MASOMO MSINGI PUBLISHERS

FINANCIAL MATHEMATICS REVISION KIT

CIFA

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UPDATED WITH 2020 EXAMINATION 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 Dominic 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 and Marshall-Edgeworth's methods
- Consumer Price Index (CPI)
- Use of Consumer Index Price (CPI); inflation, cost of living
- Limitations of index numbers

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PAST PAPERS

KASNEB

C1FA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 23 November 2020. **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) Suggest four applications of financial mathematics in finance and investments.

(4 marks)

(b) The following data shows the distribution of profits realised by 80 branches of a multinational company for the year ended 31 December 2019:

Profit/loss Sh."million"	**Number of branches**
-20 < - 10	4
- 10 < 0	8
0 < 10	14
10 < 20	38
20 < 30	10
30 < 40	6

Required:

i. The average profit of the multinational company. (2 marks)

ii. The standard deviation and the coefficient of variation. (4 marks)

iii. The median profit. (3 marks)

iv. One of the managers commented that the distribution of profit seems to be negatively skewed.

Explain to him the meaning of "negatively skewed profit". (2 marks)

(c) Jackson Kipruto deposited Sh.100,000 in two different banks, X and Y, dividing the amount into two investments.

Bank X calculates interest at a compound interest rate of 7% per annum while bank Y calculates interest at the rate of 6% per annum convertible semi-annually.

At the end of 3 years, Jackson received Sh.21,264.70 as the return on his investment.

Required:

The amount deposited by Jackson in bank X and bank Y respectively. (5 marks)

(Total: 20 marks

QUESTION TWO

(a) Examine three benefits of investing in corporate bonds. (6 marks)

(b) James Kimondo deposited Sh.252,350 in an investment fund at an annual interest rate of 5% compounded continuously.

Required:

(i) The compound amount and the interest earned after 8 years. (4 marks)

(ii) The effective rate of interest. (2 marks)

(iii) The time required for the original amount of Sh.252,350 to grow to Sh.1,030,000. (2 marks)

(c) Fredrick Nabuye's family bought a house for Sh.28,325,000. They made a down

payment of Sh.5,665,000 and took a 30-year mortgage for Sh.22,660,000 at an annual interest rate of 6%.

Required:

(i) The amount of the monthly payment required to amortise the loan. (2 marks)

(ii) The total amount of interest paid when the loan is amortised over the 30 year period. (2 marks)

(iii) The part of the first payment that is interest and the part that is applied to reducing the loan amount. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) As a junior financial analyst at Bob capital, you have been approached by a client with a newspaper advertisement on treasury bonds from Central Bank. The client is confused on various terminologies used in the article and is seeking your guidance.

Required:

Explain to your client the following terms:

(i) Coupon rate. (1 mark)

(ii) Call date. (1 mark)

(iii) Redemption date. (1 mark)

(iv) Yield to maturity. (1 mark)

(iv) Discount bond. (1 mark)

(vi) Premium bond. (1 mark)

(b) The following data relates to all the employees of ABC Ltd.:

Age (Years)	Bachelors Degree	Masters Degree	Total
Under 30	90	10	100

30 — 40	20	30	50
Over 40	40	10	50
Total	150	50	200

Required:

i. A joint probability table to represent the above data. (4 marks)

ii. The probability that an employee selected at random from the company has only a bachelor's degree. (2 marks)

iii. The probability that an employee selected at random has a masters degree given that he is over 40 years. (2 marks)

iv. The probability that an employee selected at random is under 30 years given that he has only a bachelors degree. (2 marks)

(c) XYZ Ltd. intends to invest in a project with the following estimated cash flows:

Year	0	1	2	3	4	5	6
Cash in flows (Sh."000")	-	-	30,000	40,000	40,000	40,000	40,000
Cash out flows (Sh."000")	120,000	20,000					

The company's cost of capital is 12% per annum.

Required:

i. The net present value (NPV) of the project. (3 marks)

ii. Advise the management of XYZ Ltd. on whether to accept or reject the project based on your results in (c) (i) above. (1 mark)

(Total: 20 marks)

QUESTION FOUR

(a) Describe four applications of differential calculus in finance. (4 marks)

(b) Hedmax Limited has developed the following functions to assist in monitoring the operations of the company:

Total cost (TC), C = 14 + 3x

Total revenue (TR), R = 19x - $2x^2$

Where X is the level of output in thousands of shillings (Sh. "000").

Required:

(i) The total profit function. (2 marks)

(ii) The breakeven point. (3 marks)

(iii) The level of demand necessary to maximize profit. (2 marks)

(iv) The maximum profit obtained. (1 mark)

(c) Christopher Marwa bought 12 dozen digital watches for his shop located at the Nairobi Central Business District. He sold some of the digital watches at Sh.400 each and some at Sh.250 each. His total receipts amount to Sh.51,000.

Required:

The number of watches he sold at Sh.400 and Sh.250 respectively. (4 marks)

(d) In a certain profession, it was found that 10,000 employees had a mean monthly income of Sh.175,000 with a standard deviation of Sh.5,000. The income in this profession follows a normal distribution.

Required:

The percentage of the employees earning a monthly income greater than Sh.166,800.

(4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Assess two properties of coefficient of correlation. (4 marks)

(b) The table below shows the dividend yields (x) and share prices (y) of a number of companies listed on the Securities

Exchange during the year 2019:

Company	Dividend yield (%)	Share price (Sh.)
A	12	130
B	16	145
C	17	167
D	18	187
E	22	220
F	24	234

Required:

(i) The product moment correlation coefficient. (6 marks)

(ii) Interpret your result in (b) (i) above. (2 marks)

(c) The prices per unit of the items forming the consumption bundle of an average family in two periods and the percentage of total family budget allocated to these items are as shown in the table below:

Expenditure Item	Price in period 1 (Sh.)	Price in period 2 (Sh.)	Percentage expenditure (%)
Food	30,000	34,800	40
Rent	10,000	12,000	20
Clothing	20,000	25,000	15
Fuel	4,000	5,000	15
Miscellaneous	12,000	18,000	10

Required:

(i) An appropriate consumer price index number using the above data. (5 marks)

(ii) Comment on your result in (c) (i) above. (1 mark)

(iii) Explain how time reversal test could be used in choosing an appropriate index.

