Exam RETFRC

Funding & Regulation Exam - Canada

Date: Wednesday, April 28, 2021

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 12 questions numbered 1 through 12 with a total of 100 points.

   The points for each question are indicated at the beginning of the question.

2. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions provided in this document.

Written-Answer Instructions

1. Each question part or subpart should be answered either in the Word document or the Excel file as directed. Graders will only look at work in the indicated file.

   a) In the Word document, answers should be entered in the box marked ANSWER. The box will expand as lines of text are added. There is no need to use special characters or subscripts (though they may be used). For example, β_1 can be typed as beta_1 (and ^ used to indicate a superscript).

   b) In the Excel document formulas should be entered. Performing calculations on scratch paper or with a calculator and then entering the answer in the cell will not earn full credit. Formatting of cells or rounding is not required for credit.

2. The answer should be confined to the question as set.

3. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.

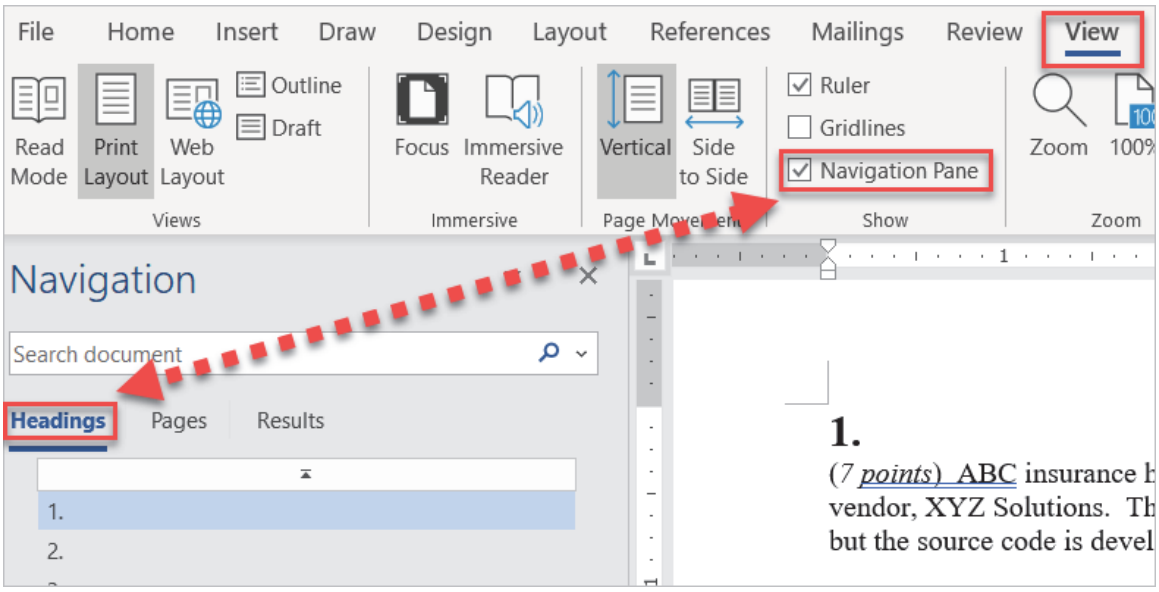
4. The Word and Excel files that contain your answers must be uploaded before time expires.

Recognized by the Canadian Institute of Actuaries.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:



1.

(*7 points*) You are the actuary for Company XYZ, which sponsors a defined benefit pension plan. You are provided with the key plan provisions below:

Provision	**Description**
Normal retirement benefit	Monthly benefit per year of credited service in accordance with the following table: **For credited service** / **Monthly Benefit Amount** Before 2008 / $35 From 2008 to 2011 / $40 From 2012 to 2015 / $42 Starting in 2016 / $43
Normal form of payment:	Life only, payable monthly in advance
Normal retirement age:	Age 65
Early retirement benefit:	6% reduction for each year prior to age 65
Termination benefit:	Deferred pension payable at age 65; or lump sum commuted value transfer from the plan

You are also given the following membership data at December 31, 2020:

Data – Active

ID	**Date of birth (mm/dd/yyyy)**	**Date of Participation (mm/dd/yyyy)**	**Sex**	**Service (years)**
23010	10/07/1980	01/01/2005	F	15
23012	09/04/1973	07/01/2013	M	
25012	07/04/2062	03/01/2006	M	12
27022	01/01/1989	01/01/2020	M	1
65024	03/04/1991		F	4

Data – Inactive

ID	**Status**	**Age**	**Sex**	**Form of pension**	**Pension amount**
2301	Retiree	58	F	Joint & Survivor	$3,000
11012	Retiree	98	M	Life Guarantee 5	$7,200
11023	Retiree	72	F	Life Guarantee 10	$14,000
12023	Beneficiary	81	M	Life	$2,203
12036	Beneficiary	62	M	Life	$1,220

You are performing the funding valuation as at December 31, 2020.

