SACE
Board of SA

External Examination 2013

2013 MATHEMATICAL APPLICATIONS, Semester 2

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MATHEMATICAL APPLICATIONS, Semester 2

Graphics calculator

Brand _____

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Computer software

Pages: 9
Questions: 4

Thursday 7 November: 9 a.m.

Time: 1½ hours in total (to complete two question booklets, one on each topic studied in Semester 2)

Topic 2: Investment and Loans

Examination material: two question booklets
one SACE registration number label

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 2:**

    Topic 1: Applied Geometry ☐

    Topic 2: Investment and Loans ☐

    Topic 3: Mathematics and Small Business ☐

    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 9 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 your SACE registration number label to the box at the top of this page on one of your question booklets. Copy the information from your SACE registration number label into the box on the front cover of your other question booklet.

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

QUESTION 1

Tom is 23 years old and is setting up his first superannuation account.

A payment is made each quarter into an account that has an interest rate of 7.3% per annum, compounded quarterly. Tom earns $32 000 annually. Tom contributes 3% of his earnings to the superannuation account and his employer contributes 11%.

(a) Show that $1120 per quarter is deposited in Tom's superannuation account.

(1 mark)

(b) Show that, when he is 65, Tom will have more than $1 200 000 in his superannuation account.

(2 marks)

(c) Calculate the amount of interest that this superannuation account will have earned by the time Tom is 65.

(1 mark)

(d) State *two* assumptions that have been made if Tom's superannuation account is to reach the amount you calculated in part (b).

(2 marks)

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(e) Tom intends to put $1 200 000 in an annuity that pays an interest rate of 3.5% per annum, compounded weekly.

(i) Calculate the weekly withdrawal that Tom could make if the money is to last for 20 years.

(2 marks)

(ii) Calculate how much of Tom's annuity will be left after 10 years. Assume that the annuity conditions and his withdrawals remain the same.

(2 marks)

(iii) Why, after 10 years (halfway through the expected term of the annuity), will more than half of the original annuity be left?
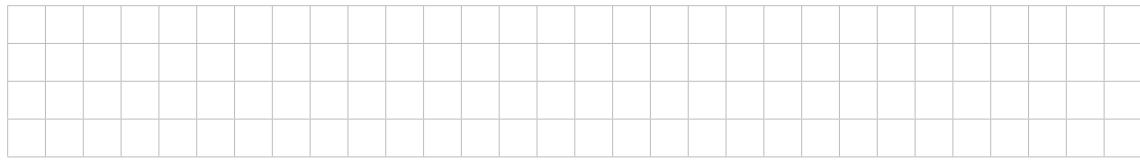
(1 mark)

PLEASE TURN OVER

QUESTION 2

Antonio has taken out a $350 000 home loan from a bank in order to buy his first home. The loan is to be repaid over 25 years and the current interest rate is 6.44% per annum, compounded monthly.

(a) (i)   Show that Antonio's monthly repayment will be approximately $2300.

(2 marks)

   (ii)   Determine the total amount of interest that Antonio will pay during the term of the loan.

(1 mark)

(b) Alternatively, Antonio is considering paying $100 more per month than the monthly repayment referred to in part (a)(i).

   How long (in months or years) would it now take Antonio to repay the loan?

(2 marks)

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(c) Determine how much interest Antonio would save by increasing his monthly repayment by $100.

(2 marks)

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QUESTION 3

Juanita is a farmer who needs to borrow $200 000 to pay for new machinery. She plans to repay the loan fully in 6 months.

(a) Juanita secures a loan at an interest rate of 7.2% per annum, compounded monthly.

(i) Calculate the monthly repayment she must make in order to repay the loan in 6 months.

(2 marks)

(ii) Calculate the total cost of the loan.

(1 mark)

(b) Juanita is investigating another option, instead of the loan described in part (a): an interest-only loan with a flat interest rate of 6.99% per annum and a sinking fund in order to save the $200 000 in 6 months.

(i) For the interest-only loan, calculate the monthly interest payment.

