

INSTITUTE OF ACTUARIES OF AUSTRALIA

LIFE INSURANCE EXAM SOLUTIONS

2003 EXAMINATIONS PAPER TWO

MARKING GUIDE

Level of Difficulty

PAPER TWO

Question	Syllabus Aims	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
Q 1a	11			15		15
Q1b	5,7,12				8	8
Q 2a	6,8		5			5
Q 2b	6,8		4			4
Q 2c	6,8				5	5
Q 2d	6,8			5		5
Q2e	3,7		3			3
Q 3a	4			5		5
Q 3b	1,2,3,4,7				15	15
Q 4a	11,12,15		2			2
Q 4b	11,12,15			3		3
Q 4c	11,12,15			1		1
Q 4d	11,12,15			9		9
Q 4e	11,12,15			4		4
Q 4f	11,12,15				6	6
Q 5a	16		2.5			2.5
Q 5b	16		2.5			2.5
Q5c	5				5	5
TOTAL			19	42	39	100

QUESTION 1

(23 marks)

You are the valuation actuary of a medium sized Australian life insurer that specialises in risk products. You have recently recruited a new graduate who has limited experience in valuing income protection products. He has calculated the best estimate liability for the income protection portfolio for the currently disabled lives (claims in course of payment).

- (a) Outline the checks that you would conduct on the results of his calculation and state what these checks might indicate. (15 marks)
- (b) Identify the key risks to the adequacy of the reserve that has been established for the income protection claims in course of payment, and outline risk mitigation strategies for each of those risks. (8 marks)

QUESTION 1: SOLUTION

(23 marks)

(a)

Comparisons - this year vs last year – on last year's assumptions ($\frac{1}{2}$ mark for each valid check and $\frac{1}{2}$ mark for explanation of what is being looked for):

- Number of claims (look for large change. Also to relate back to overall reserve).
- Average reserve per claim (look for consistency with movements in data or assumptions).
- Average monthly benefit per claim (look for swings. Use as input to reasonableness of reserve calc).
- Average duration of claim (longer duration will have lower termination rates going forward – reserve increases).
- Average age of disabled lives (older ages – lower termination rates, all else equal).
- Average length to end of benefit period (impacts reserve required).
- Average sex (eg 0=male, 1=female) – wish to see any significant movement.
- Average benefit escalation (0 = none, 1 = indexed) – look for swings – also impacts reserve required.

Impact of change in assumptions (1 mark each)

- Change in discount rate – if rate increases, liability decreases – reasonableness of change relative to derived annuity factor of reserve / annualised benefit
- Change in morbidity (claims termination assumptions) – magnitude and direction.
- Change in claims expense assumptions.
- Change in benefit escalation assumption (eg CPI rate).

Spot checks (1 mark per useful point)

- Might review projected cash flow / claims run-off – compare to actuals in recent months
- Might review sample of individual claims

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- Review analysis of profits and compare to expectations based on management reporting, etc
- Review treatment of reinsurance

(b)

Key risks include:

- reserve not calculated accurately – controls in place around valuation - refer to the process in part (a)
- claim termination – active claims management – regular communication between claims staff and actuarial staff, adequate claims staff numbers and experience/capability, proper review process in place; reinsurance arrangements, wording of definitions also important.
- expenses – active expense management – strong management control, including budgeting and reporting of costs, appropriate authorisation processes, etc.
- investment risk – match assets and liabilities – ALM process, senior management sponsorship, control over investment mandates, communication with investment professionals, etc

(½ mark for identifying risk; ½ mark for identifying appropriate risk mitigation; 1 mark for outlining the risk mitigation strategy – max 8 marks in total.)

QUESTION 2

(22 marks)

You are part of a product development team that is developing a specification for a new unit linked savings product that will be sold through your company's existing agency distribution channels. The product will be offered as both ordinary and superannuation business and includes the following investment options:

- Capital Guaranteed
- Capital Secure
- Balanced
- Growth

Each of the unit-linked options will offer a guarantee of return of premiums as a minimum surrender value after ten years.

The specification is now at the stage of describing the charges to be levied on the product.

