



Riara School of Business
Nurturing business innovators

JANUARY - APRIL 2024 TRIMESTER EXAMINATIONS
EXAMINATION FOR CERTIFICATE IN BUSINESS ADMINISTRATION
RCM 003: BASICS OF BUSINESS MATHEMATICS

DATE: APRIL 2024

TIME: 2 HOURS

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time.
This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

- 1 Write your REGISTRATION NO. Clearly on the answer booklet(s).
- 2 Answer Question One and ANY other TWO questions.
- 3 Questions in all sections should be answered in answer booklet(s).
- 4 Marks allocated to each question are shown at the end of the question.
- 5 PLEASE start the answer to EACH question on a NEW PAGE.
- 6 For the questions, write the number of the question on the answer booklet(s) in the order you answered them.
- 7 Show your workings and clearly indicate the answer to the problems provided.
- 8 Keep your phone(s) SWITCHED OFF at the front of the examination room.
- 9 Keep ALL bags and caps at the front of the examination room and do not refer to any unauthorized material before or during the course of the examination.
- 10 You are only allowed to leave the examination room 30minutes to the end of the Examination.

QUESTION ONE: COMPULSORY (30 MARKS)

- a) Find the compound interest on Kes. 12,600 for 2 years at 10% per annum compounded annually. (5 Mks)

Solution

Given,

$$\text{Principal (P)} = 12,600$$

$$\text{Rate (R)} = 10$$

$$\text{Number of years (n)} = 2$$

$$A = P[1 + (R/100)]^n$$

$$= 12600[1 + (10/100)]^2$$

$$= 12600[1 + (1/10)]^2$$

$$= 12600 [(10 + 1)/10]^2$$

$$= 12600 \times (11/10) \times (11/10)$$

$$= 126 \times 121$$

$$= 15246$$

$$\text{Total amount, A} = 15,246$$

$$\text{Compound interest (CI)} = A - P$$

$$= 15,246 - 12,600$$

$$= 1\ 2646$$

- b) The sum of two consecutive numbers is 11. Find the numbers. (5 Mks)

Solution:

Let the number be x.

Hence, the two consecutive numbers are x and x+1.

According to the given statement, the equation becomes

$$\Rightarrow x + x + 1 = 11$$

$$\Rightarrow 2x + 1 = 11$$

$$\Rightarrow 2x = 10$$

$$\Rightarrow x = 10/2 = 5$$

If $x = 5$, then $x + 1 = 5 + 1 = 6$

Hence, the two numbers are 5 and 6.

- c) You are considering the purchase of a stock which will pay dividends of Kes 20 (Dividend 1) next year and Kes 21.6 (Dividend 2) the following year. After receiving the second dividend, you plan on selling the stock for Kes 333.3. What is the intrinsic value of this stock if your required return is 15%? (5 Mks)

Solution

Step 1 – Find the present value of dividends for years 1 and 2.

$$PV(\text{year 1}) = 20/((1.15)^1)$$

$$PV(\text{year 2}) = 20/((1.15)^2)$$

They come out to be 17.4 and 16.3, respectively, for 1st and 2nd-year dividends.

Step 2 – Find the present value of the future selling price after two years.

$$PV(\text{Selling Price}) = 333.3 / (1.15^2)$$

Step 3 – Add the present value of dividends and the present value of the selling price.

$$17.4 + 16.3 + 252.0 = \text{Kes } 285.8$$

- d) List and explain any five decision-making techniques (5 Mks)

Answers

Rational Decision-making: Rational decision-making involves a systematic and logical analysis of available options, considering the pros and cons of each.

Intuitive Decision-making: Relies on intuition, gut feelings, and tacit knowledge.

Bounded Rationality: This approach involves satisficing, where decision-makers choose a solution that meets minimum criteria rather than aiming for the optimal choice, considering cognitive constraints.

Heuristics: Heuristics are mental shortcuts or rules of thumb used to simplify complex decision-making processes.

Decision Trees: Decision trees provide a graphical representation of decision options and potential outcomes.

Cost-Benefit Analysis: Cost-benefit analysis involves assessing the costs and benefits of each alternative to determine the most favorable option.

SWOT Analysis: SWOT analysis examines an organization's strengths, weaknesses, opportunities, and threats.

Pareto Analysis: Pareto analysis focuses on the vital few factors that contribute most to a problem or decision.

Six Thinking Hats: The technique involves wearing metaphorical hats representing different thinking styles, such as creativity and critical thinking.

