Actuarial Society of South Africa

EXAMINATION

15 May 2019

Subject N211 — Communications

Time allowed: Three hours

INSTRUCTIONS TO THE CANDIDATE

1. *Follow log in and saving instructions issued to you at the exam venue.*

2. *Save your work throughout the exam.*

3. *Enter all the candidate and examination details at the beginning of each question. Ensure that your Candidate number appears at the top of each page handed in. [Select "Insert", then "Header", input your candidate number on blank header template and select "Close Header"].*

4. *You have 15 minutes at the start of the exam in which to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have three hours to complete the paper.*

5. *You must not start typing your answers until instructed to do so by the invigilator/supervisor.*

6. *Mark allocations are shown in brackets on exam papers.*

7. *Attempt all questions, beginning your answer to each question on a new page.*

8. *You should show calculations where this is appropriate.*

9. *Add your word count to the bottom of Question 1. Include words in tables and graphs.*

Note: The Actuarial Society of South Africa will not be held responsible for loss of data where candidates have not followed instructions as set out above.

AT THE END OF THE EXAMINATION

Check that you have saved your work as per instructions given to you.
Hand in your question paper with any additional sheets firmly attached.

In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.

QUESTION 1

Your friend, Robert, is starting a business and applied for a loan from a bank to fund the business during its first five years. The loan has been granted and the bank is happy with the security for the loan. The bank has offered him two different loan options and Robert sent this email to you after you had spoken on the phone.

From: robertj@gmail.com
To: me@mynet.com
Date: 18 March 2019
Subject: Help!

Hi

Thanks for the chat. I really hope you can help me make the right choice on this loan. The business is ready to go and this is the last bit I need to sort out. As you know I'm cautious about money and don't need any more risk than I'm already taking on. My cash flow is going to be quite uncertain over the next while. I've attached the details that the bank sent me and I don't know how to compare the two options and get to a decision.

Please let me know which one you recommend.

Regards

Robert

From the attachment to the email you summarised the following terms:

Common to both loans:

- The loan amount borrowed is R500 000.
- The term of the loan is five years.
- Interest accrues annually in arrears and repayments to the bank are made at the end of any year they are due.

Loan option 1 – Fixed Interest

- A fixed interest rate of 14.5% per annum is charged for the whole term of the loan.
- Repayment is by five equal instalments, including both interest and capital repayment.
- There is an early settlement charge of 1.5% of the additional capital paid off for each year that the amount is paid early. Early settlement can only take place at the end of a year.

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Loan option 2 – Variable Interest

- A variable interest rate of 2% above the prime interest rate is charged annually. The prime interest rate applicable at the start of each year applies to the whole year.
- Repayment is by interest-only payments each year of the loan and the full capital repayment is due at the end of five years.
- This option does not permit any early repayment of capital.

Other information

- Robert understands how loans work and the charging of interest but would not be able to calculate the values associated with a loan himself.
- The current prime interest rate is 10.25% per annum.
- The market interest rate yield curve indicates that interest rates are expected to increase over the next five years. You are not required to show any results or calculations on any rate other than the current prime rate.
- Savings over five years can earn the annual prime rate less 3.5% and interest accrues annually in arrears.
- You need not cover anything related to the security for the loan.
- There are no options to invest anywhere else for a return of more than prime less 3.5%.

Write an email reply to Robert of no more than 650 words. Include in your email a comparison between the features of the two loans. Show him the difference between the annual and total interest he would pay on the two loans. Explain what the difference between the net interest cost of the two options would be if he were to invest the difference between the repayments of the two loans. Explain the interest cost risk associated with each of the loans.

If either of the loan options has any special features, he should be made aware of these and their implications.

You should also give reasons why your recommendation is a better match to his business's needs than the other option.

[Total 50]

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QUESTION 2

You are an actuary participating in a programme that creates excitement around mathematics for young teens. You have been asked to present at a career and subject choice day at a school and have decided to tell the story of a mathematician named Eratosthenes living in Egypt in 220 BC who discovered a method to estimate the circumference of the earth.