1. Continued

(a) (*3 points*) Identify potentially incorrect, missing, or incomplete data required for the actuarial valuation.

ANSWER:

You have requested that Company XYZ provide additional and/or revised data. Company XYZ has indicated that additional data is not easily accessible and they do not have the resources to collect that data.

(b) (*2 points*) Describe how you would proceed with a funding valuation, taking into consideration the Standards of Practice.

ANSWER:

Company XYZ has now informed you that they will be winding up the pension plan, with an effective date of December 31, 2020.

(c) (*2 points*) Describe how you would proceed with the plan wind-up valuation, taking into consideration the Standards of Practice.

ANSWER:

2.

(*11 points*) Your client sponsors a non-contributory defined benefit pension plan. You are given:

Plan Provisions:

Normal retirement benefit:	2% of final year's earnings times years of service
Normal form of payment:	Life only, payable monthly in advance
Optional forms of payment:	Actuarially-equivalent to normal form
Normal retirement age:	Age 65
Early retirement benefit:	5% reduction for each year prior to age 65
Termination benefit:	Deferred pension payable at age 65 or lump sum commuted value transfer from the plan Retirement from age 55 possible on an actuarially equivalent basis

Actuarial Assumptions and Methods:

Interest rate:	5% per year	
Salary increase rate:	3% per year	
Retirement rates:	**Age**	**Rate**
	60	25%
	63	50%
	65	100%
	All other ages	0%
Termination rates:	**Age**	**Rate**
	40	3%
	45	2%
	All other ages	0%
Pre-retirement mortality:	None	
Timing of decrements:	Beginning of year	
Actuarial cost method:	Aggregate	
Asset valuation method:	Market Value	

2. Continued

Participant Data at December 31, 2020:

	Member A	Member B	Member C
Age	40	55	64
2020 Salary:	$55,000	$65,000	$80,000
Service:	10	10	13

Annuity Factors:

$\ddot{a}_{55}^{(12)}$	15.6
$\ddot{a}_{60}^{(12)}$	14.8
$\ddot{a}_{63}^{(12)}$	14.1
$\ddot{a}_{64}^{(12)}$	13.6
$\ddot{a}_{65}^{(12)}$	13.3

Additional Information:

Market value of assets as at December 31, 2020:	$450,000

(a) (*5 points*) Calculate the accrued liability and estimated normal cost of the plan, in dollars, as at December 31, 2020.

The response for this part is to be provided in the Excel spreadsheet.

You are given:

Fund rate of return during 2021:		10%
Contribution made on December 31, 2021	$	50,000
Member A earned the following salary in 2021:	$	56,000
Member B earned the following salary in 2021:	$	79,000
Member C retired at January 1, 2021 and started collecting his monthly pension effective January 1, 2021		

(b) (*6 points*) Calculate the gains and losses by source for 2021.

The response for this part is to be provided in the Excel spreadsheet.

3.

(*13 points*) Your client sponsors a single-employer non-indexed closed defined benefit pension plan registered in Ontario. The plan is not a designated plan as defined under the Income Tax Act.

You are given the following valuation results as at December 31, 2020:

Going concern assets (including buy-in annuity; excluding present value of special payments previously established in respect of any past service unfunded actuarial liability)	$ 25,600,000
Going concern liabilities (including buy-in annuity; excluding PfAD)	$ 30,000,000
Buy-in annuity value included in going concern assets and liabilities	$ 10,000,000
Going concern annual employer current service cost (excluding PfAD)	$ 120,000
Annual provision for administrative expenses	$ 50,000
Going concern discount rate (net of investment expenses; gross of administrative expenses)	6.00%
Provision for adverse deviations ("PfAD")	16.04%
Going concern annual special payments payable in 2021 from prior valuation	$ 200,000
Duration of going concern liabilities (excluding buy-in annuity)	16
Duration of total going concern current service cost	20

Solvency assets (including buy-in annuity before wind-up expenses)	$ 31,400,000
Solvency liabilities	$ 38,800,000
Buy-in annuity value included in solvency assets and liabilities	$ 15,800,000
Solvency annual special payment payable in 2021 from prior valuation	$ 0
Solvency blended discount rate (for calculation of special payments)	3.2%
Provision for wind-up expenses	$ 200,000

There are **no** allowable exclusions from the solvency liabilities (e.g. consent benefits).