- (a) Identify the various initial and ongoing costs (expenses and commission) that would be expected to be incurred on this product. **(5 marks)**
- (b) Suggest ways in which charges may be levied on the product to cover these costs. **(4 marks)**
- (c) Given that this is a new product line for the company, outline how you would determine the expense assumptions to be included in the product model to be used in profit testing. **(5 marks)**
- (d) What differences between superannuation and ordinary business would you need to consider when pricing the product? **(5 marks)**
- (e) What is the effect of including the guarantee of return of premiums as a minimum surrender value? **(3 marks)**

QUESTION 2: SOLUTION

(22 marks)

(a)

Initial Costs incurred (some of which may be a proportional allocation of development costs rather than policy specific costs) on the policy include:

- marketing related expenses (promotional material, advertising activities, brochure production, needs analysis materials etc);
- distribution related expenses (initial commission, bonuses and allowances related to initial commissions, incentive programs, sales management expenses);
- administration - policy issue related expenses (new business data entry, policy printing and postage, stamp duty);
- other new business costs (special offers and incentives, a share of the overheads relating to policy acquisition).

(Maximum 2 marks – 1/2 mark each for marketing, distribution, and administration. Maximum 1/2 mark for other valid points not associated with these functions).

Ongoing Costs incurred (some of which may be a proportional allocation of maintenance costs rather than policy specific costs) on the policy include:

- distribution related expenses (renewal commission, asset based commission, bonuses and allowances related to renewal commissions / persistency, sales management expenses);
- marketing related expenses (investment performance reports);
- policy maintenance expenses (annual statement printing and postage, additional premiums, redemptions, switches);
- premium related expenses (premium collection, bank fees);
- other ongoing costs (a share of the overheads relating to policy maintenance such as call centres etc);
- investment management expenses;
- claims processing costs.

(1/2 mark per identified cost up to 3 marks)

(b)

Methods of levying charges to cover initial costs include:

- Explicit entry/up front fee linked to premiums received. (1/2 mark)
- Explicit exit / Surrender charges / surrender penalties / back end charges can be used to recoup unpaid up front charges if policy prematurely terminated – these are generally linked to account value payable. (1/2 mark)
- Margins in the Ongoing Management Fees as a percentage of FUM. (1/2 mark)

Other methods not generally acceptable in the contemporary Australian market (maximum 1/2 mark for any/all of the suggestions below)

- Allocate no money to the policy for a period of months.
- Allocate only a proportion of each premium to the policy for a period of months.
- Allocate money received in the early months to units that have a higher funds management charge.

(Maximum 2 marks for acquisition expense recovery)

Ongoing costs can be met via:

- Explicit percentage of each premium
- Explicit annual policy fee (deducted from premium or funds under management)
- Asset management fee on units deducted in the unit pricing process, or prior to declaring interest rates on capital guaranteed option
- Switch, redemption, add-on benefit, alteration or similar activity based fee

(1/2 mark per identified fee up to 2 marks)

(c)

Expense assumptions should be determined by reference to the following:

Assumptions should be made about:

- the average size of policy (premium and benefits),
- timing of premiums,
- distribution methods for the product,
- expected volume of sales.

Expected volumes and distribution methods will determine expected commission and commission related costs.

A budget for the product development should include items such as promotional material and advertising strategy to allow estimation of marketing expenses.

Administration/client service management should be able to estimate relative activity compared to other products to provide estimates as to the expected cost per policy of activities such as policy issue, annual reviews, maintenance activities.

Investment management expenses should be able to be determined based on negotiated cost agreements with fund manager and projected business volumes.

The last expense analysis conducted should indicate levels for particular activities and appropriate share of overheads when compared with business projections and company budgets.

Expense levels on competitor products should be considered to ensure product is competitive.

Some adjustments should be made to allow for expected expense overruns in the early years until sufficient volume of the business is written to cover the overheads and development costs so it may be necessary to consider several years expected production and the growth in funds under management.

(1 mark per point to a maximum of 5 marks.)

