This paper is intended to equip the candidate with knowledge, skills and attitudes that will take him/her through decision making. It demonstrates how financial mathematics formulas can be used to conduct detailed analysis on a set of data and variables.

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FINANCIAL MATHEMATICS REVISION KIT

CIFA

UPDATED WITH NOVEMBER 2019 PAST PAPER

INTRODUCTION

Following our continued effort to provide quality study and revision materials at an affordable price for the private students who study on their own, full time and part time students, we partnered with other team of professionals to make this possible.

This Revision kit book (Question and answers) contains kasneb past examination past papers and our suggested answers as provided by a team of lecturers who are experts in their area of training. The book is intended to help the learner do enough practice on how to handle exam questions and this makes it easy to pass kasneb exams.

Special appreciation and recognition goes to FA Kegicha William Momanyi (MBA Accounting, CPA, CISA and CCP), Johnmark Mwangi (MSc Finance, CPAK, BCom Finance) and FA Bramwel Omogo (B.sc Acturial Science, CIFA, CIIA final level and ICIFA member), CPA Gregory Mailu (Bsc. Economics) CPA Dominc Rasungu and CPA Lawrence Ambunya among others.

PAPER NO.2 FINANCIAL MATHEMATICS
GENERAL OBJECTIVE
This paper is intended to equip the candidate with knowledge, skills and attitudes that will enable him/her to apply financial mathematics in decision making.

2.0   LEARNING OUTCOMES
A candidate who passes this paper should be able to:
- Compute present and future values of cash flows
- Apply financial forecasting techniques in business
- Apply mathematical functions in finance
- Apply statistical tools in finance
- Use of probability to solve business problems
- Compute and interpret index numbers
- Use of financial calculators to solve financial problems.

CONTENT
2.1   Introduction to financial mathematics
- Nature and scope of finance; financing, investment, management of working capital and profit sharing (dividend policy) decisions
- Relationship between finance and other disciplines; finance and economics, finance and accounting, finance and mathematics
- Purpose of financial modeling

2.2   Financial algebra
- Simultaneous and quadratic equations
- Developing finance functions
- Interactive graphs; graphing financial functions
- Overview of calculator operations: Turning on and off the calculator, selecting second functions, setting calculator formulae, clearing calculator memory, mathematical operations, memory operations, using worksheets

2.3   Time value of money and interest rate mathematics
- Concept of interest rates and inflation
- Simple interest
- Compound interest
- Continuously compounded interest
- Present values
- Basics of capital budgeting
- Loan amortisation

- Time value of money and amortisation worksheets, entering variables in amortisation worksheets, entering cash inflows and outflows, generating amortisation schedules
- Cash flow worksheets; calculator worksheet variables for both even and uneven and grouped cash flow, entering, deleting, inserting and computing results
- Bond worksheets: Bond worksheets variables and terminology, entering bond data and computing results
- Depreciation worksheets; depreciation worksheet variables, entering data and computing results
- Other worksheets: Percentage change/compound interest worksheets, interest conversion worksheets, profit margin worksheets, break-even worksheets, memory worksheets

2.4 Financial forecasting

- Need for financial forecasting
- Techniques of forecasting: statistical and non-statistical methods
- Time-series components and analysis
- Share valuation
- Fixed income models for bonds and construction of yield curves
- Regression and correlation
- Use of financial calculators in regression and correlation models, entering data, computing the results and interpretation

2.5 Financial calculus

- Introduction to calculus
- Differentiation; ordinary and partial derivatives
- Integration
- Application of calculus to solve financial problems relating to maximisation of returns and minimisation of costs

2.6 Descriptive statistics

- Measures of central tendency; mean, mode, median
- Measures of relative standing; quartiles, deciles, percentiles
- Measures of dispersion; range, mean deviation, variance, standard deviation, coefficient of variation
- Statistical worksheets; statistical worksheet variables, computing statistical results and interpretation

2.7 Probability theory

- Relevance of probability theory
- Events and probabilities
- Probability rules
- Random variables and probability distributions

- Binomial random variables
- Expected value
- Variance and standard deviation
- Probability density function
- Normal probability distribution
- Stochastic functions
- Application of probability to solve business problems

