SACE
Board of SA

2012 MATHEMATICAL APPLICATIONS, Semester 1

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RE-MARKED

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

Graphics calculator ☐

Brand _____

Model _____

Computer software ☐

Thursday 7 June: 9 a.m.

Time: 1½ hours

Pages: 10
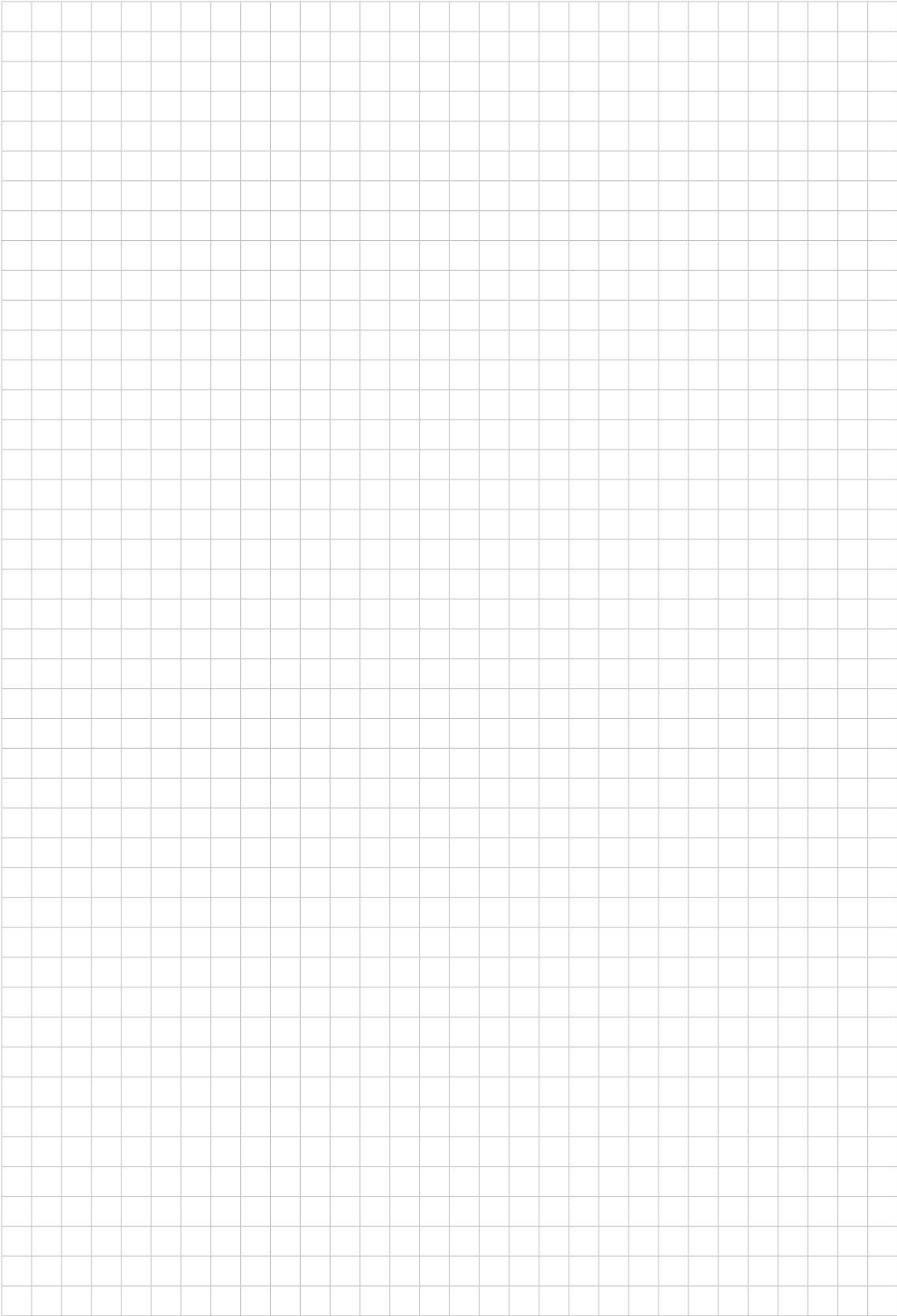Questions: 4

Topic 2: Investment and Loans

Examination material: two question booklets
two SACE registration number labels

Approved dictionaries, notes, calculators, and computer software may be used.

Instructions to Students

1. You will have 10 minutes to read the question booklets. You must not write in your question booklets or use a calculator during this reading time but you may make notes on the scribbling paper provided.

2. Each of the following five topics is printed in a separate question booklet. ***Tick the boxes by the two topics you have studied in Semester 1***:

    Topic 2: Investment and Loans ☐

    Topic 4: Matrices ☐

    Topic 5: Optimisation ☐

    Topic 6: Share Investments ☐

    Topic 7: Statistics and Working with Data. ☐

3. The total mark for each topic is 35.

4. Answer **all** parts of Questions 1 to 4 in the spaces provided in this question booklet. There is no need to fill all the space provided.

