Exam RETFRC

Funding & Regulation Exam - Canada

Date: Thursday, October 26, 2023

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 7 questions numbered 1 through 7 with a total of 80 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 the five-minute upload period expires.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:
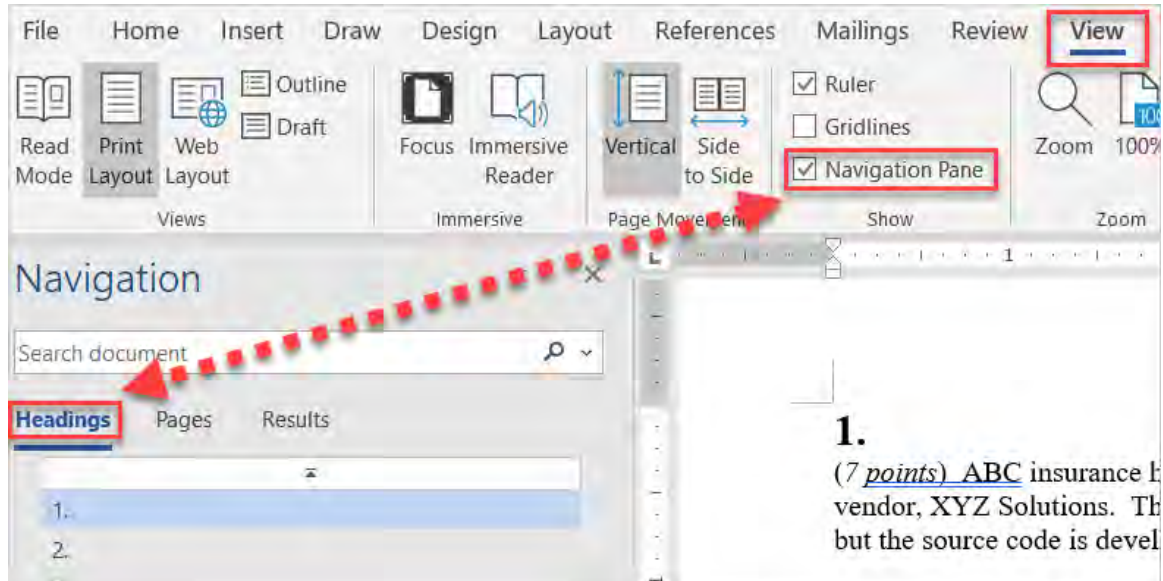
1.

(*6 points*) Your client sponsors a non-contributory defined benefit pension plan registered in Ontario. A funding valuation is due effective January 1, 2023. As the new plan actuary, you are reviewing the data that was used for the January 1, 2022 funding valuation.

The data used in the January 1, 2022 funding valuation is given below:

ID	Status	Gender	Date of Birth (mm/dd/yyyy)	Pensionable Earnings	Years of Service
8001	Active	F	03/11/1998	$45,000	1
8003	Active	F	09/01/1992	$41,000	2
8008	Active	M	04/07/1968	$65,000	16
8067	Active	M	08/04/1981	$63,000	5
8099	Active	F	11/12/1976	$112,000	18
8100	Active	M	12/05/1987	$81,000	1
8102	Active	F	01/25/1982	$70,000	14
8111	Active	M	03/09/1987	$45,000	9
8115	Active	M	12/06/1980	$95,000	10
8119	Active	M	08/22/1972	$47,000	5
8126	Active	F	10/02/1990	$50,000	5
8132	Active	M	04/20/1988	$61,000	3
8138	Active	M	07/07/1972	$84,000	10
8142	Active	F	10/30/1975	$50,000	4
8177	Active	M	01/08/1982	$115,000	10
8201	Active	F	06/11/1981	$58,000	8
8208	Active	F	08/14/1984	$64,000	2
8259	Active	M	11/01/1974	$105,000	6
8346	Active	M	07/05/1987	$35,000	15
8829	Active	F	04/03/1984	$88,000	10
8911	Active	M	07/16/1964	$66,000	5
9188	Active	M	02/20/1979	$58,000	8
9276	Active	M	12/05/1954	$121,000	22

