MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2017/2018

FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

CITY CAMPUS –REGULAR

CIT 103: MATHEMATICS FOR INFORMATION TECHNOLOGY

Date: 22nd February, 2018   Time: 12.00 - 3.00pm

INSTRUCTIONS:

- Answer Question ONE and any other TWO.

QUESTION 1 (30 Marks) - COMPULSORY

a) Briefly define the following terms

    i) An injective (one to one) function

    ii) Cartesian product of two sets

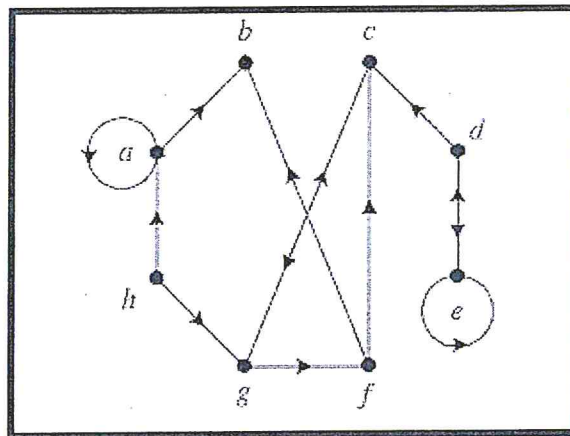   iii) Proposition in propositional logic

    iv) Range of a function   (8 Marks)

b) Let f and g be the functions $\mathbb{R} \to \mathbb{R}$ defined by $f(x) = x + 2$ and $g(x) = 1/(x^2 + 1)$ respectively. Determine

    i) $f \circ g(x)$

    ii) $g \circ f(x)$ (6 Marks)

c) A relation R on the set $A = \{a, b, c, d, e, f, g, h\}$ has the following directed graph

    i) List the elements of R

    ii) List the elements of $R \circ R$

    iii) Draw the directed graph of the relation $R \circ R$ (12 Marks)

d) Differentiate the following expression with respect to x: $y = (3x^2 - 2)^2$ and determine the value of x when

$$\frac{dy}{dx} = 0$$

QUESTION 2 (20 Marks)

a) State whether the graph shown in Figure 1 below is the graph of a function
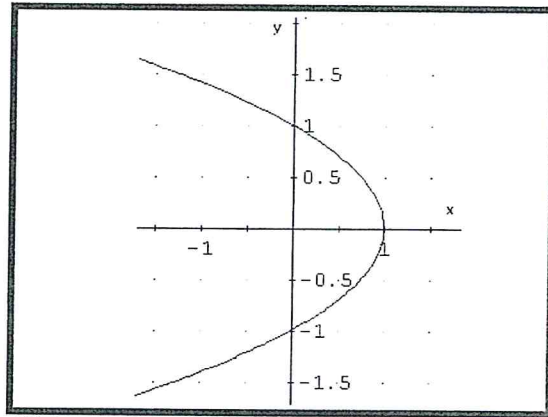
(1 Marks)

Figure 1

b) Function f is defined by $f(x) = 2x^2 + 6x - 3$ determine $f(-2)$ and $f(x - 2)$

(5 Marks)

c) Functions h and g are defined by $h(x) = -7x - 5$ and $g(x) = 10x - 12$, find $(h + g)(x)$

(5 Marks)

d) Find the domain of the function $f(x) = \sqrt{(-x^2 - x + 2)}$ (2 Marks)

e) Find the range of the function $f(x) = -x^2 - 6$ (2 Marks)

f) Functions g and h are defined by $g(x) = \sqrt{x - 1}$ and $h(x) = x^2 + 1$. Find the composite function $g \circ h(x)$ hence determine $g \circ h(-5)$ (5 Marks)

QUESTION 3 (20 Marks)

a) Construct a truth table for the compound proposition $(p \wedge \neg q) \rightarrow (r \vee q)$. Is the compound proposition a tautology?   (6 Marks)

b) Let $A = \{a, b, c, d\}$ and let $R = \{(a, b), (b, c), (c, d), (d, b)\}$ be a relation on A.
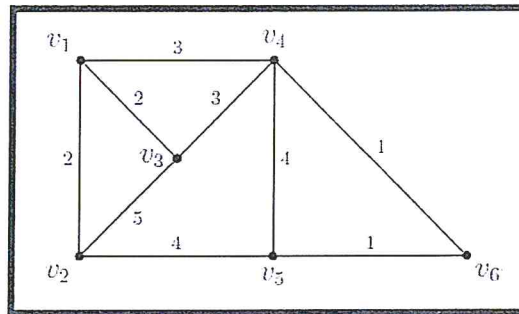
   i) Draw the directed graph representing R (2 Marks)

   ii) Determine the transitive closure R^* of R (3 Marks)

total weight of the minimal spanning tree? Draw the minimal spanning tree.

(5 Marks)

QUESTION 5 (20 Marks)

a) Consider the function $f(x) = 2x + 1$. By differentiating from first principles show that $f'(x) = 2$ Hint: Calculate the following limit: (5 Marks)

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

b) For the following functions, find the derived functions

i) $y = \frac{4}{3}x^3$ (2 Marks)

ii) $y = \frac{x^2 + 3x + 2}{x}$ (3 Marks)

c) Consider the quadratic function $f(x) = 3x^2 + 2x + 4$. Calculate (5 Marks)

$$\int_{-1}^{2} f(x)dx$$

d) Consider the derivative $f'(x) = x + 3$. Find $f(x)$ using the fact that the point $(0,1)$ lies on the curve. (5 Marks)

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