(a) (*3 points*) Calculate the minimum required and maximum permissible employer contributions in 2021.

The response for this part is to be provided in the Excel spreadsheet.

3. Continued

You are given the following:

Pension fund assets at December 31, 2021 excluding the value of the buy-in annuity	$ 14,400,000
Benefit payments for portion of liabilities not backed by the buy-in annuity in 2021	$ 200,000
Benefit payments for portion of liabilities backed by the buy-in annuity in 2021	$ 600,000
2021 total going concern current service cost	$ 150,000
Solvency incremental cost excluding buy-in annuity in 2021	$ 250,000
There are no liability gains or losses during the period	
All assumptions remain the same as at December 31, 2020	
The going concern discount rate is net of passive investment expenses of:	0.05%

The target asset allocation is the following:	
Fixed income assets	45%
Non-fixed income assets	55%

Non-Fixed Income component of the Provision for Adverse Deviations (PfAD):

% of Non-Fixed Income Assets	Closed Plans	Open Plans
0%	0%	0%
20%	2%	1%
40%	4%	2%
50%	5%	3%
60%	7%	4%
70%	11%	6%
80%	15%	8%
100%	23%	12%

3. Continued

- Benchmark Yield of Government of Canada Long-Term Bonds (V39056) at December 31, 2021 is 2.00%

- The formula to determine the benchmark discount rate that is used in the determination of the PfAD is:

$$0.5\% + \text{Benchmark Yield of Government of Canada Long-Term Bonds} + 5\% \times \text{allocation of non-fixed income} + 1.5\% \times \text{allocation of fixed income}$$

(b) (*10 points*) Calculate the minimum required and maximum permissible employer contributions for 2022, rolling forward liabilities and current service costs using extrapolation techniques.

The response for this part is to be provided in the Excel spreadsheet.

4.

(*6 points*) Company XYZ sponsors a large defined benefit pension plan. The following is a summary of the key plan provisions:

Plan Provisions:

Normal retirement benefit:	2% of final year's earnings times years of service
Normal retirement age:	Age 65
Early retirement benefit:	Unreduced at age 62 with 20 years of credited service; Otherwise 0.25% reduction per month for retirements before age 65
Termination benefit:	Deferred pension payable at age 65 or lump sum commuted value transfer from the plan Retirement from age 55 possible on an actuarially equivalent basis

You have performed a demographic experience study for the plan's going concern funding valuation. The results for the retirement and termination decrements are as follows:

Retirement Assumption

Age	Current Assumption	Experience
55-57	0.10	0.05
58-60	0.10	0.09
60-62	0.10	0.11
62-64	0.10	0.30
65 and over	1.00	1.00

Termination Assumption

Age	Current Assumption	Experience
Under 25	0.15	0.10
25-34	0.10	0.03
35-44	0.05	0.02
45-54	0.02	0.05
55 and over	0.00	0.00

4. Continued

Assume the following:

- Experience is **credible** for the retirement decrement; and
- Experience is **not credible** for the termination decrement.

(a) (*4 points*) Assess the appropriateness of the current retirement and termination assumptions.

ANSWER:

The early retirement benefit was changed as follows:

- Unreduced with 30 years of credited service; or
- Unreduced at age 62 with 20 years of credited service;
- Otherwise 0.25% reduction per month for retirements before age 65

(b) (*2 points*) Recommend changes to the current retirement assumption. Justify your recommendation.

ANSWER:

5.

(*7 points*) You are the actuary for Company ABC which sponsors a single-employer final-average salary-based defined benefit pension plan registered in Ontario.

You are preparing the actuarial valuation report for funding purposes as at January 1, 2021 for the plan.

(a) (*3 points*) List the disclosure requirements for the actuarial valuation report according to the Standards of Practice.

