Actuaries Institute Australia

LIFE INSURANCE AND RETIREMENT VALUATION

EXAM MARKING GUIDE SEMESTER 1 2019

Education Program
ACTUARIES INSTITUTE

Education that Counts

MARKING GUIDE

This exam represents 80% of the available marks for the Life Insurance and Retirement Valuation subject.

The remaining 20% come from the course assignment.

Question	Modules	Syllabus Performance Outcome and Learning Objective	Reference in Course Notes	Total Marks	Bloom's taxonomy level
1a)	3	2.	3.4	2	2
1b)	3	2.	3.4	2	2
1c)	6	3.3.5	6.3	4	2
1d)	6	3.5.6	6.3	1	2
1e)	6	3.5.3, 3.5.6	6.3	4	3
1f)	6	3.5.2, 3.5.3, 3.5.5, 3.5.6,	6.3, 6.4	12	4
1g)	8	3.7.1	8.2, 8.5.1	5	4
2a)	13	6.1	13.3	5	1
2b)	13	6.2, 6.3	13.4	6	3
2c)	13	6.3, 6.4	13.4	3	4
2d)	14	7.1.1, 7.1.3, 7.2.2, 7.2.3	14.4.6 - 14.4.17	6	3
3a)	15	8.2	15.2	1	1
3b)	15	8.2	15.4	3	2
3c)	15	8.2, 8.3, 8.4	15.2 – 15.6	6	2
3d)	15	8.3, 8.4	15.2-15.6, 15.9	4	3
3e)	15	8.6	15.9, 15.10	3	3
3f)	15	8.6	15.9, 15.10	3	3
3g)	15	8.4, 8.6	15.9, 15.10	3	3
3h)	15	8.7, 8.9	15.9, 15.10	7	4

Blooms: 1. knowledge; 2. application; 3. analysis; 4. evaluation

QUESTION 1: MARKING GUIDE (30 Marks)

a) Increasing sum insured may provide more cover for life's events such as birth of child or house purchase and possibly maintain real cover with inflation. The decrease recognises decreasing commitments with age and keeps premiums lower.

The Cover for life's events should require larger infrequent increases. Later in life commitments may not fall in line with sum insured.

Marking Guide
- **0.5 mark for addressing real value of cover maintained**
- **0.5 mark for addressing decreasing commitments later in life**
- **1 mark any valid shortfall in rules for cover increase method.**
- **Other reasonable points awarded 0.5 marks at the marker's discretion.**

Maximum of 2 marks

b) Premiums are level throughout the contract term but the sum insured decreases after the policyholder's 50th birthday. The premium term is less than the policy term in order to ensure that future premiums are less than future claims late in the policy term. If the premium term was not restricted, healthy lives may find cheaper cover elsewhere.

Marking Guide
- **2 marks for explanation**

Maximum of 2 marks

c) -$3,203

Marking Guide
- **1 mark for correct values for ad(x), aw(x), al(x)**
- **1 mark for correct cash flows**
- **deduct 0.5 mark each for errors q(x), sum insured or cash flows, maximum deduction 1 mark**
- **2 marks for correct BEL**
- **deduct 1 mark each for errors in calculating liability, maximum deduction 2 marks**

Errors carried forward
Maximum of 4 marks

d) +$1,913.

Marking Guide
Errors in BEL carried forward
- **1 mark for correct answer**
- **award 0.5 mark for progress at the marker's discretion.**

Maximum of 1 mark

e) The profit arising over one year is usually defined as cash flow in less cash flow out less change in liabilities over the period.

Using the BE assumptions, we deduced an initial liability of -$3,204 and a profit, allowing for initial costs of $1,914 at contract outset. Profit in all future years is zero. Thus, the BE basis capitalises all profit on day 1. However, there is almost no chance that this will represent actual profit over the lifetime of the contract as the BE basis is set to be 'right' 50% of the time.