The message that you want to get across is the power of mathematical thinking to solve problems of the world, even when they are so vast that we can't visualise them.

One of your actuarial students was tasked with the research for this and preparing your presentation and all he managed to do before going on study leave was the note below and the first three slides.

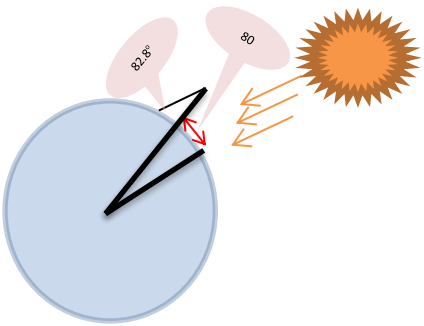
A village south of Alexandria had a deep dry well, which on midsummer's day at noon had no shadow on the walls of the well and the sun shone directly to the base of the well. In Alexandria there was a perfectly upright obelisk that could be considered perpendicular to the earth's surface i.e. makes an angle of 90^o to the earth's surface. This obelisk was measured by royal pacers to be 80 schoenus due north of the village well. On midsummer's day at noon Eratosthenes measured the angle that the imaginary line from the tip of the shadow of the obelisk to the tip of the obelisk made to the earth's surface as 82.8^o.

Aristotle had already convinced mathematicians that the earth was spherical. Eratosthenes surmised that the imaginary lines projected though the well and the obelisk must meet at the centre of the earth. The circumference of the earth could therefore comprise segments of a circle making up the 360^o around the centre of the earth.

The sun's rays striking the earth are known to be parallel to each other. The line of each segment on the earth's surface is assumed to be a straight flat line.

He then used the geometric theorem of alternate interior angles Euclid had discovered 80 years earlier to get the number of degrees that one segment made up at the centre of the earth. Knowing the distance on the earth's surface of one segment and the number of segments needed to circumference the earth the total circumference could be calculated.

Some extra information that will be useful:



- An obelisk is a tall, narrow, tapering stone monument which ends in a pyramid-like shape at the top.
- A schoenus was an Egyptian unit of length of just more than 10km.
- The interior angles of a triangle add up to 180^o.
- Euclid's theorem: If two straight lines are parallel, then a straight line that meets them makes the alternate interior angles equal.
- Circumference = number of segments of length Y on the earth's surface * Y.
- The actual circumference of the earth is 40 075Km.

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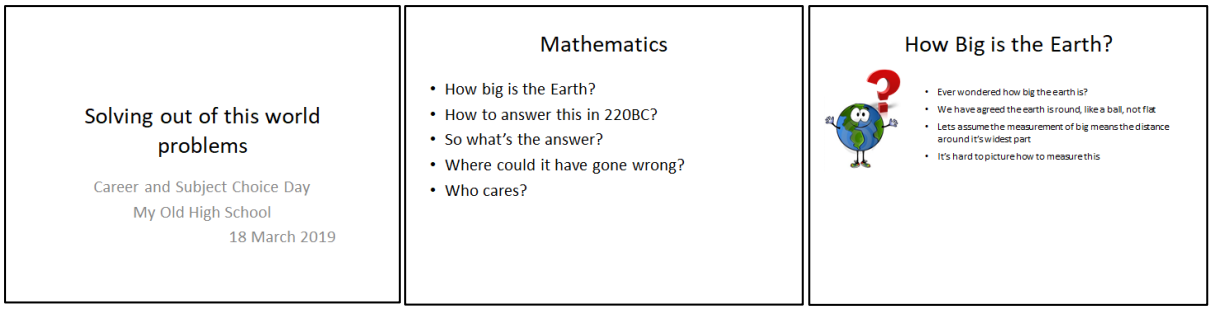
The slides the student prepared are as follows:



Your presentation of no more than nine slides including a title and concluding slide needs to cover:

- A statement of the problem that was solved by Eratosthenes
- A description of the method, with suitable graphics, to help your audience understand the method
- The measurement and other inputs he used
- The result
- Consideration of where the approach may give an inaccurate result
- A conclusion with a link to the purpose of your presentation

[Total 50]

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END OF EXAMINATION