1. **Continued**

ID	Status	Gender	Date of Birth (mm/dd/yyyy)	Date of Retirement (mm/dd/yyyy)	Pension Amount (Monthly)	Form of Payment
1261	Deferred Vested	M	07/28/1978	n/a	$800	n/a
1551	Deferred Vested	F	01/20/1977	n/a	$1,300	n/a
2652	Deferred Vested	F	04/01/1955	n/a	$2,000	n/a
2688	Deferred Vested	M	08/01/1974	n/a	$700	n/a
2710	Deferred Vested	M	11/19/1967	n/a	$1,000	n/a
2955	Deferred Vested	M	03/02/1964	n/a	$1,100	n/a
3109	Deferred Vested	F	05/10/1977	n/a	$800	n/a
1899	Retiree	M	04/22/1954	06/01/2019	$1,000	Life only
2023	Retiree	M	07/11/1951	08/01/2016	$500	Life only
2844	Retiree	M	10/09/1947	12/01/2012	$1,200	Life only
3388	Retiree	F	01/22/1954	03/01/2029	$3,000	Life only
3988	Retiree	M	02/09/1948	04/01/2014	$500	G5
4258	Retiree	F	09/05/1945	10/01/2011	$1,200	Life only
4501	Retiree	M	11/11/1937	12/01/1990	$100	Joint and Survivor 60%
5192	Surviving Spouse	F	05/18/1951	09/01/2019	$5,000	Joint and Survivor 100%
5286	Surviving Spouse	F	08/14/1941	04/01/2005	$400	Life only

1. **Continued**

You have received the following valuation data with respect to the January 1, 2023 funding valuation:

ID	Status	Gender	Date of Birth (mm/dd/yyyy)	Pensionable Earnings	Years of Service
8001	Active	F	03/11/1998	$47,000	2
8003	Active	F	09/01/1992	$42,000	3
8008	Active	M	04/07/1968	$67,000	17
8067	Active	M	08/04/1981	$65,000	6
8099	Active	F	11/12/1976	$115,000	19
8100	Active	M	12/05/1987	$83,000	2
8102	Active	F	01/25/1982	$72,000	15
8111	Active	M	03/09/1987	$46,000	10
8115	Active	M	12/06/1980	$98,000	11
8119	Active	M	08/22/1972	$48,000	6
8126	Active	F	10/02/1990	$51,000	6
8132	Active	M	04/20/1988	$63,000	4
8138	Active	M	07/07/1972	$87,000	11
8142	Active	F	10/30/1975	$52,000	5
8177	Active	M	01/08/1982	$118,000	11
8201	Active	F	06/11/1981	$60,000	9
8208	Active	F	08/14/1984	$66,000	3
8259	Active	M	11/01/1974	$108,000	7
8346	Active	M	07/05/1987	$33,000	17
8829	Active	F	04/03/1964	$91,000	11
9001	Active	M	09/22/1968	$100,000	3
9188	Active	M	02/20/1979	$60,000	9
9276	Active	M	12/05/1954	$127,000	23

1. **Continued**

ID	Status	Gender	Date of Birth (mm/dd/yyyy)	Date of Retirement (mm/dd/yyyy)	Pension Amount (Monthly)	Form of Payment
1261	Deferred Vested	M	07/28/1978	n/a	$800	n/a
1551	Deferred Vested	F	01/20/1977	n/a	$1,300	n/a
2652	Deferred Vested	F	04/01/1955	n/a	$2,000	n/a
2688	Deferred Vested	M	08/01/1974	n/a	$700	n/a
2710	Deferred Vested	M	11/19/1967	n/a	$1,000	n/a
2955	Deferred Vested	M	03/02/1964	n/a	$1,100	n/a
3109	Deferred Vested	F	05/10/1977	n/a	$800	n/a
1899	Retiree	M	04/22/1954	06/01/2019	$1,000	Life only
2023	Retiree	M	07/11/1951	08/01/2016	$500	Life only
2844	Retiree	M	10/09/1947	12/01/2012	$1,200	Life only
8911	Retiree	M	07/16/1975	05/01/2022	$500	Joint and Survivor 100%
3388	Retiree	F	01/22/1954	03/01/2029	$3,000	Life only
3988	Retiree	M	02/09/1948	04/01/2014	$500	Life only
4258	Retiree	F	09/05/1945	10/01/2011	$1,200	Life only
4501	Retiree	M	11/11/1937	12/01/1997	$100	Joint and Survivor 60%
5192	Surviving Spouse	F	05/18/1951	09/01/2019	$5,000	Joint and Survivor 100%
5286	Surviving Spouse	F	08/14/1941	04/01/2005	$400	Life only