(2 marks)

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(ii) The sinking fund earns interest of 3.75% per annum, compounded weekly.

Calculate the weekly payment that Juanita would need to make in order to save the $200 000 in 6 months.

(2 marks)

(iii) Calculate the total cost of the interest-only loan and sinking fund option.

(3 marks)

(c) Tick the appropriate box to indicate which of the two options investigated would be cheaper.

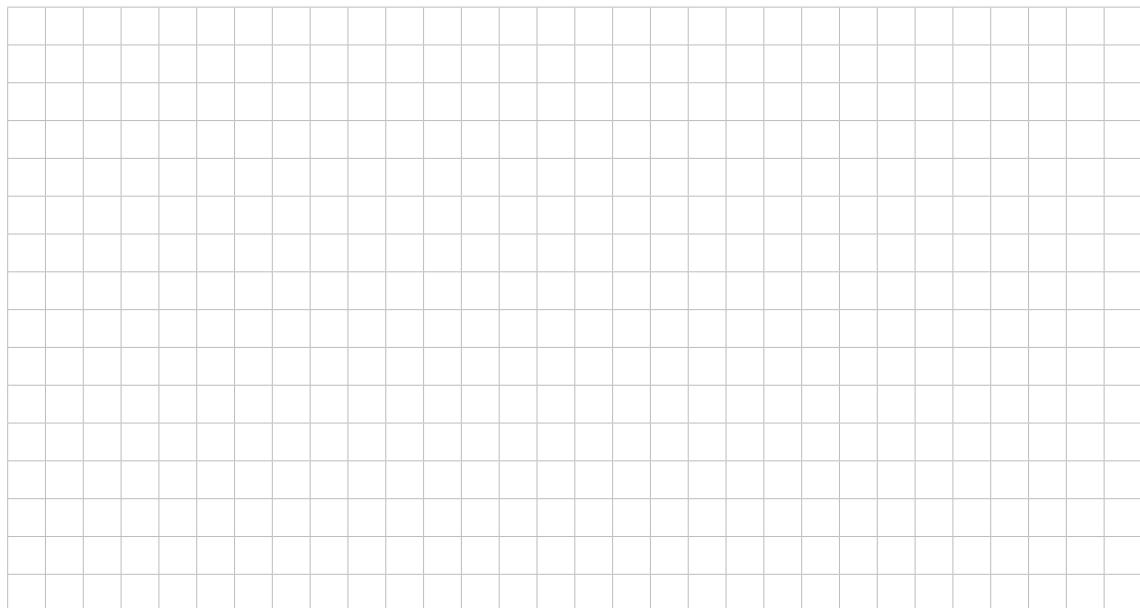• Original loan. ☐

• Interest-only loan and sinking fund. ☐

(1 mark)

PLEASE TURN OVER

QUESTION 4

Hannah wants to borrow $15 000 over 5 years and is comparing two loans. The repayments and compounding periods for both loans are fortnightly.

- Loan A has an interest rate of 9.45% per annum with an up-front fee of $100 and a fortnightly account-keeping fee of $10.
- Loan B has an interest rate of 9.70% per annum and no fees.

(a) Determine the effective (comparison) interest rate for each loan.

Write the effective interest rate for each loan in the boxes below.

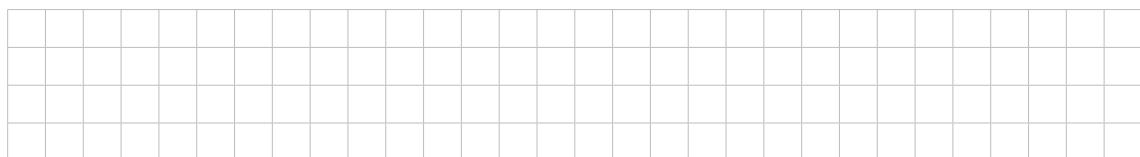Loan A effective interest rate: ☐ %

Loan B effective interest rate: ☐ %

(4 marks)