(2 marks)

(Total: 20 marks)

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:

Table 1 **Price per kilogramme (Sh.)**

Cereal	2015	2016	2017	2018
Millet	135	142	120	170
Sorghum	120	164	172	160
Wheat	80	90	70	65
Maize	200	180	160	210

Table 2 **Quantity consumed (ks)**

Cereal	2015	2016	2017	2018
Millet	600	680	720	800
Sorghum	720	900.	1020	1100
Wheat	1200	1150	1180	1250
Maize	1600	1650	1500	1850

Required:

i. Paasche's price index for years 2017 and 2018 using 2015 as the base year. (6 marks)

ii. Laspeyres quantity index for the years 2017 and 2018 using 2015 as the base year. (6 marks)

(c) Mary Mua, a sales representative, needs to make 4 sales from the next 8 customer visits to meet her monthly target. Experience has shown that the probability of a successful visit is 0.2.

Required:

The probability that she will meet her target. (4 marks)

(Total: 20 marks)

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 20 May 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) Highlight four roles played by financial forecasting in a business. (4 marks)

(b) A company has identified two investments which are mutually exclusive. The cash flow patterns for the investments are as provided below:

Year	Investment A Cash flow (Sh.)	Investment B Cash flow (Sh.)
0	(300,000)	(300,000)
1	90,000	90,000
2	90,000	60.000
3	90.000	50,000
4	90,000	40.000
5	90.000	30,000

The cost of capital for the company is 13%.

Required:

Using the net present value (NPV) method, advise the management of the company on which investment to be considered. (6 marks)

(c) The consumer price index (CPI) for the years 2013-2018 are given as follows:

Year	2013	2014	2015	2016	2017	2018
CPI	138.6	142.8	148.3	152.4	156.6	160.3

Required:

The purchasing power of the Shilling for each of the six years. (6 marks)

(d) A washing machine has a marked price of Sh.1,500,000. When the machine is bought on cash basis, a 8% cash discount is given.

The machine may also be bought on hire purchase terms, where 20% deposit is paid out. An interest of 30% is charged on the outstanding balance for the period of repayment.

The remaining balance plus the interest is payable in 24 equal monthly instalments.

Required:

The amount of money saved when the washing machine is bought on cash basis rather than hire purchase terms. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain four constraints that companies might face in making dividend decisions. (8 marks)

(b) Using matrix algebra, solve the following simultaneous equations:

$3x + 2y = 1,594$

$7x + 5y = 3,810$

(4 marks)

(c) An investor has two options of purchasing an equipment:

Option I: Purchase equipment "X" costing Sh.281,250 whose net cash flow per year is Sh.75,000 for six years.

Option 2: Purchase equipment "Y" costing Sh.178,500 whose net cash flow per year is Sh.49,980 for six years.

The required rate of return for both equipment X and Y is 11 per cent.

Required:

(i) The net present value (NPV) for both equipment X and Y. (4 marks)

(ii) The internal rate of return (IRR) for both equipment X and Y. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) The following data relate to share prices of 1,000 companies listed in a regional stock market:

Share price (Sh.)	100-120	120-140	140-160	160-180	180-200	200-220	220-240
Number of companies	18	54	200	190	330	205	3

Required:

(i) The mean share price. (3 marks)

(ii) The mode of the data. (3 marks)

(iii) The standard deviation. (3 marks)

(b) The following are estimates of one-year returns from investing in the ordinary shares of Smart Limited:

Probability of occurrence	0.10	0.20	0.40	0.20	0.10
Possible share returns	-10%	5%	20%	35%	50%

Required:

(i) The expected return. (3 marks)

(ii) The standard deviation. (4 marks)

(iii) The probability that the expected return will be more than 40% using normal probability distribution. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) An investment analyst collected data on shares of several companies and noted whether or not dividends were paid and whether or not the share increased in price over a given period of time. The following is a summary of the data:

	Price increase	**No price increase**
Dividends paid	51	117
No dividends paid	128	74

Required:

(i) A joint probability table. (3 marks)

(ii) If a share is selected at random, what is the probability that it increased in price? (2 marks)

(iii) Given that a share increased in price, what is the probability that no dividends were paid? (2 marks)

(iv) Given that a share had no dividends paid, what is the probability that there was no price increase? (2 marks)

(v) If a share is selected at random, what is the probability that dividends were paid? (2 marks)

(b) A project yields an average cash flow or Sh.750,000 with a standard deviation of Sh.90,000.

Required:

Determine the probability that the:

(i) Cash flow will be more than Sh.840,000. (2 marks)

(ii) Cash flow will be less than Sh.630,000. (2 marks)

(iii) Cash flow will be between Sh.690,000 and Sh.810,000. (3 marks)

(iv) Cash flow will be more than Sh.1,020,000. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Explain two challenges that might be faced in the valuation of ordinary shares. (4 marks)

(b) Minmax Limited has developed two functions to describe operations of the firm as follows:

Marginal revenue (MR) = 25 - 5q - 2q2

Marginal cost (MC) = 15 - 2q - 2q2

Where q is the level of output in thousands of units.

Required:

(i) The profit maximising output in units. (3 marks)

(ii) The maximum profit in Shillings. (3 marks)

(c) A borrower negotiates for a Sh.3.000.000 loan payable in 8 years from a financial institution. The term of the loan is at an interest rate of 14% per annum on a reducing balance with the principal amount being repaid in equal year end instalments.

Required:

An amortisation schedule for the loan showing interest and principal repayments.

(10 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 26 November 2018. **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) Highlight four factors that might necessitate the shifting of the base of an index number. (4 marks)

(b) The following are the indices of a country for the years 2014 2018:

Year	2014	2015	2016	2017	2018
Index	216	228	212	236	244

Required:

The chain base indices using 2013 as the base year (2013 = 100). (3 marks)

(c) James Mwambao invested Sh.1,000,000 in two investment funds X and Y at simple interest rates of 9.5% and 11% per annum respectively. The total interest earned from the two investments over a one year period was Sh.103,850.