Delphi Technique: The Delphi Technique gathers expert opinions through structured questionnaires or surveys to achieve consensus on complex issues.

Force Field Analysis: It identifies and analyzes forces for and against a decision. By visualizing driving and restraining forces, decision-makers can assess the feasibility and potential challenges associated with a decision.

Nominal Group Technique (NGT): Fosters equal participation in group decision-making, preventing domination by a single individual.

Monte Carlo Simulation: Utilizes probability distributions to model uncertainties and assess potential outcomes.

Game Theory: Game theory analyzes strategic interactions between decision-makers, modeling scenarios where one decision's outcome depends on the decisions of others.

Scenario Analysis: Scenario analysis examines multiple future scenarios to assess potential outcomes and responses.

e). The present value of an annuity is 20,000. Assuming a monthly interest rate of 0.5%, find the value of each payment after every month for 10 years. (5 Marks)

Solution

$$r = 0.5\% = 0.005$$

$$n = 10 \text{ years} \times 12 \text{ months}$$

= 120, and

$$PV = 20,000$$

$$PV = P \times (1 - (1+r)^{-n}) / r$$

$$\text{Or, } P = PV \times (r / (1 - (1+r)^{-n}))$$

$$P = 20,000 \times (0.005 / (1 - (1.005)^{-120}))$$

$$P = 20,000 \times (0.005 / (1 - 0.54963))$$

$$P = 20,000 \times 0.011...$$

$$P = 220$$

Therefore, the value of each payment is 220.

f). Simon won a lottery worth 20,000,000 and has opted for an annuity payment at the end of each year for the next 10 years as a payout option. Determine the amount that Jane will be paid as annuity payment if the constant rate of interest in the market is 5%.

Solution

Given:

* PVA (ordinary) = 20,000,000 (since the annuity to be paid at the end of each year)

$$r = 5\%$$

$$n = 10 \text{ years}$$

* Using the Annuity Formula,

$$\text{Annuity} = r * \text{PVA Ordinary} / [1 - (1 + r)^{-n}]$$

$$\text{Annuity} = 5\% \times 20,000,000 / [1 - (1 + 0.05)^{-10}]$$

$$\text{Annuity} = \$2,564,102.56$$

* Therefore, Jane will receive an annuity amount of 2,564,102.56

QUESTION TWO

- a) Express the equation $x = 3y$ in the form of $ax+by+c = 0$ and find the values of a , b and c . (10 Mks)

Solution

Given equation: $x = 3y$

The standard form of linear equation in two variables is $ax+by+c = 0 \dots(1)$

Rearranging the given equation, we get

$$\Rightarrow x - 3y = 0$$

This can be written as

$$\Rightarrow 1(x) + (-3)y + (0)c = 0 \dots(2)$$

On comparing equation (1) and (2), we get

$$\Rightarrow a = 1, b = -3 \text{ and } c = 0.$$

- b) A company intends to make an annual profit of Kes 100,000. The company's manufacturing capacity details are as follows.

Production capacity 100,000 units

Fixed Costs Kes 30,000

Variable costs/unit Kes 30

- What should be the
 i) Price per unit? (5 Mks)
 ii) Price if the variable costs changes to Kes 40? (5 Mks)

Solution

- i) Number of Units sold X Price per Unit = Numbers of units Sold X variable costs + Variable costs

$$100,000 P = (10,000 X 30) + 30,000 + 100,000$$

Substitute for P

$$10,000 P = 430,000$$

$$P = 43$$

- ii) $100,000 P = (10,000 X 40) + 30,000 + 100,000$

$$100,000 P = 400,000 + 130,000$$

$$100,000 P = 530,000$$

$$P = 53$$

- c) Suppose you are offered a cash bonus, but your employer gives you two options: receive 8,000 right now or 10,000 two years from now. Select the most profitable choice and give a rationale for it, assuming a prevailing rate of return to be 12%. (5 Marks)

If you invest the 8,000 into an account that earns 12% annual interest, your equation would be:

$$FV = 8,000 x [1 + (12\% / 1)] ^ (1 x 2)$$

$$FV = 8,000 \times [1.12]^2$$

$$FV = 10,035.20$$

Using this calculation, you find that the future value of your 8,000, invested in an account earning 12% annual interest, in two years would be 10,035.20. Taking the money today is better because you have the ability to increase its worth to an amount larger than what your employer promises to give you in two years.