5. Show all working in this booklet. (You are strongly advised **not** to use scribbling paper. Work that you consider incorrect should be crossed out with a single line.)

6. Write on page 7 if you need more space. Make sure to label each answer carefully.

7. Use only black or blue pens for all work other than graphs and diagrams, for which you may use a sharp dark pencil.

8. Appropriate steps of logic and correct answers are required.

9. Marks may be deducted if you do not clearly show all steps in the solution of problems, if your answers have an inappropriate number of decimal places, or if you use incorrect units.

10. Diagrams, where given, are not necessarily drawn to scale.

11. Complete the box on the top right-hand side of this page with information about the electronic technology you are using in this examination.

12. Attach one of your SACE registration number labels to the box at the top of this page.

13. At the end of the examination, place one question booklet inside the back cover of the other question booklet.

QUESTION 1

Each fortnight Friedrich deposits $70 in a bank account with an interest rate of 4.65% per annum, compounded fortnightly. He wants to accumulate $8000 in this account.

(a) (i) Calculate how long (in fortnights) it will take Friedrich to accumulate $8000.

(2 marks)

(ii) Calculate the amount that Friedrich must deposit per fortnight in this bank account in order to accumulate $8000 in 3 years.

(2 marks)

(iii) If Friedrich can afford to deposit only $70 per fortnight, what interest rate would he need to obtain in order to accumulate $8000 in 3 years? Assume that the account is compounded fortnightly.

(2 marks)

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(b) With reference to your calculations, which do you consider to be the least realistic of the three options given in part (a)?

<div style="border:1px solid #ccc">(grid)</div>

(1 mark)

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QUESTION 2

Soraya has borrowed $450 000 so that she can buy a house. She has taken out the loan over 25 years, with an interest rate of 7.10% per annum, compounded monthly.

(a) (i) Calculate Soraya's monthly repayments.

(2 marks)

    (ii) Calculate the total interest that Soraya will pay over the term of the loan.

(1 mark)

(b) (i) Calculate Soraya's outstanding debt at the end of the first 12 months of the loan.

(2 marks)

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(ii) Suppose that, at the end of the first 12 months of the loan, the interest rate is reduced to 6.98% per annum, compounded monthly.

Calculate the reduced monthly repayments that Soraya could now make. Assume that the term of the loan is unchanged.

(2 marks)

(iii) Calculate the total saving that Soraya would make over the term of the loan with the reduced interest rate of 6.98% from the end of the first 12 months.

(2 marks)

(iv) Soraya decides to maintain her original monthly repayments, in spite of the reduction in the interest rate.

Explain *two* effects of this decision.

(2 marks)

QUESTION 3

James has received an inheritance of $10 000. He wants to invest the money and needs to decide between two investment options:

• Option 1 — An account that will pay a *flat* interest rate of 5.5% per annum over 4 years

• Option 2 — An account that will earn 5% per annum, compounded quarterly over 4 years.

(a) (i) Show that James will earn $2200 in interest if he chooses Option 1.

(1 mark)

    (ii) Hence, calculate the effective (comparison) interest rate for Option 1.

(2 marks)

(b) Calculate the effective (comparison) interest rate for Option 2.

(1 mark)

(c) State why it would be reasonable for James to choose Option 1.

(1 mark)

You may write on this page if you need more space to finish your answers to Topic 2. Make sure to label each answer carefully (e.g. 'Question 4(b) continued').

PLEASE TURN OVER

QUESTION 4

Pauline is 30 years old and decides to start saving for her retirement at the age of 65. She can afford to deposit $400 per quarter in a superannuation account that pays an interest rate of 7.75% per annum, compounded quarterly.

(a) Calculate the total amount of money that Pauline would have in her superannuation account by the time she is 65.

(2 marks)

(b) Calculate how long (in quarters) it would take Pauline to accumulate $24 000 in this superannuation account. Assume that her payments remain the same.

(2 marks)

(c) After 10 years, Pauline finds that she can afford to deposit only $395 per quarter in the same superannuation account. (Assume that there is $24 000 in the account at the end of 10 years.)

Calculate the total amount of money that Pauline would now have in the superannuation account by the time she is 65.

(2 marks)

If Pauline retires at 63 she would have approximately $240 000 in her superannuation account.

Pauline currently lives on $4000 per month.

(d) (i) Suppose that, when she is 63, Pauline rolls the $240 000 accumulated in her superannuation account into an annuity that pays an interest rate of 5.1% per annum, compounded monthly.

Calculate the length of time (in months) that Pauline would be able to withdraw $4000 per month during retirement.

(2 marks)

(ii) At what age would Pauline run out of money?

(1 mark)

(iii) If Pauline currently lives on $4000 per month, do you think that $4000 per month would be enough to maintain her standard of living in retirement?

Give *one* reason for your answer.

(1 mark)

Question 4 continues on page 10.

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(e) Assume that Pauline still retires at 63, with $240 000 in her annuity, which pays 5.1% per annum, compounded monthly.

Calculate how much Pauline can withdraw each month, if she wants her money to last until she is 75.

(2 marks)

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