ANSWER:

(b) (*4 points*) Describe three plausible adverse scenarios that you would include in the valuation report, including the elements required for reporting on each scenario.

ANSWER:

6.

(*6 points*) Company ABC sponsors a defined benefit pension plan registered in Ontario.

You are given:

Membership Data as at January 1, 2019:

Member	Class	Date of Membership	Salary	Bonus
X	A	January 1, 2015	$ 90,000	$ 18,000
Y	A	January 1, 2000	$ 180,000	$ 36,000

Pension Plan Provisions:

Retirement benefit	1.8% of final average 3-year salary (FAE3) times credited service
Earnings	Base pay, including bonuses
Member contribution rate	No member contributions are allowed
Normal retirement age	Age 65
Disability	Accrual of benefits continues with salary frozen at the salary in the year prior to disability

Company ABC Pay Scale for all Class A Members:

Years of membership	Annual Pay Scale
0 to <5	4.5% p.a. increase
5 to <10	3.0% p.a. increase
10 to <15	2.5% p.a. increase
15+	1.0% p.a. increase

Bonus: 20% of salary if meeting 100% of sales target; otherwise, no bonus payable.

Income Tax Act defined benefit dollar limit for 2020: $3,092.22

Effective December 31, 2019, Member X goes on an authorized leave of absence (disability leave) for one year. Member Y remains active, received only the pay adjustment identified above for Class A members, and achieved 100% of her sales target.

6. Continued

(a) (*3 points*) Calculate the 2020 Pension Adjustment for Members X and Y.

The response for this part is to be provided in the Excel spreadsheet.

(b) (*3 points*) Describe the benefit improvements than can be made to maximize the pension benefit payable from the plan without generating a Past Service Pension Adjustment.

ANSWER:

7.

(*7 points*) You have recently been hired by ABC Company to provide actuarial services for its single-employer defined benefit pension plan. While reviewing the last filed Actuarial Valuation Report ("AVR") for funding purposes at January 1, 2020, you notice that the termination assumption was set by the prior actuary based on an experience study using plan data from 2015 to 2019, the results of which had significantly increased the assumed termination rates compared to that of the previously filed AVR.

After a discussion with your contact at ABC Company, you are told that the company had experienced a significant downsizing from 2017 to 2019 as part of a restructuring effort, which is now completed. No further downsizing is planned or expected.

(a) (*2 points*) Assess the appropriateness of the termination assumption used in the January 1, 2020 AVR.

ANSWER:

(b) (*2 points*) Describe how the termination assumption should have been developed based on the Standards of Practice.

ANSWER:

(c) (*3 points*) Describe the steps that should be taken and considerations for developing the credibility procedure for using the experience data.

ANSWER:

8.

(*8 points*) You are given the following information for a member terminating from a single-employer defined benefit pension plan registered in Ontario:

Member data:

Date of birth	January 1, 1966
Date of termination	January 1, 2021
Pensionable service (years)	10
Eligibility service (years)	11
Accrued benefit	$ 25,000

Plan provisions:

Normal retirement age	Age 65
Normal retirement benefit	1.5% times the sum of earnings for each year of pensionable service
Eligibility for early retirement	Age 55
Early retirement benefit	Unreduced with 80 age-plus-service points (service based on Eligibility service); otherwise 2% per year from age 65
Termination benefit	Deferred pension starting at age 65 Payable from age 55 in accordance with the Early retirement benefit
Portability	Participants may choose a lump-sum commuted value in lieu of an immediate or deferred pension at all ages
Cost-of-living adjustments	50% of CPI, pre- and post-retirement

8. Continued

Additional information:

Month	V122542 (7 year)	V122544 (long)	V122553 (real)	Mid-Term Provincial Bond Index	Mid-Term Corporate Bond Index	Long-Term Provincial Bond Index	Long-Term Corporate Bond Index
January 2021	1.32%	1.45%	0.15%	1.81%	2.42%	2.21%	2.94%
December 2020	1.63%	1.67%	0.32%	2.24%	2.99%	2.54%	3.39%
November 2020	1.50%	1.58%	0.31%	2.06%	2.75%	2.40%	3.21%

Month	Mid-Term Federal Non-Agency Bond Index	Long-Term Federal Non-Agency Bond Index
January 2021	1.38%	1.53%
December 2020	1.71%	1.76%
November 2020	1.57%	1.67%