QUESTION THREE

- a) Find the amount and the compound interest on Kes. 1,00,000 compounded quarterly for 9 months at the rate of 4% per annum. (10 Mks)

Solution

Given,

$$P = 1,00,000$$

$$R = 4\%$$

Time = 9 months

$$A = P[1 + (R/400)]^{4n}$$

Here, $R/400$ is the quarterly interest rate.

$$4n = 9 \text{ months} = 3 \text{ quarters}$$

$$\text{So, } A = 1,00,000 [1 + (4/400)]^3$$

$$= 1,00,000 [1 + (1/100)]^3$$

$$= 1,00,000 [(100 + 1)/100]^3$$

$$= 1,00,000 \times (101/100) \times (101/100) \times (101/100)$$

$$= 103030.10$$

- b) Solve the following system of linear equations (10 Mks)

$$x + y + z = 6$$

$$x + 2y + 3z = 14$$

$$x + 4y + 7z = 30$$

Solution

The given linear equations can be written in the form of a matrix equation $AX = B$, where

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 7 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{ and } B = \begin{bmatrix} 6 \\ 14 \\ 30 \end{bmatrix}$$

The augmented matrix $[A|B]$ is-

$$[A|B] = \begin{bmatrix} 1 & 1 & 1 & | & 6 \\ 1 & 2 & 3 & | & 14 \\ 1 & 4 & 7 & | & 30 \end{bmatrix}$$

We reduce the given matrix to row echelon form by applying elementary row transformations

Applying $R_2 \rightarrow R_2 - R_1, R_3 \rightarrow R_3 - R_1$

$$[A|B] \sim \begin{bmatrix} 1 & 1 & 1 & | & 6 \\ 0 & 1 & 2 & | & 8 \\ 0 & 3 & 6 & | & 24 \end{bmatrix}$$

Applying $R_3 \rightarrow R_3 - 3R_2$

$$[A|B] \sim \begin{bmatrix} 1 & 1 & 1 & | & 6 \\ 0 & 1 & 2 & | & 8 \\ 0 & 0 & 0 & | & 0 \end{bmatrix}$$

c) State and explain the relevance of the Time Value of Money concept

(4 Marks)

TVM is a fundamental principle stating that a sum of money today is worth more than the same sum in the future due to its earning potential

Relevance

Because of the time value of money, a shilling today is worth more than a shilling in the future.

The reason that money is worth more today than in the future is because money today can be invested, earning interest and capital gains.

A shilling in the future is worth less than a shilling today because of inflation, which reduces purchasing power.

The time value of money can be analyzed in two ways: present value and future value.

Present value assesses how much a cash flow received in the future will be worth today.

Future value determines how much a cash flow received today will be worth in the future.

- d) State and explain the components used in computing values under the Time Value of Money concept (4 Marks)

FV = Future value of money

PV = Present value of money

i = Interest rate per period (also called the discount rate)

n = Number of compounding periods of interest per year

t = Number of years or amount of time the money is held

QUESTION FOUR

- a) One kind of cake requires 200 g of flour and 25g of fat, and another kind of cake requires 100 g of flour and 50 g of fat Find the maximum number of cakes that can be made from 5 kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients, used in making the cakes. (10 Mks)

Step 1: Create a table as below

	Flour(g)	Fat(g)
Cake of first kind (x)	200	25
Cake of second kind (y)	100	50
Availability	5000	1000

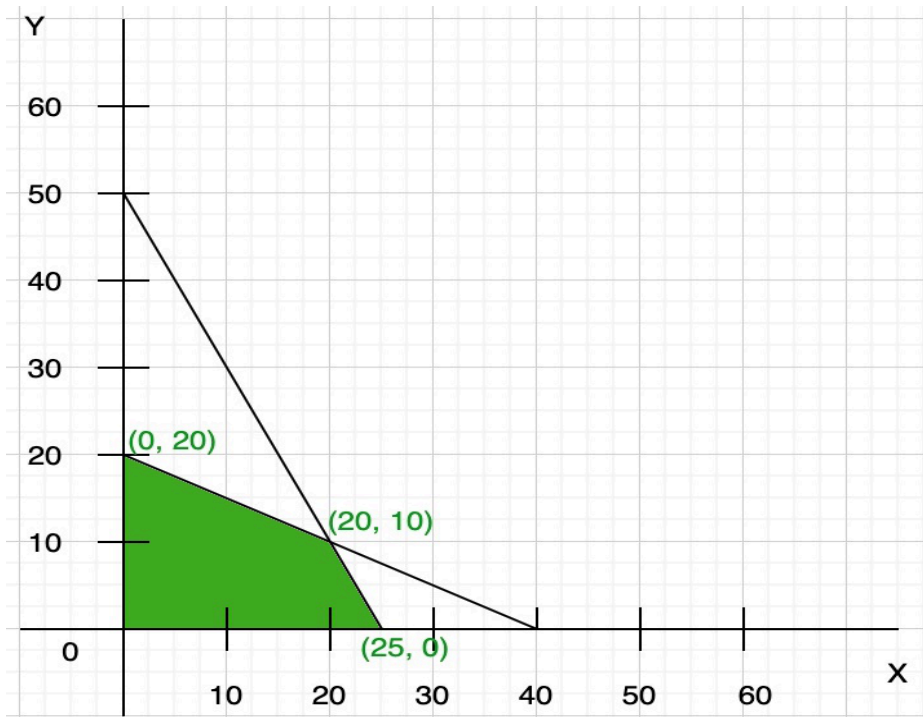
Step 2: Create linear equation using inequality