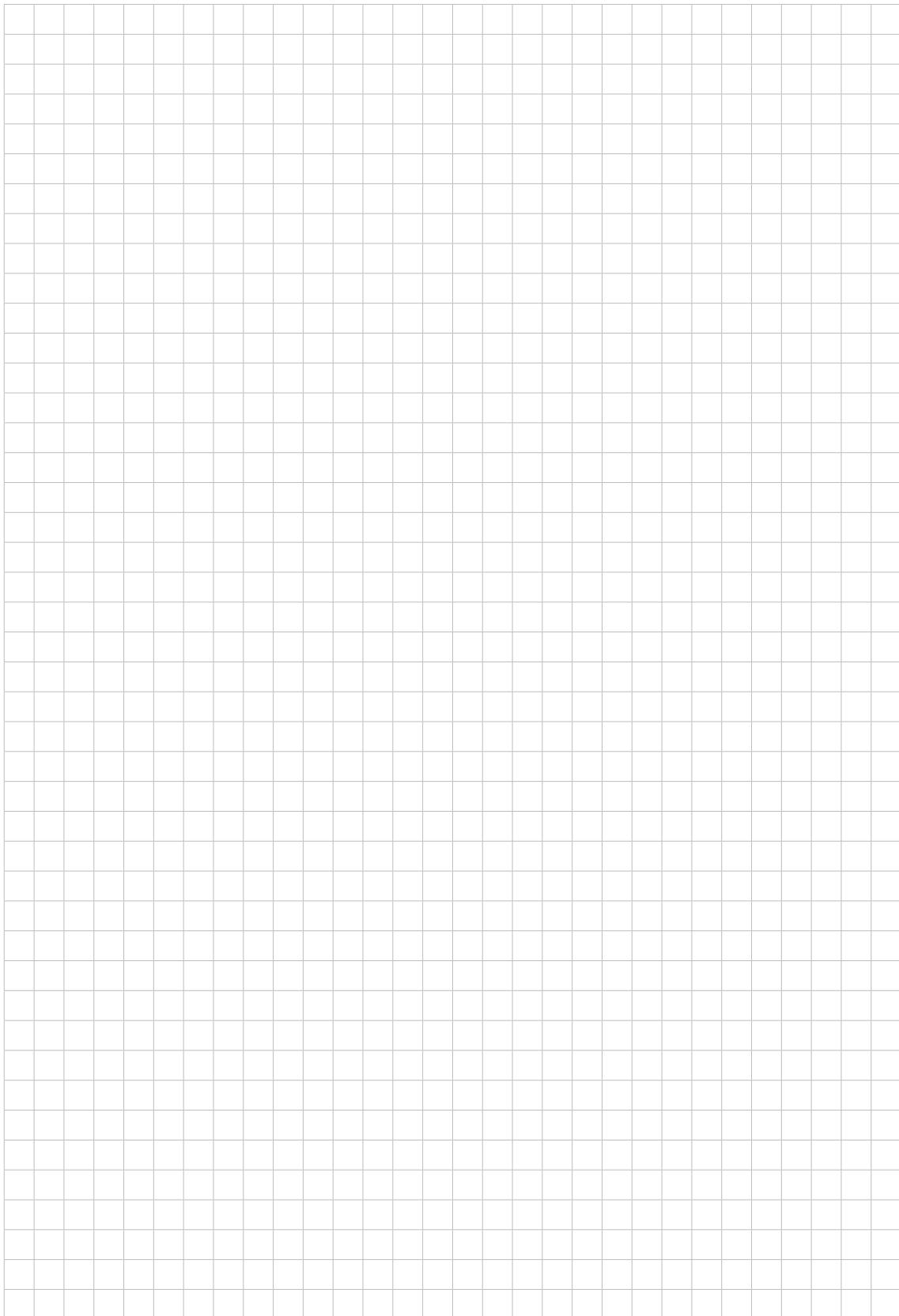(b) Which loan (A or B) has the better effective (comparison) interest rate?

Loan ☐

(1 mark)

(c) State *one* reason why Hannah may decide not to choose the loan with the better effective (comparison) interest rate.

(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(a) continued').