1. **Continued**

You are also given the following plan provisions:

Normal retirement benefit:	1.5% of the average of the final 5 years of salary multiplied by years of service
Early retirement:	Eligible for early retirement upon the attainment of age 55; 5% reduction for each year prior to age 65
Post-retirement indexation:	2% per year

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

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

After discussing data concerns with the plan administrator, you are informed that there are potential issues with the January 1, 2022 and January 1, 2023 data.

(b)   (*3 points*) Describe actions that you may take to rectify the data concerns, taking into consideration the Standards of Practice.

> ANSWER:

2.

(*27 points*) Your client sponsors a non-contributory defined benefit pension plan registered in Ontario.

Plan provisions:

Normal retirement age (NRA):	Age 65
Normal retirement benefit:	1.8% of Final 3-year Average Earnings (FAE3) multiplied by years of service
Early retirement reduction:	<u>10 or more years of service</u>: benefit is reduced 3% per year from age 62 <u>Less than 10 years of service</u>: benefit is reduced 5% per year from NRA
Termination benefit:	Deferred pension starting at age 65 Early commencement from age 55 on an actuarially equivalent basis
Post-retirement cost of living adjustments:	100% of the increase in the Consumer Price Index (CPI)

Other information:

- On January 1, 2019, a buy-in group annuity was purchased for pensioners ID5 and ID6
- Your client wants to contribute the minimum allowable under the Pension Benefits Act (Ontario)

2. **Continued**

You are given the following information at January 1, 2022:

Going concern assumptions:

Discount rate:	5.7% per year
Inflation rate:	1.8% per year
Asset valuation method (excluding the value of the buy-in annuity contract):	Asset gains and losses, determined with reference to the going concern discount rate, smoothed over a 3-year period. Cashflow assumed to occur in the middle of the year
Salary increase rate:	2.5% per year
Pre-retirement mortality:	None
Actuarial cost method:	Projected Unit Credit prorated on service

Retirement age:	**Age**	**Rate**
	62	50%
	65	100%

Termination rates (assume 100% of terminations are involuntary):	**Age**	**Rate**
	45	5%
	50	2%
	Other ages	0%

Timing of decrements:	Beginning of year (BOY)
Form of payment:	Life only. Optional forms available on an actuarial-equivalent basis
Provision for Adverse Deviation (PfAD):	9.0%

2. **Continued**

Solvency Assumptions:

Annuity purchase discount rate:	3.0% per year
Transfer value discount rates:	2.10% per year for 10 years; 3.10% per year thereafter
Percentage of active members receiving settlement by commuted value transfer:	Under age 55: 100% Over age 55: 0%
Solvency asset valuation:	Market value of assets
Pre-retirement mortality:	None
Excludable benefits:	Cost of living adjustments are excluded
Plan termination expenses:	$100,000
Retirement age:	In accordance with the Standards of Practice

Membership information (as at January 1, 2022):

Active Members	ID1	ID2
Age:	44	62
Earnings 2019:	81,500	117,500
Earnings 2020:	83,000	120,000
Earnings 2021:	85,000	140,000
Years of service:	4.0	29.0
Status:	Full-time	Full-time
Normal Cost (incl. Indexation):	13,000	38,200
Normal Cost (excl. Indexation):	10,000	30,700

