor may you use Grammarly, Grammarly Premium or similar built-in software tools including language and grammar tools which must be disabled.*
- 5. You are not permitted to bring any other material into the examination (e.g. a Formulae and Tables book). Any such information/material that may be required will be provided to you in the examination.*
- 6. You are strongly encouraged to use the first fifteen minutes as reading time only, however, you may start answering the paper whenever you are ready.*
- 7. Attempt all questions, beginning your answer to each question on a new page.*
- 8. Write in black or dark blue pen.*
- 9. Show calculations where appropriate. You may use blank paper to carry out rough work calculations. Only calculators from the ASSA-approved list are permitted.*
- 10. Mark allocations are shown in brackets.*

11. *Assume that months are all equal length, unless otherwise stated.*
12. *At the end of the two hours and fifteen minutes examination time, you must stop writing and hand your answer booklet to the invigilator. Follow invigilator instructions. **You may NOT continue to write once your examination writing time has ended as this could lead to disqualification from the examination.***

Note: The Actuarial Society of South Africa will not be held responsible for any late submissions or loss of data where candidates have not followed instructions as set out above. The onus remains on you to read and implement all examination instructions.

END OF INSTRUCTIONS

QUESTION 1

Consider the future lifetimes of two lives, one aged x and the other aged y . Assume that the mortality of life x is independent of the mortality of life y .

- i. Show that:

$$\mu_{x+t:y+t} = \mu_{x+t} + \mu_{y+t}$$

[3]

- ii. Consequently, or otherwise, show that:

$$\bar{A}_{xy} = \bar{A}_{xy}^1 + \bar{A}_{xy}^1$$

[2]

[Total 5]

QUESTION 2

A life insurance company sells a ten-year endowment assurance that pays a sum assured of R50,000 immediately on death or on survival to the end of the term of the policy.

A person aged 32 exact has enquired about the premium payable continuously for the endowment assurance.

- i. Calculate the premium.

Basis:

Mortality	$\mu_x = 0.02$ for all x
Rate of interest	7.2508% per annum
Expenses	Ignore

[7]

The company is considering implementing a multiple-decrement model to allow for other decrements such as surrenders.

- ii. Define what is meant with dependent probabilities, $(aq)_x^\alpha$, and independent probabilities, q_x^α , within the context of a multiple-decrement model.

[2]

[Total 9]

QUESTION 3

Calculate the annuity $a_{71.625}^{(8)}$.

Basis:

Mortality	PMA92C20 (Assume that the force of mortality is constant between ages 71 and 72 only.)
Interest	4% per annum

[Total 8]

PLEASE TURN OVER

QUESTION 4

A life and pension provider sells an annuity, always paid monthly in advance, that pays R10,000 per annum for the first five years. For the next five years, payments increase to R15,000 per annum. Thereafter, payments increase to R20,000 per annum. The payments for the first ten years are guaranteed. Thereafter, payments are contingent on survival. The annuity is sold to a life aged 62 exact.

Calculate the expected present value of this annuity.

Basis:

Mortality	PFA92C20
Interest	4% per annum

[Total 7]

QUESTION 5

An insurance company issues ten-year temporary assurance policies to clients with home loans. Clients are aged 55 exact when policies are issued.

The sum assured is R100,000 for the first five years, and R20,000 thereafter. The sum assured is payable immediately on death. Level annual premiums are payable in advance throughout the term of the policy or until earlier death.

Basis:

Mortality	AM92 Ultimate
Interest	6% per annum
Expenses	Ignore

- i. Calculate the annual premium payable for each policy using the basis above.

[7]

The company uses the premium basis as the reserving basis as well.

Assume (an incorrect) annual premium payable of R450 for the remainder of the question.

- ii. Calculate the gross premium prospective reserve per policy as at the end of the fifth policy year.

[4]

- iii. Describe two disadvantages to the insurance company of issuing a policy with this design.

[2]

- iv. Suggest two ways in which the policy terms could be changed to address the disadvantages identified in part iii.