(d)

Differences between Ordinary and Superannuation include:

- Tax treatment of policyholder returns will result in different after tax investment returns
- Discontinuance rates may vary – eg ordinary may be based around duration, superannuation may have increased discontinuance after (say) age 55.
- Expenses – administration and compliance with superannuation regulations is onerous and leads to higher expenses for that class of business.
- Investment mix may on average be different (longer term view for superannuation)

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- Level of fees acceptable to the market may differ – ordinary life insurance competes more directly with unit trusts, bank deposits and other forms of investment.
- Average premium size may be higher for superannuation.

(1 mark per valid point / assumption impacted to a maximum of 5 marks)

(e)

Inclusion of 'deferred guarantee' means:

- Additional cost needs to be allowed for in product pricing and in best estimate assumptions under AS1.03
- Product may appear more attractive to consumers, although the guarantee is weak
- Systems need to allow for minimum surrender values
- Cost needs to be estimated for AS5.02 purposes

(1 mark per valid point to a maximum of 3 marks)

QUESTION 3

(20 marks)

A product actuary has been seconded from your company's US affiliate office and has joined your team. He has prepared a paper on the current state of the individual term life market and recommended that your company develop a range of 'preferred life' products where lower premiums are offered on policies where the life insured meets stricter underwriting requirements.

He has argued that this would be a market leading strategy for your office that would allow it to increase its market share and profitability at the same time whilst also gaining good media exposure.

- (a) What changes to the company's underwriting guidelines would be required to support the proposed 'preferred life' product? (5 marks)
- (b) What would be the possible implications to the company of introducing a preferred life product into the Australian market? (15 marks)

QUESTION 3: SOLUTION

(20 marks)

(a)

A preferred life product is one where individuals are offered lower premium rates for the same amount of cover if they meet specific underwriting requirements. These narrower requirements result in a greater 'selection' effect so that the preferred lives are expected to have lower ongoing mortality experience than the general insured lives population.

Consequently, underwriting guidelines for preferred lives must reflect that:

1. The life insured must fall within a narrower band of acceptable variation of a number of factors including height / weight (body mass index), blood pressure, cholesterol, etc. (2 marks)
2. There must be no significant negative factors in terms of medical history, family history, occupation or hazardous pursuits. (1 mark)
3. As the underwriting is more comprehensive they usually have high minimum sums insured than standard policies so that the additional underwriting costs and reduced premiums are offset by the allowances generated from the larger policy size. (1 mark)
4. The issue ages may be narrower (usually a lower maximum entry age). (1 mark)

(b)

Implications include:

(2 marks per point – 1 for identification of issue, 1 for reasonable discussion – maximum of 15 marks)

- More competitive premium rate and charging a premium appropriate to the risk.

The main product that would be the focus of preferred life rating would be term insurance. Being able to offer lower rates would represent a competitive advantage that may result in increased market share and increased profitability if the underwriting and experience are as expected.

There is a trade off between the grouping of risks and the charging of a rate that reflects an individual risk. As the market increases in size and sophistication so there is greater acceptance of differential premium rates for different risks. This can be seen with the development of sex and smoker rates and in some cases occupationally specific rates.

If higher rates are charged for substandard risks it seems reasonable to charge lower rates for better risks so long as the pool is large enough.

- Reward healthy clients – possibly grow the market.

Individuals who take a more active interest in maintaining a healthy lifestyle often believe that they should be rewarded. Similar incentives and rewards have been developed in health and general insurance and it may be able to be used as a promotional feature to attract business.

- Focused on profitable target market.

In a competitive market place there are constant pressures to increase underwriting limits, broaden acceptance ranges and lower minimum policy sizes in order to gain business. By setting higher minimums and more stringent requirements this may result in a greater proportion of business coming from High Net Worth individuals who may generate better persistency and profitability due to larger policy sizes and ability to maintain premium payments.

- Standard rates will probably have to increase.

Unless there is a resultant change in the mix of the lives underwritten by the company then the impact of charging some lives in a pool a lower premium is the need to charge the remaining lives in the pool a higher premium if the total claims cost of the pool doesn't change. This means that those lives who do not come preferred would on the average be slightly less healthy than the previous average life for the total pool and so a higher rate should be charged for those lives. This could make the standard product that generates the majority of the business less competitive.

- More expensive for less premium income.