2. **Continued**

Pensioners	ID3	ID4	ID5 (insured annuity)	ID6 (insured annuity)
Age:	60	69	65	68
Retirement date:	January 1, 2020	January 1, 2018	January 1, 2016	January 1, 2016
January 1, 2022 monthly pension:	1,200	2,500	1,800	3,000
Form of pension:	Lifetime only	Lifetime only	Lifetime only	Lifetime only

Asset information (in $):

	2019	**2020**	**2021**
January 1 market value of assets*:	1,250,000	1,346,700	1,048,000
Employer normal cost contribution:	16,500	17,000	18,000
Employer special payments:	60,000	70,000	95,000
Benefit payments:	94,000	96,000	98,000
Transfer in from insurer:	54,200	55,300	55,700
Administration expenses:	40,000	45,000	42,000
Investment return*:	100,000	-300,000	30,000
December 31 market value of assets*:	1,346,700	1,048,000	1,106,700

*excluding the buy-in annuity contract

Liability information (as at January 1,2022 in $):

	Going-concern basis (including indexation)	**Going-concern basis (excluding indexation)**	**Solvency basis**
Active members	1,198,000	963,000	1,242,100
Non-insured pensioners	663,000	549,400	678,000
Insured pensioners (buy-in)	850,000	707,500	870,000

2. **Continued**

Amortization schedules effective as at January 1, 2021:

	Monthly amortization payment	**Date of first payment**	**Date of last payment**
Going concern	1,800	2021-01-01	12/31/2021
Going concern	1,000	2022-01-01	12/31/2031
Solvency	1,500	2022-01-01	12/31/2026

(a)   (*3 points*) Calculate the funded status of the plan on going concern and solvency bases at January 1, 2022.

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

(b)   (*2 points*) Calculate the minimum required employer contributions for 2022 and the new amortization payment schedule.

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

You are asked to complete the January 1, 2023 actuarial valuation based on the information provided below. ID6 died and no other decrements occurred in 2022.

Going concern discount rate:	6.5% per year
Annuity purchase discount rate:	4.9% per year
Transfer value discount rates:	4.30% per year for 10 years; 4.70% per year thereafter
Actual CPI increase for 2022:	6.3%

All other assumptions and methods are unchanged from the prior valuation.

2. **Continued**

Asset information (in $):

	2022
January 1 market value of assets (excluding value of annuity buy-in contract)*:	1,106,700
Total employer contributions:	85,262
Benefit payments:	84,000
Transfer in from insurer:	39,600
Administration expenses:	45,000
Investment return*:	190,000
December 31 market value of assets*:	1,292,562

*excluding the buy-in annuity contract

Demographic information:

Member ID	**Status at December 31, 2022**	**Earnings for 2022**
ID1	Active	85,000
ID2	Active	143,500

Annuity Factors
[Provided in the Excel Worksheet]

(c)   (*10 points*) Calculate the funded status of the plan on going concern and solvency bases at January 1, 2023.

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

(d)   (*4 points*) Calculate the minimum required employer contributions for 2023 and the special payment schedule resulting from the valuation.

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

2. **Continued**

(e) (*8 points*) Assess the reasonableness of the gain/(loss) analysis completed by your analyst below:

Source	Gain/(loss) amount
Investment return	127,000
Mortality	500,000
Inflation	70,000
Retirement	(130,000)
Salary	(10,000)

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

3.

(*8 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:	1.25% of earnings up to the YMPE plus 2.00% of earnings above the YMPE for each year of service
Normal retirement age:	Age 65
Early retirement age:	Age 55
Early retirement reduction (from active status):	1/3% reduction per month for retirement before age 65
Termination benefit:	Deferred pension payable at age 65 or lump sum commuted value transfer from the plan for members not eligible for immediate retirement Early retirement reduction of 1/2% per month before age 65

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

Termination rates:

Age	Current assumption	Plan experience
Under 30	0.20	0.19
30 – 39	0.10	0.03
40 – 49	0.08	0.12
50 – 54	0.02	0.06
55 and over	0.00	0.00