8. Continued

Annuity factors:

$\ddot{a}_{55}^{(12)}$	23.9
${}_{1\|}\ddot{a}_{55}^{(12)}$	22.9
${}_{2\|}\ddot{a}_{55}^{(12)}$	22.0
${}_{3\|}\ddot{a}_{55}^{(12)}$	21.0
${}_{4\|}\ddot{a}_{55}^{(12)}$	20.0
${}_{5\|}\ddot{a}_{55}^{(12)}$	19.2
${}_{6\|}\ddot{a}_{55}^{(12)}$	18.3
${}_{7\|}\ddot{a}_{55}^{(12)}$	17.4
${}_{8\|}\ddot{a}_{55}^{(12)}$	16.5
${}_{9\|}\ddot{a}_{55}^{(12)}$	15.7
${}_{10\|}\ddot{a}_{55}^{(12)}$	14.9

(a) (*4 points*) Calculate the commuted value interest rates under Section 3500 of the Canadian Institute of Actuaries' Standards of Practice as at the member's date of termination.

The response for this part is to be provided in the Excel spreadsheet.

(b) (*4 points*) Calculate the commuted value at the member's date of termination assuming the member terminated:

(i) Voluntarily; and

(ii) Involuntarily.

The response for this part is to be provided in the Excel spreadsheet.

9.

(*15 points*) You are performing a funding valuation as at December 31, 2020 for a defined benefit pension plan registered in Ontario.

Calculate the one (1)-year Solvency Incremental Cost for the defined pension plan described below.

The response for this part is to be provided in the Excel spreadsheet.

You are given:

Plan Provisions

Normal retirement age	Age 65
Normal retirement benefit	1.5% times 3-year final average earnings (FAE3) times years of credited service
Normal form	Life only; Joint & 60% survivor for participants with a spouse on retirement, actuarially equivalent to Life only
Eligibility for early retirement	Age 55
Early retirement benefit	Reduced by 4% per year from age 65
Termination benefit	Deferred pension starting at age 65 Payable from age 55 on an actuarially equivalent basis
Portability	Participants may choose a lump-sum commuted value in lieu of an immediate or deferred pension at all ages
Cost-of-living adjustments	None

9. **Continued**

Solvency Valuation Assumptions

Interest rates:	
Lump-sum commuted values	2.50% per year for 10 years; and 2.50% thereafter
Annuity Purchase	2.50% per year
Mortality rates (post-retirement):	
Lump-sum commuted values	CPM2014 Mortality Table (Combined) with mortality improvements in accordance with CPM Improvement Scale B
Annuity purchase	CPM2014 Mortality Table (Combined) with mortality improvements in accordance with CPM Improvement Scale B
Mortality rates (pre-retirement):	
Lump-sum commuted values	None
Annuity purchase	None
Option Election	100% of active participants assumed to elect a lump-sum commuted value

Going Concern Valuation Assumptions

Salary increases	3.00% per year, inclusive of merit and promotion	
Mortality rates (post-retirement)	CPM2014 Mortality Table (Combined) with mortality improvements in accordance with CPM Improvement Scale B	
Mortality rates (pre-retirement)	None	
Retirement Rates	**Age**	**Rate**
	60	15%
	62	15%
	65	100%
	All other ages	0%
Termination Rates	**Age**	**Rate**
	35	3%
	40	2%
	45	1%
	All other ages	0%
Timing of Decrements	Beginning of year	

9. **Continued**

Projection assumptions required for Solvency Incremental Cost

New entrants	None
Option Election upon Termination or Retirement	100% of active participants assumed to elect a lump-sum commuted value The lump-sum commuted value is calculated using solvency valuation assumptions
All other assumptions	In accordance with Going Concern Valuation Assumptions Assume inactive participants survive to the next valuation

Participant Data at December 31, 2020

Member ID	Status	Sex	Age	Earnings in 2020	Earnings in 2019	Earnings in 2018	Monthly Pension	Credited Service
12001	Active	Male	33	$65,000	$63,000	$62,500	N/A	10.0
12004	Active	Male	40	$72,000	$71,500	$70,400	N/A	16.0
14052	Active	Male	59	$82,500	$81,000	$80,000	N/A	20.0
30001	Retired - life only	Male	70	N/A	N/A	N/A	$2,000	N/A