Using the reporting basis, opening reserves are zero and there is a loss on day 1 equal to the initial costs of $1,290. Positive profits are recorded in years 1 – 10:

Policy Year	Reporting Liabilty	Interest on Liability	Reported Profit	NPV
1	$0	$0	$723	$3,202.52
2	$0	$0	$549	
3	$0	$0	$492	
4	$0	$0	$437	
5	$0	$0	$385	
6	$0	$0	$335	
7	$0	$0	$291	
8	$0	$0	$249	
9	$0	$0	$210	
10	$0	$0	$85	
11	$88	$4	$0	

From the end of year 11, profits are the same as the BE basis as the reserve is now positive.
So, in summary, while the BE basis recognizes all profit on day 1, the reporting basis shows a loss on day 1 and then gradually releases profits over the first 10 years of the contract.

The NPV at 4% of the reported profits is identical under both bases. This is because the assumed investment earning rate is also 4%, so the timing of profits doesn't impact the NPV.

The NPV at 4% of the reported profits is identical.

Marking Guide

- **1.0 mark for profit definition**
- **1.0 mark for stating BE capitalises profit and stating amount**
- **1.0 mark for demonstrating profit calculation under country x basis**
- **1.0 mark for stating that profit identical (zero) after y11, all profit under basis x is released**
- **0.5 marks only awarded at the marker's discretion if above points only partially addressed.**
  (errors carried forward)
- **1.0 mark (bonus) for stating that NPV of profits is equal**

Maximum of 4 marks

f)

To: CFO

From: Actuary

Spreading Profits over the life of a contract

This report outlines reporting methods that allow for a slower release of profit than the current methodology in Country X.

Current Method

Before we describe the current system, we should state that we expect to make a profit from business when premium income exceeds benefits and expenses.

Since our contracts are long term, it is necessary to consider what assets we should hold at any point to ensure we can meet our future liabilities i.e. future outgo less future income. It is important to hold enough assets to meet our future liabilities as the uncertainties involved in long term life insurance contracts mean that future outcomes will never be exactly as expected when we initially write our contracts.

Profit over a period is defined as cash flows in less cash flow out less the increase in liability.

In Country X, the liability must never be negative. This slows down profit release as we usually make a loss on day 1 (due to cash outflow on commission and set-up costs) and release positive profits until the liability is positive.

When the liability is positive, all future reported profits will be zero, assuming experience is in line with assumptions. This is purely a mathematical consequence of how the liability is defined as the present value of future outgo less income.

Possible Method

Profits could be further deferred than our current system by forcing the expected profit to be spread in a particular way over the life of the contract.

For example, one could spread the profits evenly over the life of the contract or release more upfront or release even lower. There are many choices.

***(Note to marker**; We are not looking for MOS although many may describe a variant.)*

For example, one method is to set the policy liability to zero by adding expected profit to the liability on day 1. A profit margin may be constructed that represents profit divided by the present value of e.g. premiums. When the liability is calculated in future years, we add the profit margin multiplied by the remaining present value of future premiums. The effect is to release profit in line with the emergence of premium i.e. profit is spread 'more appropriately' over the life of the contract.

An alternative is to spread the profit using claims. For example, with our level premium term assurance, premiums cease 5 years before the end of the contract and hence would not be suitable as a basis for spreading profit over the whole life of the contract.

In our current method, initial costs are recognised as losses immediately on day 1. Two alternatives, that both have the same effect as each other, are:

- Set up a deferred acquisition cost as an asset (equal to the value of the initial costs) and write that down over the life of the contract; or
- Deduct an amount from the liability and reduce this deduction (i.e. recognize the costs) over the life of the contract in line with e.g. claims.

(Any other method e.g. amortise over n years is acceptable.)

Sketch:

- the first profit line should show a large profit of $1,914 on day 1, then zero profits over the rest of the contract term.
- The second profit line should show a large loss on day 1 of $1,290, then positive but decreasing profits over the first 10 years of the contract.
- The last profit line should show profits being released in a relatively uniform style over the entire life of the contract, with no upfront large profits or losses.

The actual effect on the company is illusory if experience is in line with assumptions as the reserving basis is an accounting item and does not change actual cash flows. It is actual premiums received plus interest less actual claims and expenses over the life of a contract that determines actual profitability.