Retirement rates:

Age	Current assumption	Plan experience
55 – 60	0.12	0.08
61 – 62	0.15	0.25
63 – 64	0.20	0.25
65	1.00	0.50
66 – 67	1.00	0.20
68 – 69	1.00	0.20
70 – 71	1.00	1.00

3. **Continued**

Settlement election rates (proportion electing lump sum on termination):

Age	Current assumption	Plan experience	Industry experience
Under 30	0.70	0.80	0.82
30 – 39	0.70	0.75	0.78
40 – 49	0.70	0.75	0.75
50 – 54	0.70	0.50	0.49
55 and over	0.00	0.00	0.45

Assume the following:

- Plan experience is **credible** for the retirement decrement; and
- Plan experience is **not credible** for the settlement election assumption and termination decrement.

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

ANSWER:

The plan provisions were changed as follows:

- Retirement eligible members can elect a lump sum commuted value transfer from the plan.
- Early retirement reduction (from active status):
  - o   unreduced at 85 points (age + years of service);
  - o   otherwise; 0.25% reduction per month before age 65

(b)   (*4 points*) Recommend changes to the current retirement assumption and settlement election assumption. Justify your recommendation.

ANSWER:

4.

(*7 points*) In order to mitigate the impact of market volatility on their contribution requirements, Company ABC is considering the following asset smoothing techniques:

Method 1:

- Linear recognition of all realized gains (losses) net of investment expenses over a period of 2 years.
- The smoothed value of assets is constrained by a corridor such that it is no less than 95% of the market value of assets, and no greater than 105%.

Method 2:

- Average of the market value of assets at the valuation date and the adjusted market values of assets at the end of the four preceding years projected to the valuation date.
- The adjusted market values are determined using the market values at December 31 of each of the four preceding years projected to the valuation date with the net cash flow (contributions less benefit payments less non-investment expenses) and assumed investment return equal to the going concern discount rate applicable for each year.
- The net cash flow is assumed to occur mid-year.

You are given the following asset reconciliation:

(000's)	2018	2019	2020	2021	2022
Beginning market value of assets	85,000	87,153	102,193	106,990	118,869
Additions:					
Contributions	5,896	5,931	2,968	3,054	3,150
Realized gain/(loss)	576	3,690	3,394	7,969	17,243
Deductions:					
Benefit payments	4,754	4,962	7,941	5,186	5,250
Administrative expenses	1,218	1,285	1,421	1,559	1,671
Investment expenses	758	762	846	894	1,018
Unrealized gain/(loss)	2,411	12,428	8,643	8,495	(946)
Ending market value of assets	87,153	102,193	106,990	118,869	130,377
Beginning of year going concern discount rate	5.75%	5.75%	5.25%	5.25%	5.25%

4. **Continued**

(a)   (*4 points*) Calculate the smoothed value of assets as at January 1, 2023 using the two asset smoothing methods under consideration.

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

(b)   (*3 points*) Compare and contrast the two asset smoothing methods taking into consideration the Canadian Institute of Actuaries' guidance on asset valuation methods.

> ANSWER:

5.

(*12 points*) Your client is establishing a new non-contributory defined benefit pension plan that recognizes past service.

You are given:

Plan provisions:

Retirement benefit:	$100 per month per year of service
Normal form of payment:	Life only, payable monthly in advance
Normal retirement age:	Age 65
Termination benefit:	Accrued pension deferred to normal retirement age

Actuarial assumptions and methods:

Discount rate:	5% per year	
Decrements:	Beginning of year	
Retirement:	Later of: age 65 or 1 year after the valuation date	
Termination Rates	Age	Rate
	Prior to age 50	4% per year
	At or after age 50	0% per year
Other pre-retirement decrements:	None	
Actuarial cost method:	Attained Age Normal	
Asset method:	Market value of assets	

Participant Data at January 1, 2023:

Employee:	Member A	Member B
Age (years):	48	64
Service (years):	18	34

Additional Information:
Market value of assets as at January 1, 2023: $600,000

Annuity factors:

$\ddot{a}_{68}^{(12)} = 11.6$	$\ddot{a}_{67}^{(12)} = 11.9$
$\ddot{a}_{66}^{(12)} = 12.2$	$\ddot{a}_{65}^{(12)} = 12.5$
$\ddot{a}_{64}^{(12)} = 12.8$	$\ddot{a}_{63}^{(12)} = 13.1$

5. **Continued**

(a)   (*4 points*) Calculate the unfunded actuarial liability and the total normal cost as at January 1, 2023.

