

HERSCHEL GIRLS HIGH SCHOOL

ADVANCED PROGRAMME MATHEMATICS- GRADE 12

Paper 2-Financial Maths

DATE: September 2016
MARKS: 100

TIME: 1 HOUR

INSTRUCTIONS TO CANDIDATES:

1. This paper consists of 5 questions plus an answer sheet and formula sheet.
2. Answer ALL questions.
3. All the necessary working details must be shown with your answer.
4. Clearly number all your questions correctly.
5. Non-programmable calculators may be used unless the question states otherwise.
6. Round off your answers to TWO decimal digits correctly unless the question states otherwise.

Question 1[16]

- 1.1 A recursive formula $u_n = -3u_{n-1} + ku_{n-2}$ produces a sequence which begins:

$$2 ; 5 ; m ; 41 ; \dots$$

Determine the values of k and m . (4)

- 1.2 You open a savings account and deposit R5 000 every quarter, starting immediately.

The account earns interest at a rate of 7,2% p.a. compounded quarterly for the first 4 years and then at 7,8% p.a. compounded quarterly for the next 5 years.

The last payment you make will be made 6 months before the end of the 9 years.

Calculate the balance in the account after 9 years. (12)

Question 2[32]

You buy a house for R2 150 000. You are required to pay a 15% deposit in order to secure a home loan from the bank for the remainder of the money.

The bank charges interest at a rate of 10,5% p.a. compounded monthly and payments start one month after the granting of the loan.

The loan is to be repaid over a period of 20 years from the granting of the loan.

- 2.1 Calculate the monthly payments and hence the balance outstanding immediately after the 50th payment is made. Give the answer rounded off to the nearest rand. (10)

Immediately after the 50th payment is made the interest rate changes to 11,2% p.a. compounded quarterly. You are still required to make monthly payments.

- 2.2 Calculate your new payment from the 51st payment onwards if you are still to repay the loan in the original agreed time period. (6)

- 2.3 Show that the balance outstanding after the 140th payment is R1 228 670, rounded off to the nearest rand. (4)

You decide to take out a further loan of R260 000 in order to do renovations to your house. This new loan is added to the balance outstanding of R1 228 670

from your previous loan and the monthly payments for the new loan are to start one month later. The new interest rate on the loan is 12,6% p.a. compounded monthly.

You hit a personal problem and only start repaying the new total loan 10 months after the new loan was granted. You negotiate a new agreement with the bank and agree to pay a monthly instalment of R21 250.

- 2.4 Calculate how many payments of R21 250 will be required and the value of the final, lesser payment which clears the loan. (12)

Question 3[8]

The number of yeast cells in a new laboratory culture grows from 18 to 80 over the course of 4 hours.

- 3.1 Determine the hourly intrinsic growth rate of the culture.
[Give the answer as a percentage correct to 2 decimal places] (4)
- 3.2 Write a Malthusian difference equation to represent the population growth on an hourly basis for the population and use it to determine the yeast population after 7 hours. (4)

Question 4[21]

A population of 25 zebra are kept in a protected reserve. Their population increases before levelling off to a stable population.

The table below records the zebra population at yearly intervals.

n	P_n	ΔP	$\Delta P/P_n$
0	25		
1	31	9	A
2	43	12,5	0,290698
3	56	B	C
4	59	2	0.033898
5	D		

- 4.1 Complete the table by calculating the values of A, B, C and D giving the answers to A and C correct to 6 decimal places. (4)
- 4.2 Determine the equation of the straight line representing the relationship between the growth rate and the population. [Give the gradient in scientific

notation correct to 3 decimal places and the y-intercept correct to 5 decimal places] (3)

4.3 Calculate, as a percentage correct to 2 decimal places, the annual intrinsic growth rate for this model. (2)

4.4 Draw a labeled, sketch graph of the population growth versus time for the zebra population. (3)

4.5 Express the growth of the zebra population as a recursive formula. Use it to calculate the zebra population after 8 years. What can be concluded about the zebra population after 8 years? (5)

4.6 How many of the zebra should be sold each year if it is decided to maintain a stable population of 63 at the reserve? (4)

Question 5[23]

Consider a population of 25 tundra wolves, W_n , and 1 500 caribou, C_n , living in an area in northern Canada.