Required:

The amount of money James Mwambao invested in each investment fund. (5 marks)

(d) The Financial and Investment Analyst at ABC Ltd., a construction company, is considering investing in a certain project. The project has an initial cost of Sh.4 million and an economic life of four years with nil residual value.

The expected earnings before depreciation and tax of the project are as shown below:

Year	Earnings before depreciation and tax (Sh.million)
1	3.0
2	3.2
3	3.4
4	4.0

The corporate tax rate is 30% and the company's cost of capital is 15%.

Depreciation is to be provided for on a straight line basis.

Required:

Using the net present value (NPV) approach, advise the Financial and Investment Analyst of ABC Ltd. on whether to invest in the project. (8 marks)

(Total: 20 marks)

QUESTION TWO

(a) Highlight five factors that a company might consider when making a dividend policy decision. (5 marks)

(b) Madebe Limited borrowed Sh.400,000 from XYZ Commercial Bank at an interest rate of 1.8% compounded monthly. The loan is to be amortised using the reducing balance method and be repaid in 12 equal monthly instalments payable at the end of each month.

Required:

A loan amortisation schedule. (9 marks)

(c) An investor plans to buy shares and hold them for four years. From past records, the probability distribution indicating the price of the share after one year is as follows:

Price per share (Sh)	Probability
42	0.08
45	0.12
50	0.15
56	0.25
60	0.30
65	0.10

Required:

(i) The expected price per share. (2 marks)

(ii) The standard deviation of the share price. (2 marks)

(iii) The coefficient of variation of the share price. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Summarise four advantages of the net present value (NPV) method used in measuring an investment's profitability. (4 marks)

(b) The following, data of medium manufacturing firms relate to daily expenditure to daily output in units of ten companies:

COMPANY	A	B	C	D	E	F	G	H	I	J
Daily output ("000" units)	5	10	14	22	20	32	30	30	45	50
Daily Expenditure (Sh."000")	180	240	250	300	315	340	305	300	340	370

Required:

(i) The least squares regression line of daily expenditure on daily output. (8 marks)

(ii) The daily expenditure associated with daily output of 35,000 units. (2 marks)

(c) The probability of defective items in a certain manufacturing process is 0.10 in a total of 400 items.

Required:

Assuming binomial distribution, determine:

(i) The mean. (2 marks)

(ii) The standard deviation. (2 marks)

(iii) The coefficient of skewness. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) The data given below show the distribution of share prices of filly companies listed on a certain securities exchange of a country:

Share price (Sh.)	Number of companies
30 – 40	3
40 — 50	7
50 — 60	A
60 — 70	14
70 — 80	B
80 —90	5
90 — 100	4
	50

The median share price of the companies is Sh. 65,70.

Required:

(i) Me values of A and B. (4 marks)

(ii) The mean share price of the companies. (3 marks)

(iii) The modal share price of the companies. (3 marks)

(b) A washing machine costs Sh.980,000. The machine is expected to depreciate to a scrap value of Sh. 130,000 in 5 years' time.

Required:

(i) Using the reducing balance method of depreciation, find the annual depreciation rate. (2 marks)

(ii) The book value of the machine at the end of the third year, using the reducing balance method. (2 marks)

(iii) Using the straight line method of deprecation, find the net book value of the machine at the end of the third year. (2 marks)

(c) A market survey undertaken of 160 workers at the Nairobi industrial area revealed the following:

63 workers used personal cars to get to work.

82 workers used public vehicles to get to work.

63 workers used motorbikes to get to work.

26 workers used both motorbikes and public vehicles to get to work.

15 workers used both personal cars and public vehicles to get to work.

20 workers used personal cars and motorbikes to get to work.

6 workers did not use any of the three modes of transport to get to work.

Required:

(i) Represent the given information in a Venn diagram. (2 marks)

(ii) The number of workers who used all the three modes of transport to get to work. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) A factory produces bulbs that have a limited life. Records indicate that the life of the bulbs is normally distributed with a mean of 900 hours and a standard deviation of 80 hours.

Required:

Proportion of the bulbs that will fail:

(i) Before 1,000 hours. (3 marks)

(ii) Before 850 hours. (3 marks)

(iii) Between 850 hours and 880 hours. (3 marks)

(iv) Between 800 hours and 950 hours. (3 marks)

(b) The total revenue function of an electronic company is quadratic in nature.

The data below show the number of television sets sold by the electronic company and their corresponding sales revenue:

Number of television sets sold (q)	15	20	30
Sales revenue (R) Sh."000	2,325	2,900	3,750

Required:

(i) The total revenue function. (5 marks)

(ii) The maximum revenue. (3 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 21 May 2018. **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 how a finance manager might apply financial mathematics in performing any four of his/her functions in a company. (8 marks)

(b) A wholesaler sells 760 articles at a total price of Sh.3,952,000. His profit is 25% on the cost of all the sold articles. The selling price per article is the same. After selling 20% of the articles, 10% of the articles were found to be defective with no resaleable value.

Required:

(i) The total cost of all articles. (2 marks)

(ii) The selling price per article. (2 marks)

(iii) The number of articles the wholesaler must sell to make a profit of between Sh.305,760 and Sh.343,200.
(Assume no defective articles have been found). (3 marks)

(iv) The selling price of the remaining articles if the wholesaler was to earn the same profit on the cost price as before. (5 marks)

(Total: 20 marks)

QUESTION TWO

(a) Summarise three key differences between correlation analysis and regression analysis. (6 marks)

(b) The cost accountant of XYZ Ltd. wishes to use the budgeted expenditure to predict the actual expenditure on research and development.