9. **Continued**

Annuity Factors

Age	# of years of deferral	Annuity Factor	
		December 31, 2020	December 31, 2021
33	22	12.78	12.79
33	23	12.24	12.26
33	24	11.72	11.73
33	25	11.21	11.23
33	26	10.72	10.74
33	27	10.24	10.26
33	28	9.78	9.79
33	29	9.33	9.34
33	30	8.88	8.90
33	31	8.46	8.47
33	32	8.04	8.05
34	21	13.08	13.10
34	22	12.53	12.55
34	23	12.00	12.01
34	24	11.48	11.49
34	25	10.98	10.99
34	26	10.49	10.50
34	27	10.01	10.02
34	28	9.55	9.56
34	29	9.09	9.11
34	30	8.65	8.67
34	31	8.23	8.24
40	15	15.07	15.09
40	16	14.43	14.45
40	17	13.81	13.83
40	18	13.22	13.23
40	19	12.63	12.65
40	20	12.07	12.08
40	21	11.52	11.53
40	22	10.98	11.00
40	23	10.46	10.47
40	24	9.95	9.96
40	25	9.45	9.47
41	14	15.43	15.45
41	15	14.78	14.79

9. **Continued**

Annuity Factors

Age	# of years of deferral	Annuity Factors	
		December 31, 2020	December 31, 2021
41	16	14.14	14.16
41	17	13.53	13.55
41	18	12.93	12.95
41	19	12.35	12.37
41	20	11.79	11.80
41	21	11.24	11.26
41	22	10.70	10.72
41	23	10.18	10.20
41	24	9.66	9.68
59	0	19.67	19.70
59	1	18.78	18.81
59	2	17.92	17.95
59	3	17.07	17.10
59	4	16.25	16.28
59	5	15.45	15.48
59	6	14.67	14.70
60	0	19.22	19.25
60	1	18.33	18.37
60	2	17.47	17.50
60	3	16.63	16.66
60	4	15.81	15.84
60	5	15.01	15.04
70	0	14.22	14.26
71	0	13.68	13.72

10.

(*9 points*) You are the actuary for a defined benefit pension plan.

(a) (*6 points*) Describe the considerations in setting the following assumptions for a solvency valuation:

(i) mortality rates assumption;

(ii) portion electing a commuted value;

(iii) wind-up expenses;

(iv) increase in average wage index

ANSWER:

(b) (*3 points*) Describe the considerations for setting the assumptions required when determining the solvency incremental cost.

ANSWER:

11.

(*5 points*) Describe ways in which the regulatory framework provided by the Pension Benefits Act (Ontario) adheres to "Core Principle 5. Plan design, pension benefits, disclosure and redress" from the OECD Core Principles of Private Pension Regulation.

ANSWER:

12.

(*6 points*) Company ABC sponsors a single-employer defined benefit pension plan. Company ABC has implemented an investment strategy to mitigate the volatility of the solvency funded status caused by changes in interest rates. Company ABC would like to further reduce the volatility of the solvency funded status by changing the asset valuation method.

Company ABC is considering one of the asset valuation methods described below:

Asset Valuation Method	**Description**

1. Unit method (10-year average)	• Assets are viewed as being comprised of a certain number of "units" and the actuarial value of assets at the valuation date is equal to:
	  o The number of units; multiplied by,
	  o The average value of a unit over an averaging period of ten years.
	• At inception of this method, the value of a unit is set to 100 and the initial number of units is set equal to the market value of assets divided by 100.
	• Over time, cash flows will change the number of units throughout the year, and the value of a unit is recalculated once per year at the valuation date and remains fixed for the year.

2. 20% Corridor based on expected income	• The actuarial value of assets is set such that it falls within a 20% corridor, where the corridor is plus or minus 20% of the market value at the beginning of the period plus an assumed growth of 4% (with adjustments for contributions and benefit payments).
3. Deferred recognition of equity returns only	• Under this method, only a portion of investment experience is recognized in the current year. • Investment returns on the equity portion of the portfolio that are greater or less than 5.5% are recognized evenly in the current year and over the following four years.

Assess the appropriateness of each of the above asset valuation methods to achieve Company ABC's objective, taking into consideration the Canadian Institute of Actuaries' guidance on asset valuation methods.

ANSWER:

****END OF EXAMINATION****