A slower recognition may make shareholders or the Board nervous but the company more able to withstand changes e.g. lapse rate changes.

I hope that the above helps and would welcome the opportunity to talk through the issues. If you want me to examine specific country's rules then please let me know.

Signed: Actuary

Marking Guide

- **Report style; award maximum 2 marks at the marker's discretion – structure format, clarity, sub-headings, stated purpose**
- **2 marks max: 1 mark each for stating reasonable alternative methods**
- **2 marks max: 1 mark each for explaining the impacts of the stated methods above**
- **3 marks for stating three reasonable alternative methods for treating initial costs. Deduct 0.5 mark each for lack of clarity in explaining methods. Deduct 1 mark for less than three methods – max 3 marks deducted**
- **2 marks max for graph – Awarding up to full 2 marks is at markers discretion. There will be a range of levels of quality and clarity. As a guide: Deduct 1 mark if graph not clearly labelled, deduct further mark if graph shapes are not consistent with definition.**

- **1 mark for any reasonable comment on impact to company that captures the fact that the methodology affects reporting of profit only not cash flow**
- **Other reasonable points on any of the above awarded 1 mark each at the marker's discretion**

Maximum of 12 marks

g)

In order to value the renewal commission, changes I would make to the best estimate basis include:

- **Assuming higher lapse rates**: reflecting the troubled state of the broker and the increased likelihood they will be unable to continue to look after their policyholders and therefore may have more policyholders letting go of their policies;
- **Assuming higher renewal and termination expenses**: if the broker is no longer able to provide full service to its customers, more work may be required by the insurer in relation to answering policyholder queries and processing their claims (to the extent the broker was previously able to assist in these processes).

The changes above apply to 75% of the book. There is no information on why we would want to alter the assumption for the other 25%.

If we were looking to make an offer, then we should start with the revised best estimate for the relevant polices and then decrease the sum to the level we think the broker will accept. The technical calculation may be achieved by reducing further the probability of receiving the renewal commission.

Marking Guide

- **1 mark for stating that BE basis forms the starting point**
- **1 mark for recognising the need for more adverse lapse assumptions**
- **1 mark for relating analysis to subsequent negotiations**
- **1 mark for potential impact on renewal and termination costs**
- **1 mark for recognising that 75% of the book impacted**
- **Other reasonable points awarded 1 mark at the marker's discretion.**

Maximum of 5 marks

END OF QUESTION 1: MARKING GUIDE

QUESTION 2: MARKING GUIDE (20 Marks)

Report to: Directors of Company ABC

Prepared by: Candidate XYZ, analyst, Risk management division

Date prepared: 25 February 2019

Background

To date, our company has focused solely on traditional savings and protection insurance products. A new market opportunity has arisen, following the recent introduction of legislation which allows individuals to contribute up to 20% of their gross of taxation income to pension plans.

You have requested this report be produced to:

- Explain the role of our risk management framework in considering this new market opportunity; and,
- Consider the impact on our capital requirements of entering this new market.

Whilst this report is written from the perspective of the risk management function, our risk management framework relies on a three lines of defense risk model. Thus, day-to-day management (line 1), risk management function (line 2) and our internal and external auditors (line 3) all have a role to play in both identification and reporting on risks identified.

Risk Management Framework

We manage risk across the company in accordance with Enterprise Risk Management principles. We have a clear and consistent risk management framework that identifies all risks and it incorporates the totality of systems, structures, policies, processes and people.

With the objective of entering the new market, there is:

- Uncertainty about the likelihood of achieving the objective ('risk'); and
- Capital to support achievement of the objective.

Any identified risks can be responded to by either reducing, removing, transferring or accepting the risk. These ideas will be discussed in a subsequent report.

The objective of entering the newly created pension market necessitates an update of our risk management framework and associated documentation. Changes are required to:

- Our strategic plan;
- Our risk appetite statement;
- Roles in the risk management function;
- Documentation listing who is responsible for managing material risks arising from the new retirement products, and any associated concepts such as dealing with new regulators;

- Policies and procedures that support the management of material risks arising from the inclusion of the new product lines;
- The risk management process, which needs to include capital considerations for the new products; and
- Our management information system.