The following data show expenditure incurred over an eight-year period where x is the budgeted expenditure in millions of shillings and y is the actual expenditure incurred in millions of shillings:

Year	1	2	3	4	5	6	7	8
Budgeted expenditure (x) in Sh."million"	30	50	20	80	10	20	20	40
Actual expenditure (y) in Sh."million"	50	80	30	110	20	20	40	50

Required:

(i) The regression equation of y on x. (6 marks)

(ii) Using the result obtained in (b) (i) above, predict the actual expenditure incurred in year 9 with a budgeted expenditure of Sh.15 million (3 marks)

(c) The following probability distribution shows the payoffs of launching a product in a company:

Payoff Sh."million")	0	25	50	20
Probability	0.60	0.25	0.10	0.05

Required:

(i) The expected value of the product. (3 marks)

(ii) The standard deviation of the product. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Outline four applications of indices in your country. (4 marks)

(b) A quality inspection of 100 cartons containing 50 articles of a product in each carton revealed the following non-defective articles:

Number of non-defective articles	45	46	47	48	49	50
Number of cartons (cumulative)	6	18	46	82	98	100

Required:

(i) The mean number of non-defective articles. (3 marks)

(ii) The standard deviation. (4 marks)

(iii) Probability of a carton containing 48 non-defective articles or less. (2 marks)

(c) The return on a share purchased from a certain company depends on the brokerage fee and capital gains tax paid. The return is expressed using the following function:

$48x + 60y + 10xy\ 10x^2 — 6y^2$

Where

R = Return

x = Brokerage fee

y = Capital gains tax

Required:

The values of x and y that maximise return. (7 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Highlight four merits of payback method of project appraisal. (4 marks)

(b) The table below shows the cash flows of two mutually exclusive projects namely; P and Q, having the same useful life:

Year		0	1	2	3	4	5
Cash flows in	P	-170	65	65	65	65	65
Sh. "million"	Q	-500	155	155	155	155	155

The required rate of return is 12% for both projects P and Q.

Required:

Evaluate each project using the net present value (NPV) method. (4 marks)

(c) Maryland Ltd. deals in the export of horticultural products to the COMESA market. The revenue and cost functions of the company are quadratic in nature.

Analysis of the company's records produced the following data:

Quantity of exports in units (x)	3	6	9
Revenue (R) Sh."000"	1,164	2,256	3,276
Total cost (C) Sh."000"	7,709	7,436	7,181

Required:

i. The revenue function. (3 marks)

ii. The total cost function. (3 marks)

iii. The profit function. (2 marks)

iv. The quantity which will maximise profit. (2 marks)

v. The maximum profit of the company. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) A cereal manufacturer makes breakfast cereals packed in boxes. The cost function is given by C = $4x^2$ - 45x + 1200 where x is in millions of boxes.

The revenue function of the manufacturer is given by R = $3x^2$ + 35x.

Required:

(i) The manufacturer's break-even number of boxes. (5 marks)

(ii) The revenue at which maximum profit is realised. (4 marks)

(iii) Maximum profit. (2 marks)

(b) The following data show the prices and quantities of livestock products over a three-year period:

	Price per kilogramme (Sh.)			Quantities (Kg) "000"		
Year / Product	2015	2016	2017	2015	2016	2017
Meat	280	340	360	400	480	520
Butter	60	72	80	660	672	705
Hides	100	120	110	80	95	72

Required:

(i) The Laspeyre's index for 2016 and 2017 using 2015 as the base year. (4 marks)

(ii) The Paasche's index for 2016 and 2017 using 2015 as the base year. (4 marks)

(iii) Fisher's ideal index for 2016. (1 mark)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 27 November 2017. **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 the following concepts as applied to indices:

(i) Time reversal test. (2 marks)

(ii) Factor reversal test. (2 marks)

(iii) Base shifting. (2 marks)

(b) An index was at 100 in year 2012. The index rose by 6 per cent in year 2013 and subsequently fell by 4 per cent in year 2014. Thereafter, the index fell by 6 per cent in year 2015 and then rose by 5 per cent in year 2016.

Required:

(i) Using year 2012 as the base year, calculate the index number for each year from year 2013 to year 2016. (4 marks)

(ii) Using year 2014 as the base year, calculate the index numbers for the years 2012, 2013, 2015 and 2016. (4 marks)

(c) The demand and supply expression for products A and B are given as follows:

Demand	Supply
$P_A = 1500 - 4q_A - 3q_B$	$P_A = 400 + 3P_A + P_B$
$P_B = 700 - P_A - 2q_B$	$P_B = 200 + q_A + q_B$

Where P_A and q_A are the price and quantity demanded of product A respectively and P_B and q_B are the price and quantity demanded of product B respectively.

Required:

The prices and quantities to be sold of product A and product B. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) The table below shows the levels of disposable income and number of inhabitants in each level in two small counties namely; A and B.

Disposable Income (Sh."000")	**Number of Inhabitants**	
	County A	**County B**
14 – 16	5	15
16 – 18	7	30
18 – 20	7	28
20 – 22	18	14
22 – 24	23	7
24 – 26	14	3
26 – 28	10	2
28 – 30	16	1

Required:

(i) The mean disposable income in each county. (4 marks)

(ii) The median disposable income in each county. (4 marks)

(iii) The modal disposable income in each county. (4 marks)

(b) Motorcars Limited realised a profit of Sh.12,000 from selling 7 cars, Sh.12,400 from selling 9 cars and Sh.11,300 from selling 4 cars. The profit function is believed to be quadratic in nature.

Required:

(i) Derive the profit function. (6 marks)

(ii) Determine the number of cars that maximises profit. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight four assumptions made in basic discounted cash flow analysis. (4 marks)

(b) The data below relate to the revenue realised from sale of shares in a stock exchange:

Shares (quantity)	Revenue (Sh.)
2	108
3	416
3	783
6	1,056
4	664
2	526
1	340
5	610

Required:

(i) Using the least squares method, determine the equation of best fit. (5 marks)

(ii) The expected revenue if 9 shares are sold. (2 marks)

(c) The customer accounts of a certain supermarket have an average balance of Sh.120,000 and a standard deviation of Sh.40,000. The account balances are normally distributed.

Required:

(i) The proportion of accounts whose balances are over Sh.145,000. (3 marks)

(ii) The proportion of accounts whose balances are between Sh.90,000 and Sh.132,000. (3 marks)

(iii) The proportion of accounts whose balances are below Sh.70,000. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) State two advantages of the following statistical measures:

(i) Standard deviation. (2 marks)

(ii) Range. (2 marks)

(b) An investor is considering investing money in either one of two possible investment proposals. The investor's interest is to choose the investment with a higher average net present value and lower standard deviation and coefficient of variation.