$$200x + 100y \leq 5000 \text{ or } 2x + y \leq 50$$

$$25x + 50y \leq 1000 \text{ or } x + 2y \leq 40$$

Also, $x > 0$ and $y > 0$

Step 3: Create a graph using the inequality as below



Step 4: To find the maximum number of cakes ($Z = x + y$). Compare each intersection point of the graph to find the maximum number of cakes that can be baked.

x	y	$Z = (x+y)$
0	20	20
20	10	30
25	0	25

Z is maximum at co-ordinate (20, 10). So the maximum number of cakes that can be baked is $Z = 20 + 10 = 30$.

b) Evaluate

$$\lim_{x \rightarrow -\infty} \frac{\sqrt{4x^6 + 5}}{x^3 + 1}$$

(5 Mks)

Solution:

Divide through by x^3 , in the numerator. Therefore

$$\frac{\sqrt{4x^6 + 5}}{x^3 + 1} = \frac{\sqrt{4 + 5/(x^6)}}{1 + 1/(x^3)}$$

As x goes to $-\infty$, the numerator goes to $\sqrt{4} = 2$. As x goes to $-\infty$, the denominator goes to 1.

Hence the answer is -2 .

- c) Find the area under the curve, for the region bounded by the circle $x^2 + y^2 = 16$ in the first quadrant.

Solution:

The given equation of the circle is $x^2 + y^2 = 16$

Simplifying this equation we have $y = \sqrt{4^2 - x^2}$

$$\begin{aligned} A &= \int_0^4 y \cdot dx \\ &= \int_0^4 \sqrt{4^2 - x^2} \cdot dx \\ &= \left[\frac{x}{2} \sqrt{4^2 - x^2} + \frac{4^2}{2} \sin^{-1} \frac{x}{4} \right]_0^4 \\ &= \left[\left(\frac{4}{2} \right) \times 0 + \left(\frac{16}{2} \right) \sin^{-1} 1 \right] - 0 \\ &= \left(\frac{16}{2} \right) \left(\frac{\pi}{2} \right) \\ &= 4\pi \end{aligned}$$

Answer: Therefore the area of the region bounded by the circle in the first quadrant is 4π sq units

- d) State and explain five ways through which statistics can improve business performance (5 Marks)
- i. Data-Driven Decision Making:

Statistics help businesses make informed decisions based on data analysis rather than relying solely on intuition or gut feelings. By analyzing historical data and trends, businesses can identify patterns and make decisions that are more likely to lead to favorable outcomes.

- ii. Performance Measurement and Monitoring:

Statistics enable businesses to measure and monitor key performance indicators (KPIs). Whether it's sales figures, customer satisfaction scores, or production efficiency, statistical analysis helps track performance over time, identify areas for improvement, and set benchmarks for success.

- iii. Risk Management:

Businesses face various risks, including market fluctuations, economic changes, and operational uncertainties. Statistics help in assessing and quantifying these risks, allowing businesses to develop risk management strategies. By understanding the probabilities associated with different scenarios, companies can make more informed choices to mitigate potential losses.

- iv. Customer Segmentation and Targeting:

Statistical techniques, such as clustering and regression analysis, enable businesses to segment their customer base. By understanding customer preferences, behavior, and demographics, companies can tailor their marketing strategies, product offerings, and customer experiences. This targeted approach can lead to more effective marketing campaigns and increased customer satisfaction.

v. Process Optimization:

Statistics play a vital role in optimizing business processes. Through techniques like Six Sigma or statistical process control (SPC), companies can identify and eliminate inefficiencies in their operations. This leads to improved quality, reduced waste, and increased overall efficiency, resulting in cost savings and enhanced productivity.