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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. Degree in Health Promotion
First Year - Semester I Examination – March 2021

FDN 1204 – BASIC MATHEMATICS

Time: Two (02) hours

Answer all (04) questions

1. a) Let W, X, Y *and* Z be three set such that,

$W = \{-1, -3, -4, 0, -2, 5, -7, 3, 6, 1\}$,
$X = \{0, 1, 9, 10, -3, -1, -4, 5\}$,
$Y = \{1, -1, -2, -3, -7, 2, 6, 8, 12, 15\}$
$Z = \{-6, -9, -3, 2, 5, -1, -2, -8, 13, 14, -10\}$

Find the following sets,

i. $W \cap (Y - X)$
ii. $X \cup (Y \cap Z)$
iii. $W \cup ((Y - Z) - X)$

(30 marks)

b) In a survey of 130 people, the following data were collected: 106 people subscribed to newspaper, 29 people subscribed to magazines, and 17 people were members of a mail CD club. Seventeen subscribed to both the newspapers and the magazines, 5 people subscribed to magazines and were members of a CD club, and 10 people subscribed to the newspaper and were members of a mail CD club. Three people subscribed to both the newspaper and magazines and were members of a mail CD club. Illustrate this situation in a Venn diagram.
Using the Venn diagram answer the following questions,

i. How many people subscribed neither the newspaper nor the mail CD club?
ii. How many people were not subscribed any of the three modes?
iii. How many people subscribed all three modes?
iv. How many people subscribed exactly two modes?

(30 marks)

c) The length of a rectangle is $1m$ longer than 3 times its width. The area is $80m^2$. Find the dimension of this rectangle.

(20 marks)

d) If one side of a square is increased by $10cm$ and another side is increase by $5cm$, a rectangular is formed with an area 3 times the area of the given square. Find the length of the side of the square.

(20 Marks)

2. a) Find the following limits

i. $\lim_{x\to \frac{1}{2}} \frac{e^x(6x^2+5x+1)}{(x-1)(4x^2+4x-3)}$

ii. $\lim_{n\to\infty} \frac{(n^3+3n-1)}{(n^2-n+1)(3n-4)}$.

(30 Marks)

b) Using the definition of the differentiation find the derivative of the function $f(x) = x^2 + 2x$.

(20 Marks)

c) Find all turning points and inflection points for the function $f(x)$

$f(x), where\ f(x) = \frac{1}{3}(x^3 - 3x^2 - 24x)$. Then sketch the graph.

(50 Marks)

3. a) The volume of a cube is increasing at the rate of $8cm^3s^{-1}$. How fast is the surface area increasing when the length of an edge is $12cm$?

(15 Marks)

b) Find the following integrations with respect to x.

i. $\int (\sin^2 x + 1)dx$

ii. $\int x^2 e^{x^3} dx$ (Hint: Take suitable substitution)

iii. $\int_0^1 \frac{2x+1}{1+x^2} dx$.

(45 Marks)

c) When a tap at the base of a storage tank is turned on, water flows out of the tank at the rate of $225e^{-\frac{1}{7}t}$ liters per minute, where t is time. If the volume of water in the tank at the start is 1500 liters, find how much is left after the tap has been running for 12 minutes.

(20 Marks)

d) Find the first and second order partial derivatives of the function $Q(u,v,w)$ with respect to each variable, where

$Q(u,v,w) = u^4 \sin w^2 - 2v + \ln(v^2 w)$.

(20 Marks)

4. a) Let $X = \begin{pmatrix} r & 0 & -1 \\ 0 & -1 & 0 \end{pmatrix}, Y = \begin{pmatrix} 2 & 1 & 3 \\ 1 & -r & 4 \end{pmatrix}$ *and* $Z = \begin{pmatrix} s & -2 \\ -1 & s+1 \end{pmatrix}$ be matrices such that $XY^t = Z$, where $r, s \in R$. Find r *and* s. Show that Z is a singular matrix. Let $W = -\frac{1}{3}(Z - 2I), where\ I$ is the identity matrix of 2×2. Find W^{-1} and also find the matrix L such that $3W(L + 3I) = W - I$.

(65 Marks)

b) Let $A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ p & q & r \end{pmatrix}$ and I be the identity matrix of 3×3 *where* $p, q, r \in R$, Show that

$A^3 = pI + qA + rA^2$. Find the condition for the matrix A to be invertible.

(35 Marks)

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