The relevant data for the two investment proposals is as follows:

Investment Proposal A		Investment Proposal B	
Net present value (NPV) Sh."000"	**Probability**	**Net present value (NPV) Sh."000"**	**Probability**
1,559	0.20	-10,050	0.20
5,662	0.60	5,812	0.60
9,175	0.20	20,584	0.20

Required:

(i) The expected net present values for each investment proposal. (4 marks)

(ii) The standard deviation of each investment proposal. (6 marks)

(iii) The coefficient of variation for each investment proposal. (4 marks)

(iv) Based on your calculations in (b) (i) to (b) (iii) above, advise the investor on the viable investment proposal. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Explain three principles of capital budgeting decisions. (6 marks)

(b) An investor is considering investing Sh.800,000 for a two year period. The data below relates to interest rates of three investment opportunities available:

Investment opportunity	Interest
A	10% simple interest per annum.
B	9.5% per annum compounded semi-annually.
C	9% per annum compounded quarterly.

Required

The investment opportunity that would provide the highest return on investment for the two year period. (6 marks)

(c) A 4-year, 5.8% coupon bond is selling to yield 7%. The bond pays interest annually. The bond's interest rates decrease from 7% to 6.2% one year to maturity.

Required:

(i) Price change attributable to moving to maturity. (4 marks)

(ii) Price change attributable to the change in the discount rate from 7% to 6.2%. (4 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 22 May 2017. **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 the following methods of valuing shares:

(i) Dividend yield method. (2 marks)

(ii) Earnings method. (2 marks)

(iii) Net asset method. (2 marks)

(iv) Discounted cash flow method. (2 marks)

(b) The table below shows the interest rates of ABC Ltd.'s corporate bond sold over a period of 12 months:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Interest rate (%)	12.1	11.9	12.0	12.2	12.4	12.3	12.4	12.5	12.7	12.6	12.8	12.9

Required:

(i) Derive a trend function using the ordinary least squares method. (10 marks)

(ii) Use the trend function obtained in (b) (i) above to estimate the interest rate of ABC Ltd.'s corporate bond in the 15th month. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Distinguish between the following terms:

(i) Margin and mark-up. (2 marks)

(ii) Depreciation and appreciation. (2 marks)

(b) The cost function of a certain company is given by the function $C(x) = 6x^2+1,440x - 1,280$. The revenue function is given by $R(x) = 2,000x - 24x^2$. X is in thousands of units.

Required:

(i) Profit function of the company. (2 marks)

(ii) The break even number of units. (3 marks)

(iii) Number of units at which profit is maximised. (3 marks)

(c) An investor plans to make a series of payments to an investment fund. He deposits Sh.200,000 at the beginning of year 1, Sh.2,400,000 in year 2 and Sh.400,000 at the beginning of year 5. Due to financial constraints, the investor withdrew Sh.450,000 and Sh.250,000 at the beginning of year 3 and year 7 respectively with no withdrawal penalties. The investor's interest rate was at 14%.

Required:

(i) The future value of the investment in 8 years' time. (4 marks)

(ii) The present value of the investment. (2 marks)

(iii) Explain the value additivity principle of net present value (NPV) method. (2 marks)

(Total: 20 marks)

QUESTION THREE

The following data relate to the floor area of 300 houses designed by a developer in an upcoming residential area:

Floor Area (m2)	Probability
20 — 40	0.02
40 — 60	0.07
60 — 80	0.15
80 — 100	0.32
100 — 120	0.23
120 — 140	0.11
140 — 160	0.04
160 — 180	0.03
180 — 200	0.03
	1.00

The approximate cost of construction is Sh.12,500 per square metre.

Required:

(a) The mid class values. (2 marks)

(b) The frequency of each class. (4 marks)

(c) The arithmetic mean of the distribution. (4 marks)

(d) The standard deviation. (4 marks)

(e) An appropriate measure of skewness. Interpret your result. (4 marks)

(f) The mean cost of houses in the area. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) State five purposes of financial models. (5 marks)

(b) Kaza Mwendo borrowed Sh.80,000 from XYZ commercial bank at an interest rate of 1.25% compounded monthly. The loan is to be amortised using the reducing balance method and be repaid in 12 equal monthly instalments payable at the end of each month.

Required:

A loan amortisation schedule. (9 marks)

(c) Faida Enterprises expects its earnings before interest and taxes (EBIT) to fluctuate with the economic environment as shown below. The earnings distribution is expected to continue in perpetuity. The company has one million shares outstanding and no debt in the capital structure. The company pays all its earnings in dividends and shareholders require a 12% return. The company pays no taxes.

	Economic environment			
Details	**Bad**	**Fair**	**Good**	**Very good**
Probability	0.25	0.25	0.25	0.25
EBIT (Sh. million)	2.2	3.8	4.8	6.0
Earnings per share (EPS) (Sh.)	2.2	3.8	4.8	6.0
Return if share price is Sh.35	29%	10.86%	13.71%	17.14%

Required:

(i) Expected earnings per share. (2 marks)

(ii) Standard deviation of earnings per share. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) State four properties of a normal probability distribution. (4 marks)

(b) Highlight four shortcomings of consumer price index numbers. (4 marks)

(c) The price of a share of ABC Limited is normally distributed with a mean of Sh.51.80 and a standard deviation of Sh.4.30.

Required:

The probability that the price of the share will be:

(i) Greater than Sh.60.00. (4 marks)

(ii) Less than Sh.36.40. (4 marks)

(iii) Between Sh.41.80 and Sh.58.80. (4 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 21 November 2016. **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) Highlight four disadvantages of using the net present value (NPV) method for project appraisal. (4 marks)

(b) The table below shows fluctuations in price of two shares, A and B over the last four months.

Share price (Sh.)	Number of days over 4-month period	
	Share A	**Share B**
30 — 32	4	6
32 —34	12	10
34 — 36	20	18
36 — 38	35	20
38 — 40	22	26
40 —42	5	12
42 —44	2	8

Required:

Advise a risk-averse investor on the share to invest in using coefficient of variation.

(8 marks)

(c) The variable cost for a newspaper run is Sh.65 per unit. The cost of set up is estimated to be Sh.$2x^2$ where x is the number of newspapers. The fixed cost per day is estimated at Sh.28,800.