2.8 Index numbers

- Purpose of index numbers
- Construction of index numbers
- Simple index numbers; fixed base method and chain base method
- Weighted index numbers; Laspeyre's, Paasche's, Fisher's ideal andMarshall-Edgeworth's methods
- Consumer Price Index (CPI)
- Use of Consumer Index Price (CPI); inflation, cost of living
- Limitations of index numbers

2.9 Emerging issues and trends

CONTENT   **PAGE**

Past papers

Suggested answers and solutions:

PAST PAPERS

KASNEB

C1FA PART I SECTION 1

FINANCIAL MATHEMATICS

TUESDAY: 26 November 2019.   Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a)   Explain four types of finance.   (8 marks)

(b)   Analyse the relationship between the discipline of finance and:

    i.   Financial accounting.   (2 marks)

    ii.   Cost accounting.   (2 marks)

    iii.   Management accounting.   (2 marks)

(c)   Solve the following equation using matrix method:

$4x - 3y = 9$

$3x - 2y = 7$

(6 marks)

(Total: 20 marks)

QUESTION TWO

    a) Explain four steps involved in the capital budgeting process.   (8 marks)
    b) Riko Ltd. would like to purchase a machine to produce product "J". The production manager has identified two machines, X and Y, which may be used to produce "J". Information relating to the two machines is as follows:

Machine

	X	Y
Cost (Sh.)	900,000	600,000
Annual net cash flows (Sh.)	240,000	168,000
Useful life (years)	6	6
Required rate of return (%)	11	11

Required:

i) Internal rate of return (1RR) for machine X and machine Y. (5 marks)

ii) Net present value (NPV) for machine X and machine Y. (5 marks)

iii) Advise the production manager on which machine to purchase based on the information in (b) (i) and (b) (ii) above. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a)   The test scores in a college admission test are normally distributed with a mean of 450 and a standard deviation of 100.

Required:

i. The percentage of candidates who score between 400 and 500 marks. (3 marks)

ii. The percentage of candidates who score better or worse than candidates who scored 630 marks. (3 marks)

iii. The percentage of candidates admitted to college given that the cut off mark is 480. (3 marks)

(b)   The following table shows the daily production in kilogrammes of two machines in a factory, machine A and machine B, and the frequency of production per machine in hours.-

Machine

Production	A	B
Kilogrammes	Hours	Hours
100 — 104	6	10
145 — 109	8	13
110 — 114	13	17
115 — 119	21	26
120 — 124	17	20
125 — 129	11	15
130 — 134	8	12
135 — 139	4	9
140 — 144	2	3
	90	125

Required:

(i)   The mean production of each machine.   (3 marks)

(ii)   The standard deviation of each machine.   (6 marks)

(iii) The coefficient of variation of each machine.   (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a)   The following data relates to sales made by AFL Limited for the past four years:

YEAR	QUARTERLY SALES (Sh. millions)			
	1	2	3	4
2015	52.3	48.3	57.8	53.5
2016	51.4	47.6	50.2	52.8
2017	50.9	46.1	49.5	51.6
2018	49.2	45.3	48.7	50.3

Required:

(i)   A simple regression analysis equation for the data.   (6 marks)

(ii)   The expected sales in the year 2019 using the function obtained in (a) (i) above.

(b)   Urembo Ltd. manufactures lipstick. "Red Rose" is their most popular brand. The marketing department has estimated the demand function for "Red Rose" is linear. If the price of Red Rose was fixed at Sh.570, the daily sales of the lipstick would be 400 pieces, whereas if the price is increased to Sh.820, the daily sales would drop to 200 pieces. Data from the production department indicates that the marginal cost (MC) of producing Q pieces of "Red Rose" is given by the equation:

$$MC = 2Q - 570$$

The daily fixed cost is Sh.1,100.

Required:

(i)   The revenue if Q pieces of Red Rose are sold.   (4 marks)

(ii)   The total cost function.   (2 marks)

(iii)   The daily break-even number of pieces.   (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Outline four applications of index numbers in a business environment.   (4 marks)

(b) The following tables show prices and quantities of cereals over the years 2015-2018:

FINANCIAL MATHEMATICS

NOVEMBER 2019

SUGGESTED ANSWERS

QUESTION ONE

a) **Types of finance**

Finance is the management of money and includes activities such as investing, borrowing, lending, budgeting, saving and forecasting. Types of finance include:

