



## Paper 2: Finance & Modelling

July, 2019

Name: \_\_\_\_\_

Teacher:

1. This paper consists of 3 pages and an information sheet.
2. Show ALL calculations, answers only will NOT be awarded full marks.
3. Approved non-programmable calculators are permissible unless stated otherwise. Ensure your calculator is set to RADIANS
4. Round off answers to Two decimal places, unless stated otherwise.
5. Diagrams are NOT necessarily drawn to scale.

[illegible]

**Question 1****[25 Marks]**

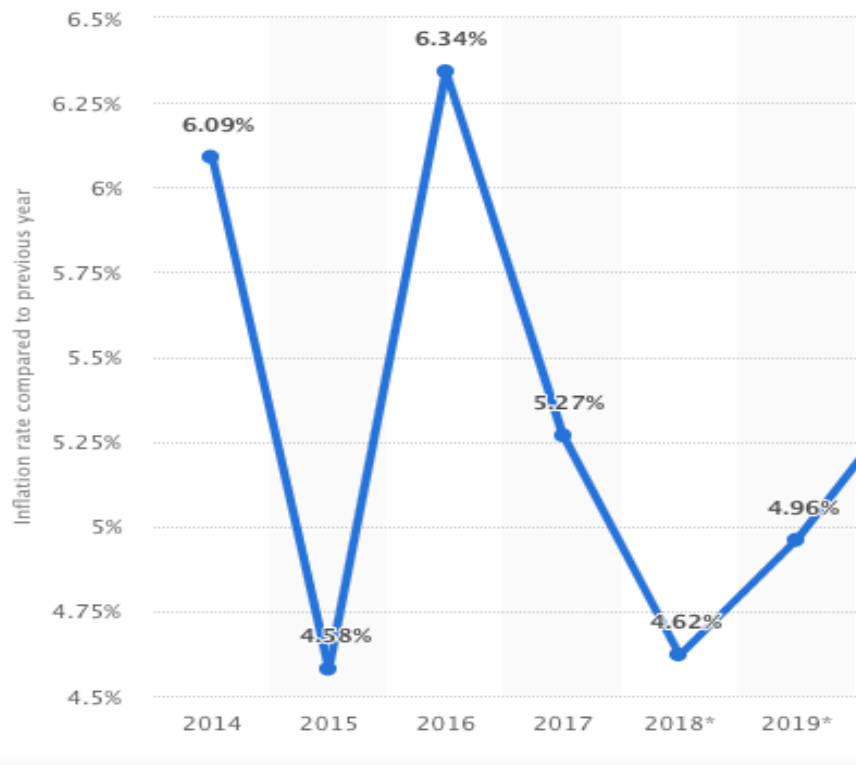
Mr Smith takes out a loan of R750 000 at an annual interest rate of 10%p.a, compounded monthly.

- (a) He plans to amortise the loan by paying R6 000 per month, starting in one month's time. Explain, with the aid of calculations, why the bank would not accept him repaying R6 000 per month. [3]
- (b) The bank instructs him to pay off the loan over a period of 8 years with equal monthly instalments, starting one month after the loan is approved. Calculate the value of these equal monthly payments. [6]
- (c)
  - (i) Mr Smith decides instead to pay off the loan with equal monthly payments of R18 000 starting 3 months after he took out the loan. Calculate how many payments he will have to make. [9]
  - (ii) Calculate the value of the final payment. [7]

**Question 2****[22 Marks]**

A contractor buys a truck for R600 000. The value of the truck depreciates by 30% per annum on a reducing balance. This truck will need to be replaced at the end of 4 years. The value of a new truck is expected to appreciate by 8% per annum due to inflation.

- (a) Calculate the resale value of the truck in 4 years' time. [3]
- (b) What should be the value of a sinking fund that needs to be set up to pay for the new truck, if the old truck is used as a trade-in? [5]
- (c) The truck will need to be serviced at the end of each year for the first 3 years at a cost of R12 000 per service. Monthly payments are made into a sinking fund account which earns interest at 12% per annum compounded monthly. Payments commence in 1 month's time. Calculate the size of the payments that need to be made each month to cover the cost of replacing the truck and the cost of the services. [14]

**Question 3****[15 Marks]****Annual Rates of Inflation for South Africa from 2014 to 2019**

The annual inflation rates for South Africa for the period 2014 - 2018 are represented on the graphic above.

- (a) If a basket of groceries cost R800,00 at the beginning of January 2014, how much would you expect it to cost at the beginning of January 2019? [6]
- (b) What is the percentage increase in the price of this basket of groceries from the beginning of January 2014 to the beginning of January 2019 correct to 2 decimal places? [3]
- (c) Use the information to determine the average rate of inflation from January 2014 to December 2018 correct to 5 decimal places. [6]

**Question 4****[21 Marks]**

- (a) The sequence given below is defined by the second order difference equation,

$$T_{n+1} = aT_n + bT_{n-1}$$

- . Determine the values of  $a$  and  $b$ . [8]

n	1	2	3	4
$T_n$	-1,5	2,00	2,25	7,125

- (b) A Malthusian model is described by the recursive formula  $T_{n+1} = p.T_n$  with  $0 < p < 1$ . Draw a graph of  $T_n$  against  $n$  (with  $n$  the independent variable) that represents the population trend for this model as  $n$  increases. [4]
- (c) A Logistic model has a carrying capacity of 120 and an initial population of 54. Two cycles later the population has reached 70. Calculate the intrinsic growth rate of the model, correct to two decimal digits. [9]

**Question 5****[17 Marks]**

In the Kruger National Park live both lion ( $L_n$ ) and wildebeest ( $W_n$ ). The latter, despite their size, are rather docile and readily fall prey to lions. The Lotka-Volterra model for these two species is given below:

$$W_{n+1} = W_n + 0,345.W_n \left(1 - \frac{W_n}{25000}\right) - 0,000655.W_n.L_n$$

$$L_{n+1} = L_n + 0,000000169.W_n.L_n - 0,083333.L_n$$

- (a) Give the average lifespan of a lion in years. [1]
- (b) Calculate, correct to six decimal places, the efficacy rate at which lions turn their food into offspring. [4]
- (c) A female wildebeest gives birth once a year to one calf. The survival rate of a calf is about 60%. Calculate, correct to one decimal place, what percentage of the wildebeest is female. [4]
- (d) The population of these two species tends to an equilibrium. Calculate the equilibrium population for lion, if the equilibrium population for wildebeest is 5500. [8]