We do not anticipate a change to the risk management process, although it is likely that a detailed analysis will show more staff are required to ensure it remains effective.

We outline changes required to the Strategic Plan and the Risk Appetite Statement below.

Strategic Plan Update

The new market requires us to offer contracts that we have not previously developed, marketed, or administered. Specifically, we will need to consider the impact on our company of introducing unit linked policies and lifetime annuities.

The strategic plan will need to be updated to consider:

- How we can staff the necessary newly created, or amended, departments e.g.;
  - Unit pricing systems;
  - Administering annuities;
  - Sales training and compliance;
  - Changes to actuarial and accounting systems.
- How to design and build the necessary functionality;
- The potential impact on existing business if senior management are devoted to the new project;
- The project costs and any implications on existing plans; and
- the effect on growth plans and capital usage.

Detailed consideration will be required on our anticipated volumes, potential size of market, who will enter the retirement market and a discussion on their strengths/weaknesses, and how we will distribute products.

The proposal introduces significant reputational risk if we fail to comply with, as yet, unclear legislation. However, the alternative is to ignore a market that may dominate the savings market and cause a significant reduction in volumes of our existing savings product line. The current potential product does not interfere with our protection products as the proposed product has minimal protection benefits.

Risk Appetite Update

We have a well-developed risk appetite statement that describes the amount and types of risks we are currently willing to bear. Also, we have processes and procedures that describe how we set tolerance to risk and monitor compliance.

We are taking on different risks and this needs to be considered in the context of the types of risks we currently undertake. The existing risk appetite statement does not allow for the new types of risks (which are described below) and will need to be updated to reflect these.

The current statement was based on competition in our existing product lines, our risk capacity and expectations of our shareholders. The new market entrance requires us to reconsider our risk appetite.

In particular, we need to understand risk tolerances for new material risks. The risk tolerance for a given risk is the maximum level of acceptable risk given our risk appetite, risk profile and capital strength.

Material new risks are discussed in the next section.

Assessing the material risks in the retirement market

Our risk management framework will require us to:

- Identify all the quantitative and qualitative risks involved in entering the retirement market;
- Assess the size and likelihood of these risks; and
- Use these quantified risks to compare the benefits and risks of making a decision to move to this new market.

In this report, we identify the material risks and defer answers to the other questions above to a subsequent report.

The new material risks arising from an expansion into the retirement market are:

- **Insurance**
  - Longevity risk associated with the lifetime annuity component of the benefit. The annuity purchasers may, on average, live longer than anticipated.
  - The longevity risk may be avoidable if we are not obliged to offer an annuity and can transfer the monies to a third party although we need to be prepared to take on the risk if we are unable to transfer it.
- **Investment**
  - Risk that investment returns are lower than customer expectations, resulting in a transfer of policies to our competitors
  - Risk that competitors offer a wider choice of funds and attract more customers
- **Operational**
  - Our lack of experience in the unit-linked and annuity markets, especially around the complexity of system design and operation.
  - Our lack of experience in selling and managing unit-linked business and annuities
  - This lack of experience may impact our customer satisfaction scores for the new product (and existing products if our customer service teams are over-loaded)
- **Strategic**
  - Risk that shareholder returns will be negatively impacted by this new line of business as there may be lots of competitors
  - Risk that a move to this new market will detract from sales of our traditional products (e.g. customers stop buying pure endowment policies in favour of these pension policies)

- **Reputational**
  - Death benefits pre-retirement are limited to return of premiums. This looks low and brings into question who receives any unit-fund in excess of premiums.
  - Retirees are faced with sequencing risk as returns are based on actual fund performance. This may be a new risk in the market and not understood by the policyholders.
  - Whilst the freedom to choose when to annuitise should not cause us liquidity risks, as we merely change the unit fund into money and use that money to purchase the assets backing an annuity, there is an extension to sequencing risks due to policyholders investing in assets that do not mimic changes in annuity rates. Marketing literature will either explain how to switch as retirement approaches or explain the risks borne by the policyholder.
  - Compulsory purchase of annuities is generally disliked
- **Political Risk**
  - The terms of the qualifying products need further refining and this may impact on timing of delivery
  - Worldwide, governments have a habit of changing their requirements and that may necessitate frequent product changes.