The assessment of a preferred life policy is more onerous and will usually require more underwriting information and medical tests. This results in a higher per policy underwriting cost. At the same time the client is given a premium discount. Unless the resultant selection impact is significant enough to cover

both the premium reduction and increased acquisition costs the product may not be as profitable as a policy of a similar size written on standard terms.

- Distribution acceptance.

As preferred life policies require more underwriting and more underwriting information there is greater need for intermediary involvement and greater chance of the need to go back to the client to seek additional information, thus it is more onerous for an intermediary.

Most commission systems are based on the premium payable so a preferred life product would pay less commission (unless there was a higher commission rate on preferred life business) than for a standard policy with the same sum insured as the premium payable would be lower.

In addition intermediaries will need to learn about the new product and determine when it is appropriate to offer it (when there is a reasonable chance the life could be a preferred life) so the intermediary has to initially underwrite the life.

All this can lead to rejection of the product by a commission remunerated distribution channel.

- Negative reaction to being non-preferred.

If a large proportion of the lives that propose for preferred life status are rejected then it may develop a negative reaction from both customers and distribution. Further as more comprehensive underwriting is done it is possible that something could be discovered that would result in the life not only being rejected for preferred but being loaded as substandard. If the normal underwriting process would not have otherwise picked this up then this may result in increased dissatisfaction

- Cannot use some factors – eg, Racial & Genetic Information.

There are some factors that are known to identify differences in expected mortality experience that are not permitted to be used in the underwriting process by law or industry code. This includes racial factors under the Racial Discrimination Act (indigenous life expectancy is significantly lower than non-indigenous) and genetic factors under IFSA standard 11 (agreement to not offer preferred terms for favourable genetic test results). This can limit the ability to truly differentiate between preferred and standard lives.

- Impact on existing business.

If there is a cheaper product introduced, it is likely that clients and intermediaries will attempt to switch over to it. This will lead to higher discontinuance rates on the existing book, thus reducing its profitability and value. It would also lead to a relative deterioration in its mortality experience, and the consequent need to

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increase premium rates or suffer lower profitability. Increasing premium rates will involve expense, likely lead to 'shock lapses' and risk disenfranchising distributors and clients.

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QUESTION 4

(25 marks)

You are the Appointed Actuary for a newly established life insurance company in Australia about to calculate the policy liability for its first year-end. The company has issued only one product in its first year of business, namely an allocated pension product (with only one investment option). The product has two charging structures:

	Charging Basis 1	Charging Basis 2
Entry Fee	3%	0%
Management Fee (p.a.)	1.5%	2.0%
Exit Fee	Nil	Nil

At the end of company's first year of business the following information has been extracted from the general ledger, administration system and valuation systems:

Premiums	\$100.0m
Pensions Payments Paid	\$3.0m
Surrenders Paid	\$1.94m
Policyholder Investment Income	\$5.78m
Shareholder Investment Income	\$2.0m
Acquisition Expenses	\$3.5m
Maintenance Expenses	\$2.0m
Tax Expense	- \$0.423m (i.e. a refund)
Entry Fees	\$1.2m
Management Fees	\$0.89m

	Charging Basis 1	Charging Basis 2	Total
Inforce Units at year-end	35.15m	54.50m	
Unit Price at year-end	1.1050	1.0992	
PV Charges @ Inception	\$5.8m	\$12.0m	\$17.8m
PV Profit @ Inception	- \$0.31m	\$0.2m	- \$0.11m
PV Charges @ Year End	\$5.5m	\$11.4m	\$16.9m
PV Profit @ Year End	\$0.4m	\$0.9m	\$1.3m

(Where PV is an abbreviation for present value)

The recently hired Chief Financial Officer (CFO), having been hired from a well established life office, expresses some surprise when he hears of your plan to use the accumulation method instead of a projection method to calculate the policy liability.