Required:

(i) The cost per unit function. (2 marks)

(ii) The number of newspaper runs that minimises cost per unit. (4 marks)

(iii) The total cost of the newspaper at the minimum cost per unit. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Matsangoni county government has proposed to sell a 5-year bond of Sh.5,000,000 at 8% rate of interest per annum. Investors have a minimum required rate of return of 7%. The bond's principal amount will be repaid equally over its life time.

Required:

The present value of the bond. (5 marks)

(b) Deborah Mbetsa intends to purchase a private saloon car at a cost of Sh.800,000. She currently has Sh.620,000 which she intends to invest in two alternative plans.

Plan A: Invest at a simple interest rate of 5.4% per annum.

Plan B: Invest at a compound interest rate of 4.8% per annum.

Required:

The number of years Deborah Mbetsa will take to purchase the car under each of the alternative investment plans. (5 marks)

(c) A retailer of a new beauty product has observed that he sells 126 units of the product when the price is Sh.55 and only 109 units of the product when the price is Sh.72. The retailer's daily fixed cost is Sh.5,880 while the variable cost per unit is Sh.12.

Required:

(i) A linear equation showing the relationship between the price (P) and the

quantity demanded (x). (2 marks)

(ii) The price at the break-even point. (4 marks)

(iii) The price that maximises profit. (3 marks)

(iv) The maximum profit. (1 mark)

(Total: 20 marks)

QUESTION THREE

(a) State four assumptions that underlie the binomial distribution. (4 marks)

(b) The following data show estimated probabilities and useful life of two plants, X and Y.

	Estimated probabilities	
Useful life (years)	**Plant X**	**Plant Y**
10	0.05	0.10
20	0.25	0.50
30	0.50	0.30
40	0.20	0.10

Required:

(i) The expected useful life of each plant. (2 marks)

(ii) The standard deviation of each plant. (4 marks)

(c) The production level at a manufacturing company is approximately normally distributed with a mean of 134,786 units per month and a standard deviation of 13,000 units.

Required:

The probability that monthly production will:

(i) Exceed 150,000 units. (3 marks)

(ii) Drop below 100,000 units. (3 marks)

(iii) Lie between 145,000 units and 160,000 unit (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) The following data show the number of tonnes cleared weekly by a shipping agency in a busy port:

398	412	560	476	544	690	587	600	613	457	504	477	530
641	359	566	452	633	474	499	580	606	344	455	505	396
347	441	390	632	400	582							

Required:

(i) Group the data into a frequency table with a class width of 50 starting with the class, 300 — 349. (4 marks)

(ii) The mean weekly tonnage cleared. (3 marks)

(iii) The standard deviation. (5 marks)

(iv) The median of the data. (2 marks)

(v) The skewness of the data. Interpret your result. (4 marks)

(b) Highlight two merits of coefficient of variation over the standard deviation as measures of dispersion. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Zowerani Ltd. manufactures and sells two interdependent products, A and B.

The demand functions for the two products are given by:

$P_A = 800 - x - 2y$ and $P_B = 1{,}100 - x - 2.5y$

Where; P_A is the unit price of product A

P_B is the unit price of product B.

x and y are the number of units of products A and B sold respectively.

The total cost function of producing both products is given by the function:

$$C = 150x + 50y.$$

Required:

(i) The total revenue function. (2 marks)

(ii) The profit function. (2 marks)

(iii) The number of units of each product required to maximise total profit. (4 marks)

(iv) The selling price of each product. (1 mark)

(v) The maximum profit. (1 mark)

(b) The following data relate to the prices of a good X in the various years:

Year	**Price (Sh.)**
2011	600
2012	650
2013	690
2014	680
2015	740

Required:

The chain base index for each of the years using 2011 as the base year. (2 marks)

(c) The following data give the quantities and prices of items purchased by a certain family for two consecutive years:

Items	Quantity (kilogrammes)		Prices (Sh.)	
	Year 1	Year 2	Year 1	Year 2
A	1,225	1,407	1,155	1,372
B	224	322	952	1,117
C	336	301	2,070	1,867
D	455	462	1,642	1,552

Required:

Using year 1 as the base year, calculate:

(i) The Laspeyre's price index for year 2. (3 marks)

(ii) The Paasche's price index for year 2. (3 marks)

(iii) Fisher's ideal price index for year 2. (2 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

MONDAY: 23 May 2016. **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) The following table shows a sample of the rates of return of a certain company for a 7-year period:

Year	Annual rate of return (%)
2009	80.54
2010	26.52
2011	32.70
2012	59.50
2013	102.40
1014	46.10
2015	62.64

Required:

(i) The average annual rate of return, (2 marks)

(ii) The standard deviation. (3 marks)

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

(b) The share price of Galanema Ltd. over the last 50 days is shown below:

Share price (Sh.)	Number of days
20	5
14	9
x	8
9	6
x - 2	7
12	9
16	6

The mean share price over the 50-day period was Sh. 14.8.

Required:

(i) The value of x, (3 marks)

(ii) The coefficient of variation of the share price. (3 marks)

(c) The profit function of Karakara Grocery is given by the function, P = - x^2 + 796x - 75,460 where P is the profit function and x is the number of units sold.

Required:

(i) The range of break-even points in units sold. (3 marks)

(ii) The number of units sold to maximise the profit. (2 marks)

(iii) The maximum profit. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain the following terms:

(i) Loan amortisation. (2 marks)

(ii) Bond. (2 marks)

(iii) Compound interest. (2 marks)

(b) A machine costs Sh.150.000 with an expected net cash flow of Sh.40.000 per year for six years. The company has an alternative of purchasing an equivalent machine whose cost is Sh.100.000 with annual expected net cash flows of Sh.28.000 per year for six years.

The required rate of return of both machines is 11%.

Required:

(i) The net present value (NPV) of both machines. (6 marks)

(ii) The internal rate of return (1RR) of both machines. (8 marks)

(Total: 20 marks)

QUESTION THREE

(a) A contractor applied for a tender in two companies, P and Q. The probability of the contractor being awarded a tender in company P is 0.6 and the probability of the tender being rejected at company Q is 0.5.