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

You are given the following for 2024:

- A contribution of $20,000 was made to the plan on December 31, 2023.
- The plan's assets earned a rate of return of 5% during 2023.
- Member B did not retire.

(b)   (*3 points*) Calculate the unfunded actuarial liability and the total normal cost as at January 1, 2024.

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

(c)   (*5 points*) Calculate the effect of the demographic experience by source between January 1, 2023 and January 1, 2024 on the normal cost for each member.

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

6.

(*10 points*) You are the actuary for a company that sponsors a defined benefit pension plan registered in Ontario.

You are given the following information as at January 1, 2023.

Valuation data:

Member	Age (years)	Service (years)	Earnings		
			2020	**2021**	**2022**
A	49	5	70,000	73,000	75,000
B	60	30	90,000	95,000	98,000

Pension plan provisions:

Normal retirement benefit:	2% of final 3-year average earnings multiplied by service
Normal form of pension:	Life only
Normal retirement age:	Age 65
Earliest retirement age:	Age 55
Early retirement reduction:	4% per year prior to age 60
Termination benefit:	Deferred pension payable at age 65. Early commencement of pension subject to an actuarial equivalent reduction.

Solvency assumptions:

Discount rate – annuity purchase:	4% per year
Discount rate – lump sum payment:	5% per year for 10 years, 5% per year thereafter
Percentage of members electing a commuted value:	100% of members under age 55, 0% otherwise
Retirement age:	In accordance with the Standards of Practice
Pre-retirement decrements:	None

6. **Continued**

Going concern assumptions and methods:

Discount rate:	6% per year
Salary increase:	3% per year
Retirement age:	Age 65
Termination decrement:	None
Other pre-retirement decrements:	None
Actuarial cost method:	Projected Unit Credit

Solvency annuity factors
[provided in the Excel Worksheet]

(a)   (*6 points*) Calculate the 2023 solvency incremental cost (SIC).

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

(b)   (*4 points*) Describe the considerations in setting the SIC projection assumptions.

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

7.

(*10 points*)

(a)   (*4 points*) Describe the considerations for setting the following going concern valuation assumptions for a pension plan:

     (i)   Discount rate

     (ii)   Inflation rate

     (iii)   Average Industrial Wage growth

     (iv)   Salary scale

     (v)   Plan expenses

ANSWER:

7. **Continued**

You are the actuary for ABC Company who sponsors three defined benefit pension plans registered in Ontario. Key plan provisions of the three plans are provided below:

	Hourly Plan	**Salaried Plan**	**Executive Plan**
Plan type:	Flat dollar benefit	Career average earnings	Final average earnings
Normal retirement benefit:	$50 per month per year of service	1.0% of earnings per year of service Accrued benefit increased annually by the increase in the Average Industrial Wage (AIW)	1.5% of final average earnings up to the final 3-year average YMPE, plus 2.0% of final average earnings in excess of the final 3-year average YMPE, per year of service Final average earnings is equal to the best five consecutive years in the past ten years.
Earnings:	Not applicable	Base salary	Base salary plus bonus
Post-retirement indexation:	2.0% per year	None	75% of the Consumer Price Index (CPI) per year to a maximum of 7% per year

In 2023, the increase in CPI was in excess of 8%. Company ABC is concerned about the impact of a persistent high inflation environment on its plans.

(b) (*6 points*) Explain how the high inflation environment could impact the plans' going concern and hypothetical wind-up liabilities.

> ANSWER:

END OF EXAMINATION