Their annual interaction has been modelled by the equations:

$$C_{n+1} = C_n + 0,05C_n \left(1 - \frac{C_n}{K}\right) - bC_nW_n \text{ and}$$
$$W_{n+1} = W_n + 0,0001C_nW_n - 0,05W_n$$

5.1 If the 1 500 caribou in the area represent 88,24% of the carrying capacity for the area, determine, to the nearest whole number, the carrying capacity for the area. (2)

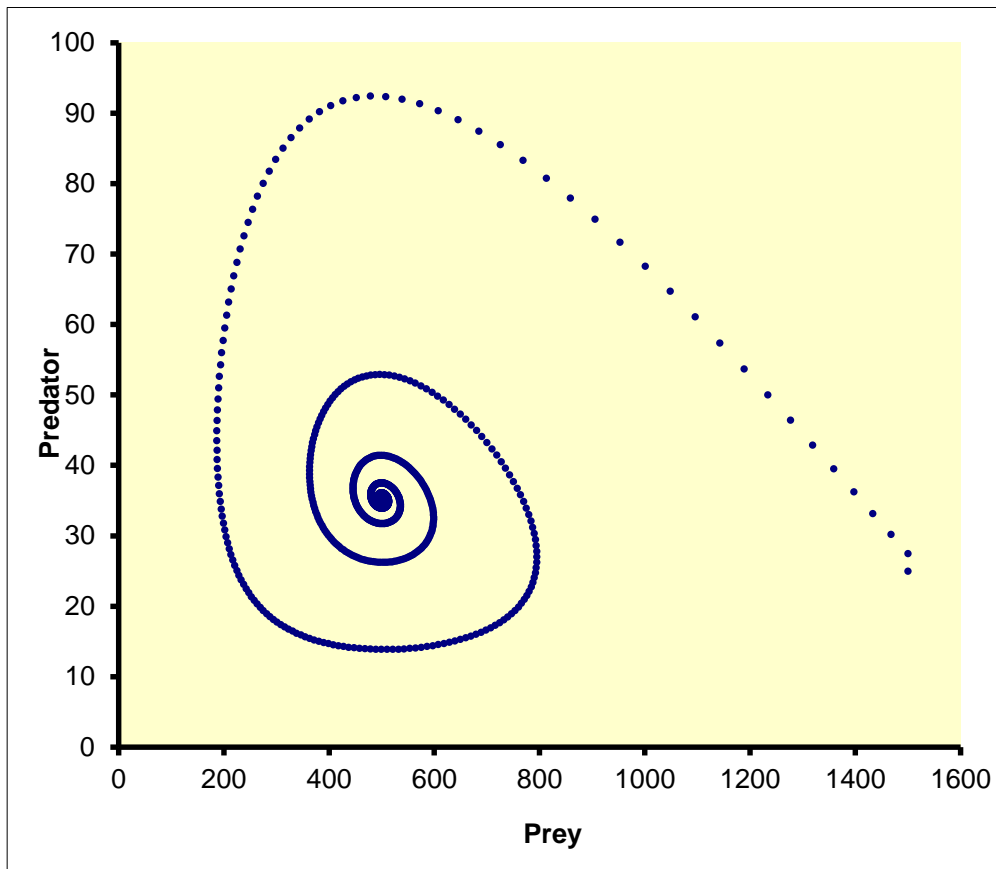
5.2 Determine the average lifespan of a wolf, in years. (2)

5.3 A female caribou gives birth to 2 calves every year. The percentage of females is 45%. Calculate, to 1 decimal place, the percentage of calves that survive. (3)

5.4 The population of the 2 species tends to an equilibrium or stable state. If the equilibrium population for the wolves is 35, calculate the rate at which encounters between the 2 species result in the death of the caribou. [Give the answer as a percentage correct to 1 decimal place] (3)

5.5 Calculate the equilibrium population of the caribou. (3)

The graph shows how the number of wolves and caribou change from one cycle to the next. A copy of the graph appears on the answer sheet. Use the graph to answer the questions that follow.



- 5.6 Indicate on the graph on the answer sheet where the maximum number of wolves and minimum number of caribou can be read off from the graph. [Use the letters A and B to indicate the answers] (2)
- 5.7 On the graph, indicate where the equilibrium number of caribou can be read off. [Use the letter C on the graph] (1)
- 5.8 Indicate, using the letter D on the graph on the answer sheet, when the wolf population first started to decrease. (1)

5.9 Indicate, using the letter E on the graph on the answer sheet, the first population cycle where the wolves start increasing and the caribou start decreasing. (1)

5.10 If the wolf population changed to

$$W_{n+1} = W_n + 0,0005C_nW_n - 0,05W_n$$

explain, without any further calculations, how the equilibrium populations of the wolves and caribou would change. [Assume other parameters remain the same] (5)

Total: 100

Answer Sheet

Name: _____

Question 5