- (a) Briefly explain the difference between the projection method and the accumulation method. (2 marks)
- (b) Justify your decision to use the accumulation method. (3 marks)

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- (c) The CFO also wants to know why you consider it appropriate to treat this as a single related product group. Justify your decision. (1 mark)
- (d) Using the accumulation method, calculate the policy liability at the end of the first year of business. (9 marks)
- (e) Calculate the profit the company made for the first year. (4 marks)
- (f) The CFO is still concerned that the auditors will not sign off the accounts without an analysis of profit and he does not believe that an analysis of profit can be performed as a projection method was not used. Draft a response to address his concerns including how (using the information provided) you did analyse the profit and thus ensured that the policy liability was reasonable. (6 marks)

QUESTION 4: SOLUTION

(25 marks)

(a)

The projection method is a prospective valuation involving the projection of all the expected future cashflows and discounting them back to the present. (1 mark)

The accumulation method is a retrospective valuation where the liability is the value of the benefits accumulated so far less a DAC (if applicable). (1 mark)

(b)

Use of the accumulation method is justifiable because:

- policy charges generally match policy expenses so it is not inappropriate. (1 mark)
- it is easier to explain to the remainder of the management of the company – the concept of the liability being equal to the account balance less a DAC is more easily understood by management than profit margins, profit carriers and the best estimate liability (many of them would be familiar with the concept of establishing a DAC and the subsequent run off). (1 mark)
- simplicity/quickness particularly if data is grouped. (1 mark)
- Incidence of profits is not materially affected by choosing the accumulation method. (1/2 mark)
- Release of profit is neither accelerated nor deferred. (1/2 mark)
- Profit is recognised when the service has been provided. (1/2 mark)

(c)

Benefit characteristics & pricing structure are sufficiently similar to meet the requirements of the Actuarial Standards.

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(d)

Acquisition Expenses 3.5 (before tax and entry)
less entry fee (1.2)

gives net amount of 2.3

Adjust for tax (0.69) (i.e. $30\% \times 2.3$)

Gives an amount of \$1.61m

However, as the PV profit at inception is negative, i.e. a loss of 0.11m, then the DAC @ inception of \$1.61m is not fully recoverable

A maximum DAC of \$1.5 can be held at the inception of the business

(1 mark: adjusting the acquisition expenses for the entry fee

1 mark: for adjusting for tax

2 marks: recognising the lack of recoverability at inception and adjusting for this)

DAC Margin @ Inception = $1.5/17.8 = 8.427\%$

DAC @ Valuation Date = DAC Margin * PV Charge @ Valuation date
= $.08427 \times 16.9\text{m}$
= 1.424m

However as this is greater than the PV Profit this amount of DAC cannot be fully recovered. Hence maximum amount of DAC that can be held is the PV of profit of \$1.3m.

Account balance = units * price
= $35.15 \times 1.105 + 54.5 \times 1.0992$
= 98.747m

Policy Liability = Account Balance – DAC
= $98.747\text{m} - 1.3\text{m}$
= 97.447m

(3 marks for DAC, including DAC Margin & Recoverability testing

1 mark for the account balance

1 mark for the policy liability

Note: No student should lose additional marks if they get the DAC at inception incorrect but use the answer appropriately for answering the rest of the question.)

Alternative

Some students may approach the valuation of the policy liability differently whereby they do not elect to expense the amount of acquisition expenses that cannot be recovered in the first year but set up a Capitalised Loss which they wish to carry forward into future years where it may become recoverable. In this case

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DAC Margin @ inception = $1.61/17.8 = 9.045\%$

DAC @ Valuation Date = $0.09045 * 16.9m$
= 1.529m

Capitalised Loss @ Valuation Date = $1.529 - 1.3 = 0.229m$
Policy Liability = Account Balance – DAC + Capitalised Loss
= $98.747 - 1.529 + 0.229$
= 97.447

(e)

Using the transitional arrangements under AASB 1038 a P&L would look like the following:

Premium	100.000m
Policy Outflows	(4.940m)
Expenses	(5.500m)
Investment Income	7.780m
Tax	0.423m
Movement in Policy Liability	(97.447m)
Profit	0.316m

(0.5 mark for each line item and 1 mark for the correct profit. Subtract 0.5 marks for each incorrect item included.)

As the transitional period has expired it would be more appropriate to use the following layout where the capital items have been excluded from the movement in the policy liability:

Expenses	(5.500m)
Investment Income	7.780m
Tax	0.423m
Movement in Policy Liability	(2.387m)
Profit	0.316m

(Give a bonus mark if students used this later approach or comment upon that they recognised that the transitional period had expired but commented that it would not change the profit but merely the items making up the profit.)