Roll Out

If a decision is made to enter the retirement market, our risk management framework can be used to ensure a successful roll out as follows:

- A process is already in place for all staff, led by team managers, to identify potential risks and record them on our central risk register;
- Our risk management team will monitor the identified risks, as well as add identified risks to the register ourselves;
- Our risk management team will, with input from management, quantify the size and likelihood of each risk identified;
- Our risk management team will suggest an appropriate risk management strategy, depending on the importance of each risk. This will range from monitoring the risk over time to taking actions to mitigate or reduce risks where possible; and
- Our internal and external audit teams will provide oversight of this process, ensuring it is functioning well and suggesting enhancements which could be made to the process.

After properly assessing all material identified risks, specific strategies which may be adopted to reduce the potential impact of risks include:

- Training in retirement style products for:
  - Sales force
  - Administration teams
  - Investment division
- Purchase of reinsurance to protect against longevity risk of the lifetime annuity and to provide external expertise as we build our own experience in the pension market;
- Monitoring and appropriately responding to the experience of the business as it unfolds.

Capital requirements

Within the remit of our existing business plan, we are a well-capitalised company. The quality and quantity of capital on our balance sheet is sufficient for the existing plan.

A thorough investigation of the capital requirements of this business expansion will need to be conducted before making a decision to go ahead. Risk capital is held to provide a financial buffer in the event of adverse experience. The existing risk-based capital model may be adjusted to consider the new risks.

High level capital considerations are as follows:

- The investment risk for the unit-linked funds will be borne by the policyholder. This should release capital relative to our current products where the risks are either borne by the shareholder (non-participating business) or shared with the policyholders.
- Longevity is a new risk exposure and will add to capital requirements. However, it is negatively correlated with our current mortality risk arising from term business. Thus, we may have a diversification benefit that will lessen the impact of the new risk.
- Investment risk with the annuity portfolio is introduced as there is a mismatch risk between assets and liabilities. The current internal model may be used to quantify this risk. This may provide direction on how to invest the annuity purchase monies.
- It is possible that sales of the retirement products will increase rapidly over the next few years, due to the favourable tax treatment of the product. This may create two capital issues:
  - new business strain, to finance the sales growth; and
  - increasing our risk-based capital requirement such that the excess capital falls below what we consider acceptable.

  As a result, we may have to review our risk tolerances and the minimum amount of desired capital exceeding liabilities may be reviewed.
- The increased operational risk of entering a new market, in which we don't currently have experience, is likely to increase our capital requirements. This is necessarily a subjective assessment and it is not clear on how to set up an appropriate reserve for all the new complexities introduced above
- There is a considerable risk that if we do not compete in this new market then we will be unable to sell our current volumes of business. That will have a significant effect of staffing levels. If the company reduces in size then we may consider a capital reduction exercise.

Please contact us if you would like to discuss any part of this report.

Signed: Risk Manager

Marking Guide

Report style;
Award maximum 2 marks at the marker's discretion –
structure, format, clarity, sub-headings, stated purpose.
These are bonus marks. Maximum marks overall for question is 20 marks

a) maximum 5 marks

- 1 mark for purpose of RMF
- 1 mark each for raising and discussing changes required to specific elements of RMF" (maximum of 4 marks)
  - Strategic plan and risk appetite statement
  - Risk management roles / expertise / responsibilities
  - policies and procedures; unit pricing
  - capital considerations
  - mgt information systems
  - any other relevant elements
- Deduct marks for lack of clarity or explanation at markers discretion

b) maximum 6 marks

- 1 mark each for each category of material risk discussed
  - Insurance
  - Investment
  - Operational
  - Strategic
  - reputational
  - Political
  - any other material risks
- Deduct marks for lack of clarity / relevance to product initiative under consideration