The probability of at least one of the contractors' tenders being rejected is 0.7.

Required:

The probability that the contractor would be awarded a tender in one of the companies. (6 marks)

(b) The following data relate to a company's level of sales and value of current assets over a 0-year 17eriod:

Year	Current assets (millions of shillings)	Sales (millions of shillings)
2006	7.6	140
2007	3.1	162
2008	3.5	167
2009	3.8	157
2010	4.0	178
2011	4.5	202

2012	4.8	215
.2013	5,0	205
2014	5.4	227
2015	5.6	240

Required:

(i) The least squares regression line of sales on current assets. (10 marks)

(ii) The correlation coefficient. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) The mean weekly share contribution of 500 members of an investment club is Sh.1,500 with a standard deviation of sh.150.

The share contribution follows a normal distribution.

Required:

(i) The number of members whose contributions fall between Sh.1,200 and Sh.1,545. (4 marks)

(ii) The number of members whose contributions are greater than Sh. 1,800. (4 marks)

(iii) The number of members who contributed more than Sh.1,725 but less than Sh.1,875. (4 marks)

(b) The following information shows the returns and their probabilities of two investments. A and B:

Investment A		**Investment B**	
Returns (%)	**Probability**	**Returns (%)**	**Probability**
18.5	0.75	25	0.15
10.5	0.35	15	0.20
1.5	0.15	10	0.45
-2.0	0.25	-10	0.20

Required:

(i) The expected return of each investment. (2 marks)

(ii) The standard deviation of return for each investment. (4 marks)

(iii) Advise a risk-averse investor on the viable investment based on your results in (b) (i) and (ii) above. (2 marks)

Total: 20 marks)

QUEST1ON FIVE

(a) The total cost of producing a certain product is believed to be quadratic in nature. The following data show the total cost of production for different levels of production in units.

Level of production (units)	10	15	20
Total cost of production (Sh.)	350	745	1,290

Required:

(i) The total cost function. (5 marks)

(ii) The level of production in units for the total cost of Sh.1,054. (3 marks)

(b) (i) The consumer price indices (CPI) of a certain county for the period 2011 to 2015 were as follows:

Year	**Consumer price index (CPI)**
2011	132.6
2012	140.8
2013	144.4
1)014	147.2
2015	151.5

Required:

The purchasing power of the shilling for each of the rive years, (.3 marks)

(ii) The following data relate to the price relatives of some items during the year 2015 with 2010 as the base year:

Commodity expenditure	Food	Housing	Transport	Clothing	Water and electricity	Others
Price relative (year 2015)	160	152	140	125	120	115
Average expenditure (Sh.)	45.0	10.0	15.0	5.0	1 0 0	15.0

Required:

The cost of living index for the year 2015. (4 marks)

(c) Nyalle Ltd. finds that its cost function is given by:

C = 8,000$\sqrt{x}$ - 6000 $\sqrt[3]{x}$ shillings, where

x is the daily production of steel in tonnes.

Required:

(i) The marginal cost function. (2 marks)

(ii) The marginal cost when 64 tonnes of steel are produced. (3 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

FRIDAY: 20 November 2015. **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) Outline four uses of time series analysis. (4 marks)

(b) The table below shows the sales of new cars by quarters during a period of four years:

Year	Quarter 1 Sh."million"	Quarter 2 Sh."million"	Quarter 3 Sh."million"	Quarter 4 Sh."million"
2011	40	64	124	58
2012	42	84	150	62
2013	46	78	154	96
2014	54	78	184	106

Required:

Forecasted sales for quarter 1 of 2015 using four-quarter moving averages. (4 marks)

(c) The marginal revenue of a company is given by the expression MR = 40q - 3q2 while its average cost is given by the expression AC = 2q 50 - 10, where q represents the number of units produced and sold by the company.

Required:

(i) The total revenue function. (2 marks)

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

(iii) The total profit function. (2 marks)

(iv) The quantity which would maximise profit. (4 marks)

(v) The maximum profit. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) Describe four methods that might be used to calculate seasonal indices. (8 marks)

(b) The following data show the earnings per share (EPS) of a company at two different levels of debt and their probability distribution:

	Earnings per share (EPS) in shillings	
Probability	**25% debt**	**50% debt**
0.05	-0.25	-1.25
0.10	0.50	0.25
0.15	0.75	0.75
0.35	1.20	1.65
0.30	1.60	2.45
0.05	3.00	5.25

Required:

(i) The expected earnings per share at each level of debt. (2 marks)

(ii) The standard deviation of earnings per share at each level of debt. (6 marks)

(iii) The coefficient of variation at each level of debt. (2 marks)

(c) A commodity X has a linear demand function that passes through the following points:

Price (Sh.)	2,525	1,525
Quantity (units)	100	200

Required:

The demand function. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) A businessman bought 250 shares of company X and 375 shares of company Y for Sh.29,750. He also bought another 420 shares of company X and 295 shares of company Y with an additional cost of Sh.1,470 to his investment.

Required:

Using matrix algebra, determine the cost of a share in company X and company Y.

(6 marks)

(b) Crown Contractors have summarised the relationship between transport costs and output units of the merchandise in their storage factory as shown in the data below:

Output ("000" units)	**Transport costs (Sh."000")**
22	37.6
26	43.5
20	58.9
14	30.6
22	38.9
31	48.0
26	35.4
23	39.2

Required:

(i) Using the least squares method, determine the equation of best fit. (6 marks)

(ii) The expected transport cost, if output is 18,000 units. (2 marks)

(c) Laika Ltd. manufactures electric cables. From historical data, the company realised a profit of Sh.12,580 after selling 10 cables and a profit of Sh.13,280 after selling 15

cables.

The profit function is quadratic in nature.

Required:

(i) The profit function. (4 marks)

(ii) The amount of profit realised if the company sold 18 cable (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain the difference between "mutually exclusive events" and "independent events". (2 marks)

(b) The mean weight of medium sized cakes in a bakery is 151 grammes with a standard deviation of 15 grammes. The baking process is normally distributed. The process produces cakes in batches of 500.