[2]

[Total 15]

PLEASE TURN OVER

QUESTION 6

An African life insurance company would like to launch a with-profits endowment assurance product. The company would like to issue 30-year with-profits endowment assurance policies to lives aged 35 exact. The sum assured of R200,000 plus declared reversionary bonuses is payable at the end of the year of death or on maturity. Level premiums of R8,400 per policy are payable annually in advance for 30 years or until earlier death.

The company decides to declare simple bonuses and bonuses will vest at the end of each year.

Basis

Mortality	AM92 Select
Rate of interest	4% per annum
Initial expenses	R1,000 plus 50% of the first annual premium, incurred at the policy commencement date
Renewal commission	3% of each premium, payable from the start of the second policy year
Claim expense	R500 at the point of claim payment

Calculate the level simple bonus rate that can be supported each year by this policy, using the principle of equivalence.

[Total 13]

QUESTION 7

A large construction company offers the following benefits to one of their male employees aged 50 exact as part of their remuneration package:

- A. R200,000 payable at the end of the year of death, if this occurs before the age of 60.
- B. On death of the employee at any time, a pension of R100,000 per annum is payable monthly to his widow for the remainder of her life, should she survive him. This benefit is available throughout the lifetime of the male. The male's wife is ten years older than him.

The construction company pays level premiums annually in advance for five years, or until the death of the male employee, if earlier. If the male were to survive to age 60 exact, the company receives a refund of 10% of total premiums paid without interest.

Basis:

Male mortality	PMA92C20
Female mortality	PFA92C20
Rate of interest	4% per annum
Expenses	Ignore

Calculate the premium for this policy.

[Total 13]

PLEASE TURN OVER

QUESTION 8

On 1 January 2022, a life insurance company issued joint whole-life assurance policies. Each policy was issued to a male life aged 55 exact and a female life aged 57 exact. A sum assured of R500,000 is payable at the end of the year of death of the second of the lives to die.

Premiums of R7,400 are payable annually in advance for each policy while at least one of the lives is alive.

At the beginning of 2024, there were 10,000 policies in force and for all of them both lives were still alive.

- i. Calculate the gross premium prospective reserve at the end of 2024 for a policy with both lives still alive.

[3]

Assume that the gross premium prospective reserve at the end of 2024 for a policy with both lives still alive was calculated to be R8,422.

The company recorded the following deaths during the 2024 calendar year:

Scenario	Male/Female/Both died	Number of policies affected
A	Both lives died	1
B	Only male life died	14
C	Only female life died	12

- ii. Calculate the total mortality profit or loss for the calendar year 2024 using gross premium prospective reserves.

[12]

Basis:

Mortality	PMA92C20 for the male PFA92C20 for the female
Rate of interest	4% per annum
Expenses	Ignore

[Total 15]

PLEASE TURN OVER

QUESTION 9

At the beginning of 2020, a life insurance company issued several ten-year endowment assurance policies to male lives then aged 55 exact. Each policy provides a death benefit of R100,000 payable at the end of year of death and a maturity benefit of R200,000.

Annual premiums of R18,520 on each policy are payable in advance for the term of the policy, ceasing on earlier death.

Premium basis:

Mortality	AM92 Ultimate
Interest	4% per annum
Initial commission	50% of the first annual premium
Initial expenses	R5,000
Renewal expenses	R1,000 per annum at the start of the second and subsequent policy years

The company uses the premium basis to calculate the gross premium retrospective reserve.

- i. Calculate the gross premium retrospective reserve for each policy in force at the end of the fifth policy year.

[6]

- ii. State the gross premium prospective reserve for each policy in force at the end of the fifth policy year, giving reasons.

[3]

At the beginning of 2024, there were 1,000 policies in force. Actual experience for this portfolio of business during 2024 was as follow:

Number of deaths	4
Mortality profit for the calendar year	R60,130
Interest earned for the calendar year	3.8%
Expenses incurred per policy in force at beginning of policy year	1,000

Additional info:

Prospective reserve per policy in force at the start of 2024	R60,350
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- iii. Derive, using the recursive relationship between the opening and closing prospective reserves, the profit/loss for this portfolio of business in 2024 separately for:

- expenses
- interest

[6]

[Total 15]

[GRAND TOTAL 100]

END OF EXAMINATION