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*Bastion of Knowledge...*

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OFFICE OF THE DEPUTY PRINCIPAL  
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

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# UNIVERSITY EXAMINATIONS

## 2021/2022 ACADEMIC YEAR

FIRSTYEARSECOND SEMESTER REGULAR EXAMINATION

**FOR THE DEGREE OF BACHELOR OF SCIENCE  
(APPLIED STATISTICS WITH COMPUTING)**

**COURSE CODE: STA 115**

**COURSE TITLE: INTRODUCTION TO MATHEMATICS FOR  
FINANCE**

**DATE: 08/06/2022**

**TIME: 2.00PM – 5.00PM**

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### INSTRUCTION TO CANDIDATES

- SEE INSIDE

**THIS PAPER CONSISTS OF 4 PRINTED PAGES**

**PLEASE TURN OVER**

**REGULAR – MAIN EXAM**

**STA 115: INTRODUCTION TO MATHEMATICS FOR FINANCE**

**STREAM:ASC**

**DURATION: 3 Hours**

**INSTRUCTION TO CANDIDATES**

Answer **ALL** questions from section A and any **THREE** from section B.

**SECTION A [31 Marks]. Answer ALL questions.**

**QUESTION ONE [15 Marks]**

- a) Explain clearly the following terms as used in finance [2 Marks]  
i) Present value of money  
ii) Annuity
- b) Find the slope of the line that passes through the points, (5,-3) (-2,-3) [2 Marks]
- c) Suppose a businessman borrowed \$7500 at 7% simple interest for 10 months in order to buy furniture for his premises. How much interest will he pay? [3 Marks]
- d) Find the maturity value for loan of \$4500 to be repaid in 7 months with simple interest of 7.7% [3 Marks]
- e) A firm producing poultry feed finds that the total cost  $C(x)$  in dollars of producing and selling units is given by  $C(x) = 18x + 117$ .  
Suppose the management plans to charge \$32 per unit for the feed. Find the number of units that must be sold for the firm to break even and to give a profit of \$1250 [5 Marks]

**QUESTION TWO [16 Marks]**

- a) Define perpetuity [2 Marks]
- b) Find an equation in slope-intercept form for the line with -intercept 7 and -intercept 2 [2 Marks]
- c) Suppose \$1200 is deposited for 8 years in an account paying 6.25% per year compounded annually. Find the;  
i) Compound amount [2 Marks]  
ii) Amount of interest earned [1 Mark]
- d) Find the amount of interest earned by a deposit of \$4258 for 12.5 years at 7.73% compounded quarterly [3 Marks]
- e) Suppose two individuals A and B agree to contribute to the endowment fund where A says that he will give \$500 at the end of each year for 9 years and B prefers to give a lump sum today. What lump sum can he give that will equal the present value of A annual gifts, if the endowment fund earns 7.5% compounded annually? [3 Marks]
- f) Let  $A$  be a matrix given as  
 $A = \begin{bmatrix} 2 & -4 \\ 1 & -2 \end{bmatrix}$  Find the inverse of  $A$  [3 Marks]

**SECTION B [39 Marks] [Answer any THREE Questions]****QUESTION THREE [13 Marks]**

- a) Solve the following exponential equation [4 Marks]

$$32^{2x-1} = 128^{x+3}$$

- b) A recent study on salmon have found that the oxygen consumption of yearling salmon increases exponentially with the speed of swimming according to the function defined by  $f(x) = 1000e^{0.09x}$  where  $x$  is the speed in feet per second.

Find oxygen consumption

- i) when the fish are still [2 Marks]  
ii) at a speed of 2 ft per second [2 Marks]
- c) Consider the following production data

Year	2013	2014	2015	2016	2017	2018	2019	2010	2021
Production(kgs)	2.207	2.616	2.918	3.224	3.713	6.225	6.914	10.213	12.256

Find an exponential function in the form of  $p(x) = p_0a^{x-2014}$  that models this data, where  $x$  is the year and  $p(x)$  is the production. Use the data for 2014 and 2021 [5 Marks]

**QUESTION FOUR [13 Marks]**

- a) When is a loan said to be amortized? [2 Marks]
- b) Assume that an individual buys a truck for \$307,200, with a down payment of \$115,900. He take out a 20-year loan for \$285,300 at an annual interest rate of 6%. Find the;
- iii) amount of the monthly payment needed to amortize this loan [4 Marks]
- iv) total amount of interest paid when the loan is amortized over 20 years [3 Marks]
- v) part of first payment that is interest and part that is applied to reducing the debt. [4 Marks]

**QUESTION FIVE [13 Marks]**

- a) Use the inverse of the coefficient matrix to solve the system [6 Marks]

$$2x - 3y = 4$$

$$x + 5y = 2$$

- b) Use the Gauss-Jordan method to solve the system [7 Marks]

$$x + 5z = -6 + y$$

$$3x + 3y = 10 + z$$

$$x + 3y + 2z = 5$$

**QUESTION SIX [13 Marks]**

- a) Suppose a farmer raises only goats and sheep and that he wants to raise no more than 16 animals, including no more than 10 goats. He spends \$25 to raise a goat and \$75 to raise a sheep, and he has \$900 available for his project. Each goat produces \$12 in profit whereas each sheep produces \$40 in profit. How many goats and how many sheep should he raise in order to maximize total profit? [8 Marks]
- b) Suppose that a manager of a supermarket has studied the supply and demand for watermelons. He has noticed that the demand increases as the price decreases. He has determined that the quantity (in thousands) demanded weekly dollars) per watermelon,  $p$ , are related by the linear function  $p = D(q) = 9 - 0.75q$
- Find the;
- i) quantity demanded at a price of \$5.25 per watermelon [2 Marks]
  - ii) equilibrium quantity and price for the watermelon [3 Marks]

**QUESTION SEVEN [13 Marks]**

- a) Draw a graph that shows feasible region for the following system [4 Marks]
- $$4x - 5y \leq 10$$
- $$x + 2y \leq 8$$
- $$x \geq 0$$
- $$y \geq 0$$
- b) Suppose a local manufacturing industry makes product P and Q, both of which must be processed by mixing. Manufacturing one batch of product P requires 1 hour of mixing in stage I and 2 hours in stage II, and producing one batch of product Q requires 2 hours in the stage I and 1 hour in stage II. Each stage is operated for at most 12 hours per day.
- i) Write a system of inequalities that expresses these restrictions [3 Marks]
  - ii) Using a graph determine whether 3 batches of product P and 2 batches of product Q can be manufactured in one day. Also can 4 batches of product P and 6 batches of product Q be manufactured in one day? Justify your answer [6 Marks]

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