(f)

The product is similar to a unit trust product for profit reporting purposes. Hence, having used the accumulation method, it is possible to determine the profit in the same way as a unit trust product, i.e. a Fees minus Expenses view rather than a traditional life insurance company P&L view. (1 mark)

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The profit should be the same as that calculated previously and is as follows:

Entry Fee	1.200m
Management Fee	0.890m
Expenses	(5.500m)
S/H Investment Income	2.000m
Tax	0.423m
Movement in DAC	1.300m
Unexplained	0.003m
 Profit	 0.316m

(2 marks for showing the Fees – Expenses view)

(1 mark for explaining why the unexplained might exist.)

Discussion of analysis of surplus by examining actual verses expected experience items. (1 mark)

Additional approximate analysis/checking has been performed on the key items such as fees based on the information available. (1 mark)

The veracity of those checks would be improved if the policy related transactions (fees, premiums, claims) were recorded in the general ledger at product level (entry fee/nil-entry fee). (1 mark)

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QUESTION 5

(10 marks)

You are the actuary of a life insurance company operating in a developing nation. The legislative and regulatory environment in place for the life insurance industry is modelled on the Australian environment and is very similar in all respects. The company offers only traditional products (participating and non-participating). The asset mix supporting the liabilities is as follows:

Domestic Equity	30%
International Equity	20%
Property	10%
Fixed Interest	25%
Cash	15%

The investment performance over recent years is similar to the Australian market (several years of strong gains followed by several years of weak performance).

- (a) Briefly discuss the criteria for a satisfactory surplus distribution method. (2.5 marks)
- (b) Discuss 2 methods of distributing capital appreciation and how each of these methods would have fared given the investment performance experienced over recent years. (2.5 marks)
- (c) One of the Directors suggests that during these uncertain times (war, SARS virus, volatile markets) the assets should be invested in cash in a safe-haven such as Australia, and has asked for your written advice on his proposal. Briefly outline the points that you would consider in providing your advice. (5 marks)

QUESTION 5: SOLUTION

(10 marks)

- (a)
- equity - fair between policyholders of different terms, entry ages durations etc.
 - acceptable to the policyholder – meets their expectations.
 - beneficial to the office – participating contracts are intended to protect the office against insolvency.
 - consistency – with premium and surrender bases.
 - simplicity – for ease of administration and explanation to both the distribution channel and policyholders.

(½ mark per valid point – maximum 2.5 marks)

(b)

(½ mark for identifying each method, up to 1 mark for the comments for each – maximum 2.5 marks)

Reversionary Bonuses

This requires a cautious approach to the release of surplus and usually only a fraction of past appreciation is allotted because of the guaranteed nature of the bonus once allotted. Whilst this would normally be considered a disadvantage of these methods it could prove to be highly appropriate given the recent investment performance as much of the past capital appreciation would have been significantly reduced over the past two years.

Terminal Bonuses

The terminal bonus system offers the greatest flexibility as the bonus is only declared/vested on the expiry of the policy. Hence, it is possible to take into account the latest asset position prior to the expiry of the policy. Hence, with the recent investment performance it would have been possible to scale back the declarations as the deteriorating investment performance emerged.

(c)

Points that should be covered include:

- Currency mismatch – capital implications - impact on resilience reserve
- Potentially adds volatility to the investment returns in local currency if unhedged – markets can turn quickly and local currency may strengthen against ‘safe-haven’ currencies.
- Change in asset portfolio may require realisation of capital gains – tax considerations.
- Policyholder reasonable expectations – marketing material, etc, re investments backing the policies.
- May have a lower expected investment return under the new investment strategy. This would ultimately impact bonus rates and shareholder profits. Likely to impact embedded values.
- May be more effective to use derivatives (if market is sophisticated enough) to protect against downside risk in local equities. [Credit should also be given for other effective risk-mitigation strategies].
- Impact of transaction costs.
- Current level of surplus – ability to sustain investment downturns, etc.

(1 mark per valid point – maximum 5 marks)

END OF PAPER TWO SOLUTIONS