c) maximum 3 marks

- 1 mark each for
  - development of risk management strategies
  - training
  - monitoring and responding
  - offsetting risks such as through reinsurance
- 1 mark each for any other
- Deduct marks for lack of clarity / relevance

d) maximum 6 marks

- 1 mark referencing current capital position
- 1 mark each for raising and discussing the factors affecting risk-based capital requirements (maximum of 5 marks)
  - Positive impact of policyholder bearing investment risk
  - Annuity investment risks
  - Longevity risk
  - New business strain / capital requirements
  - Operational risk
  - Strategic risks
  - any other relevant risks
- Deduct marks for lack of clarity / relevance at markers discretion

END OF QUESTION 2: MARKING GUIDE

QUESTION 3: MARKING GUIDE (30 Marks)

a) An appraisal value is made up of the following 3 components:

- The adjusted net worth (ANW)
- The value of existing business (VEB)
- The value of new business (VNW)

Marking Guide

- **1 mark for all components correct**

b) See spreadsheet LI&R q3 for details:

Note that no negative reserves allowed. Premium income exceeds benefit and expense outgo each year.
The 2019 business was sold on 1st January and is thus included in the cashflows.

In-force business			
2016 Sales	**2017 Sales**	**2018 Sales**	**2019 Sales**
0	3,479	4,487	5,000
0	0	4,473	4,985
0	0	0	4,970

Profit in a year = premium + investment earnings less claims less expenses. No need to consider change in reserve as these are all zero. (The negative "raw" reserves are set to a minimum of zero each year.)

Assets (boy)	Premiums (boy)	Claims (eoy)	Expenses (eoy)	Investment Earnings (eoy)	Assets (eoy)	Profit (eoy)
$0	$7,779,319	$5,445,523	$777,932	$388,966	$1,944,830	**$1,944,830**
$1,944,830	$5,674,824	$3,972,377	$567,482	$380,983	$3,460,777	**$1,515,948**
$3,460,777	$2,982,027	$2,087,419	$298,203	$322,140	$4,379,323	**$918,546**

Marking Guide

- **1 mark for correct numbers of policies**
- **1 mark for correct cash flows**
- **1 mark for correct profit (based on cash flows only)**
- **Errors carried forward**
- **deduct 0.5 mark each for errors**

Maximum of 3 marks

c) There are three components as stated in (a) above.

VEB:

Profit[1] (eoy)	Solvency margin (SOY)	Distributable profit (EOY)
1944830	5523316	3439021
1515948	4029125	3427834
918546	2117239	3035785

The solvency margin is 100% of claims plus 10% of expenses.
The distributable profit = profit – change in solvency margin over the year.
Forced to assume a 0% return on solvency capital.

VEB at 10% = $8.24m

VNB

Net Worth

Cash assets	25,000,000
less o/s claim	1,000,000
less UPR	7,779,319
less Solvency margin	5,523,316
ANW	**10,697,365**

Net worth $10.697m.

VNB:

One year's new business of 6,000 policies has VNB = $1.7m
Annuity factor = 1/0.1 = 10.
VNB= $17.044m.

Total AV = $35.98m

Marking Guide

- **VEB 2 marks**
  - **1 mark for correct solvency (full mark awarded if a reasonable alternative interpretation of the solvency requirement is used, providing the calculations are correct for the method adopted)**
  - **1 mark for correct distributable profit and discounting**
  - **Errors in solvency carried forward**
- **1 mark for correct net worth**
- **VNB 2 marks**
  - **0.5 mark for correct treatment of solvency requirement**

- **1 mark for correct distributable profit (Errors in solvency carried forward)**
- **0.5 mark for any reasonable approach to multiple**

- **1 mark for correct AV, adding 3 components. (errors carried forward)**
- **deduct 0.5 mark each for errors**

Maximum of 6 marks

d) VEB:
Past sales are known
Presumably past experience has led to the 70% of premium for claims and 10% of premiums for expenses.
10% required return is a fact **(1 Mark)**

although one should compare with returns desired in the market for this type of business. **(0.5 Marks)**
Net worth: Looks reasonable in relation to the data. **(0.5 Marks)**

EV < assets as release is tempered by the solvency margins. **(0.5 Marks)**

Solvency margins look large and not reasonable for three-year business. **(1 Mark)**

VNB
Constant flat sales look unreasonable as no inflationary element. **(0.5 Marks)**

Annuity factor of 10 is mathematically consistent with flat sales and 10% return but looks optimistic. **(0.5 Marks)**

0.5 mark each for any other reasonable points argued
Maximum of 4 marks

e) Changes to the best estimate mortality without changing premium rates will cause profitability to decrease as expected claims will increase.