Required:

(i) The number of cakes weighing between 120 grammes and 155 grammes. (4 marks)

(ii) The number of cakes weighing more than 185 grammes. (4 marks)

(iii) The number of cakes weighing less than 128 grammes. (4 marks)

(c) In a manufacturing company. 20% of a certain product produced by a machine are defective. Four units of the product are chosen at random.

Required:

(i) The probability that two units of the product are defective. (2 marks)

(ii) The probability that at most two units of the product are defective. (4 marks)

(**Total: 20 marks)**

QUESTION FIVE

(a) The table below shows the distribution of salaries of medical employees in two counties, P and Q in thousands of shillings:

Salaries (Sh. "000"	County P	County Q
94 - 98	20	15
98 - 102	50	45
102 106	120	133
106 - 110	170	184
110 - 114	140	155
114 - 118	60	75
118 - 122	30	25
122 - 126	10	18

Required:

(i) The mean medical salary of each county. (4 marks)

(ii) The median medical salary of each county. (4 marks)

(iii) The semi-interquartile range of medical salary of each county. (4 marks)

(iv) The modal medical salary of each county given that: mean - mode =3 (mean - median). (2 marks)

(b) ABC Ltd. has borrowed a loan of Sh.3,200,000 for capital from a commercial bank. The loan is repayable at an interest rate of 12% per annum for seven years.

Required:

A loan repayment schedule. (6 marks)

(Total: 20 marks)

KASNEB

CIFA PART I SECTION 1

FINANCIAL MATHEMATICS

PILOT PAPER

September 2015. **Time Allowed: 3 hours.**

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

QUESTION ONE

(a) Explain four determinants of working capital of a business organisation (8 marks)

(b) The Ministry of Economic Development in a country has provided the following data to estimate the cost of living of several households over a two month period:

	Quantity (Kg.)		Purchases (Sh.)	
Commodity	**July**	**August**	**July**	**August**
Rice	400	500	12,000	16,000
Sugar	20	15	2,200	1,500
Maize	80	100	2,000	2,800
Beans	90	90	3,600	3,780

Required:

(i) Laspeyre's quantity index. (4 marks)

(ii) Paasche's quantity index. (4 marks)

(iii) Fisher's ideal index. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) Explain four limitations of index numbers. (8 marks)

(b) The following is the distribution of salaries of 62 employees in a financial institution:

Salary (Sh.	**Number of employees**
Less than 20	3
20 - 29	5
30 - 39	8
40 - 49	8
50 - 59	12
60 - 69	9
70 - 79	7
80 - 89	4
90 - 99	4
Above 99	2

Required:

(i) Modal salary. (3 marks)

(ii) Quartile deviation. (3 marks)

(iii) Median salary. (3 marks)

(iv) Percentile seventy (P_{70}) (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) Maxmin Enterprises has Sh.23,000,000 to invest in either project X or project Y.

The following are the expected cash inflows from each project for four years:

	Cash inflows (Sh. '000')	
Year	**Project X**	**Project Y**
1	4000	10000
2	8000	9000

3	12000	6000
4	5000	4000

The cost of capital is 10% per annum.

Required:

(i) Net present value (NPV) for each project. (10 marks)

(ii) Advise the management on the project to invest in. (2 marks)

(b) The data below shows the net profit (loss) and share prices of a sugar producing company in Country X over a five year period.

Net profit (loss)	**Share price**	
Year	**Sh.**	**Sh.**
2010	(2,000,000)	3
2011	980,000	5
2012	1,200,000	8
2013	(500,000)	4
2014	(150,000)	2

Required:

(i) Karl Pearson's coefficient of correlation (r). (6 marks)

(ii) Interpret the value of r. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) In harsh economic conditions, the chances of a microfinance collapsing is 40%

Required:

Determine the probability that out of five microfinances, four or five microfinances will collapse. (8 marks)

(b) A manufacturing company produces a single product that passes through two departments: assembly and packaging. Production is made on order.

The following information relates to the product:

Revenue per unit, R = 960 - 0.06q where q is the quantity sold.

Variable cost per unit in each department:

Assembly $VC_A = 18 + 0.08q$

Packaging $VC_p = 10.5 + 0.06q$

Fixed costs per annum:

Assembly Sh.180,000

Packaging Sh.220,000

Required:

(i) Total revenue function (TR). (3 marks)

(ii) Total cost function (TC). (3 marks)

(iii) Profit function and the expected profit. (6 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Explain four principles followed in the construction of graphs. (8 marks)

(b) Maloba is a hawker at Huruma market. He sells shirts, blouses and shoes. The following information relates to the three items for the first three weeks of July 2015:

		Shirts	Quantity Blouses	Pairs of shoes	Sales Sh.
Week	1	13	20	3	2,340
Week	2	15	12	1	1,900
Week	3	10	15	2	1,750

The selling prices remained the same over the 3-week period. Items are marked up at 25%.

Required:

(i) Formulate three simultaneous equations, (3 marks)

(ii) Determine the selling price and cost price of each item. (9 marks)

(Total: 20 marks)

PART B:

SUGGESTED ANSWERS AND SOLUTIONS

FINANCIAL MATHEMATICS

NOVEMBER 2020

QUESTION ONE

1) a) Applications of financial mathematics

- Risk management
- Quantitative investing strategies
- Portfolio creation and structuring
- Derivative security pricing and valuation

b i) Average profit of multinational company

Profit/loss Sh ."million"	Midpoint x	f	cf	fx	fx^2
-20<-10	-15	4	4	-60	900
-10 < 0	-5	8	12	-40	200
0 < 10	5	14	26	70	350
10 < 20	15	38	64	456	8550
20 < 30	25	10	74	250	6250
30 < 40	35	6	80	210	7350
		$\sum f = 80$		886	23,600

Average profit $(\bar{x}) = \frac{\sum fx}{\sum f}$

$= \frac{886}{80}$ *= 11.075 (sh. million)*

=11,075,000

b ii) Standard deviation and coefficient of variation

$$\textit{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx^2}{\sum f^2}\right)}$$

$$= \sqrt{\frac{23600}{80} - \left(\frac{886^2}{80^2}\right)}$$

$$= \sqrt{295 - 122.655625}$$

=13.128 (Sh. million)

= Sh.13, 128,000