1. **Personal finance**: this refers to managing the finance or funds of an individual and helping them achieve their desired goals. Personal finance is specific to individuals and the strategies on the individuals earning potential, requirements, goals, time frame e.t.c. Personal finance include investment in education, assets like real estate, cars, life insurance policies, saving and expense management

2. **Corporate finance:** is about funding the company expenses and building the capital structure of the company. It deals with source of funds and the channelization of those funds like the allocation of funds for resources and increasing the value of the company by improving the financial position. Corporate finance focus on maintaining the balance between the risk and opportunities and increasing the asset value

3. **Public finance:** finance that is related to states , municipalities, provinces e.t.c. this is simply government required finance

4. **Micro-finance:** also known as microcredit. This type of finance is designed for individuals who do not have easy access to financial services. These individuals include unemployed and lower income group individuals.

5. **Trade finance:** includes financial services and instruments that enable and facilitate trade intermediary.

b) **Relationship between finance and:**

    i. **Financial accounting** - Finance is a future looking concept which makes use of past data in accounting to make decision related to future. Without accounting data finance will find it difficult to make above decisions and also accounting will not be effective if it is not used along with finance.

    ii. **Cost accounting** - Cost accounting focuses on inventory valuation and operations performance in efforts to improve product gross margin while

finance supports strategy as management is faced with how to grow the business through capital investment and acquisition

iii. **Management accounting** - Finance combines economic principles with accounting practices to help executives and management teams make smart business decisions. Finance and managerial accounting are the two major components that make up managerial accounting. Although each serve different functions, both complement each other when it comes to helping managers make important financial and operational decisions.

c) **Solving equation using matrix method**

3x – 3y = 9
3x – 2y = 7

Using Cramers rule

Value of X

$$\begin{pmatrix} 4 & -3 \\ 4 & -2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 7 \end{pmatrix}$$

$$X = \frac{Determinant \begin{pmatrix} 9 & -3 \\ 7 & -2 \end{pmatrix}}{Determinant \begin{pmatrix} 4 & -3 \\ 3 & -2 \end{pmatrix}}$$

$$X = \frac{(9 \times -2) - (7 \times -3)}{(4 \times -2) - (3 \times -3)}$$

$$X = \frac{-18 + 21}{-8 + 9} = \frac{3}{1}$$

$$X = 3$$

Value of Y

$$Y = \frac{Determinant \begin{pmatrix} 4 & 9 \\ 3 & 7 \end{pmatrix}}{Determinant \begin{pmatrix} 4 & -3 \\ 3 & -2 \end{pmatrix}}$$

$$Y = \frac{(4 \times 7) - (3 \times 9)}{(4 \times -2) - (3 \times -3)}$$

$$Y = \frac{28 - 27}{-8 + 9} = \frac{1}{1}$$

$$Y = 1$$

QUESTION TWO

a) Steps involved in capital budgeting process

Capital budgeting is a multi-step process business used to determine how worthwhile a project or investment will be. A company might use capital budgeting to figure out if it should expand its warehouse facilities, invest in new equipment or spend money on specialized employee training. The process of capital budgeting consists of five steps:

1. **Generalization of investment proposal:** proposals originate from various departments in an organization e.g the production department may propose how to buy a new advanced machine or replace an existing one
2. **Estimation of cash flows**: cash flows are inflows or outflows of cash respect of a project. Since project cash flows are to be received in future, care must be taken to ensure that correct estimates are done. Upon investigation of cash inflows and outflows, the two are used to come up with net cash flows.
3. **Evaluation of cash flows:** this helps the organization in making the decision on whether or not to invest in a given project. This will help in making investment decisions such as expanding the project, acquisition or replacement. To help in project evaluation, methods like payback period and net present value method are used to determine viability of projects
4. **Implementation:** hereby the company chooses to move forward with a project, it will need an implementation plan. The plan should include a means of paying for the project at hand, a method for tracking costs and a process of recording cash flows or the benefits of the projects. The implementation plan should also include a timeline with key project milestones, including an end date if applicable.
5. **Monitoring and supervision:** overseeing the actual project and ensuring everything is going as per plan

b) Riko Ltd
i. IRR for machines X and Y

Internal rate of return for machine X

Estimated annuity factor machine X

$$\frac{900,000}{240,000} = 3.75$$

From present value of annuity table 3.75 lies between 15% and 16%

Thus,

NPV when discount rate is 15%