If the BE rate is increased, both VEB and VNB will fall. If BE mortality is decreased, both will go up.
The same situation will apply to the net worth since solvency is a percentage of mortality.

Thus, increases in the BE mortality estimates will cause AV to fall and vice versa if BE mortality assumptions decrease.

Marking Guide

- **1 mark for projected profit decrease/ increase therefore value decrease / increase**
- **0.5 mark for mentioning projected change in premiums can restore projected profitability (bonus 0.5 mark for mentioning time delay and potential lapse / sales impacts of premium increases)**
- **1 mark for mentioning corresponding impact on both VEB and VNB**

- **1 mark for solvency impact with flow on impact to value and net worth**
- **0.5 mark each for any other reasonable points argued**

Maximum of 3 marks

f) Increasing the prudence of the solvency assumption means increasing the amount of solvency capital each year. This in isolation would lower AV as the assumed earning rate on the extra solvency requirement is less than the discount rate.

Introducing a 10% lapse assumption reduces future margins as less premiums are received. The lapse rate therefore lowers AV.

Thus, the combination of increasing the prudence of the solvency assumptions and introducing a lapse assumption will lower the AV.

Marking Guide

- **1.0 marks for increase solvency capital therefore delay profit release therefore lower AV (impact on both VEB and VNB)**
- **1.0 marks for higher lapse therefore less profit therefore lower AV (impact on both VEB and VNB)**
- **1.0 mark decrease in net worth due to higher solvency (not in solution above)**
- **Up to 1 mark for each for any other reasonable points argued**
- **Deduct 0.5 marks at markers discretion for lack of clarity of points made**
- **Maximum of 3 marks**

g) Repeat earlier calculation with changed assumptions
4800 start in 2019, not 5,000
6% on assets in 2019 only and then 5% in subsequent years
7% of 2018 policies did not renew in 2019.
To use the 20 deaths data item, calculate expected deaths = expected death outgo already calculated. Mortality rate multiplied by number of polices determines the expected number of policies exiting through death. The ratio of 20/expected number multiplied by expected death outgo provides actual outgo. This calculation assumes the same death benefit per policy and ignore the fact that more polices are in force than expected since actual death claims are lower than expected.

VEB = $8.17m

Marking Guide

- **1 mark for using methodologies consistently with individual items in h)**
- **2 marks for correct VEB**
- **deduct 0.5 mark each for errors**

Maximum of 3 marks

h)

Total change: (Actual less expected)	**($69,643)**
- Comprising:	
Fewer polices sold	**($142,014)**
Earning on assets	$75,816
Higher deaths	$206,885
Lapsed policies	**($210,330)**

Need to write brief memo – but overall recommendation should be no change in best estimate basis because…. Students needs to look at each item of change and make a comment about whether it should lead to a change in basis. Plus, mention that only one year's experience and need to look at longer time periods.

Marking Guide

- **1 mark for each of**
  - **Sales**
  - **Earnings on assets**
  - **Higher deaths**
  - **lapses**
- **1 mark for calculating differences and presenting results**
- **errors carried forward (these may cancel with successive incremental changes)**
- **deduct 0.5 mark each for errors**
- **2 marks in total for discussion**
  - **1 mark for clearly argued recommendation**
  - **1 mark for stating that 1-year experience not sufficient to change assumptions**
  - **0.5 mark each for any other reasonable points argued**
  - **Maximum of 2 marks**

Maximum of 7 marks

END OF QUESTION 3: MARKING GUIDE

END OF MARKING GUIDE