



Instructions to candidates

Duration: One(01) hour

Number of questions: Four(04) Essay Questions

Mark allocation: 100 mark

Use standard symbols without definition.

Scientific calculators are allowed.

Answer TWO(02) questions ONLY

1.

a. Describe each of the following sets in *set builder notation*.

i. $A = \{2, 4, 6, 8, 10\}$ (03 mark)

ii. $B = \{\text{prime numbers less than } 15\}$ (03 mark)

b. List all the subsets of the set $A = \{1, 2, 3\}$. (02 mark)

c. If X, Y, and Z are three non-empty sets, represent the following using the Venn diagrams by shading the relevant regions.

i. $(X \cup Y) \cap (X \cup Z)$ (04 mark)

ii. $(X \cap Y) \cap Z'$ (04 mark)

d. In a group of 70 cars tested by a garage in Badulla, 15 had faulty tires, 20 had faulty brakes and 18 exceed the allowable emission limits. Also, 5 cars had faulty tires and brakes, 6 failed on tires and emission, 10 failed on brakes and emissions, and 4 cars were unsatisfactory in all three respects.

i. Draw an appropriate Venn diagram. (10 mark)

ii. How many cars had no faults in these three checks? (05 mark)

e. If $A = \{2, 4, 6, 8\}$ and $B = \{3, 5, 7\}$. R be a relation from A to B, where

$$R = \{(a, b) : a \text{ is greater than } b\}$$

i. Find the Cartesian product of A and B, $A \times B$. (05 mark)

ii. List the elements of relation R. (05 mark)

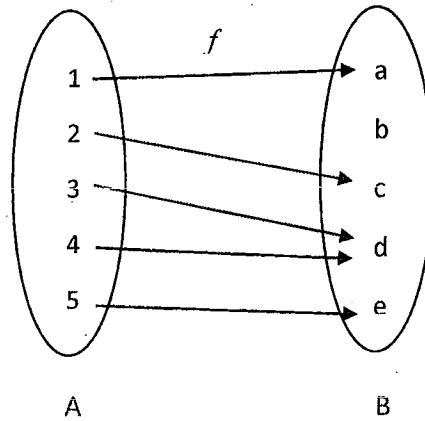
iii. Find the domain and range of R. (04 mark)

iv. Represent R diagrammatically. (05 mark)

2.

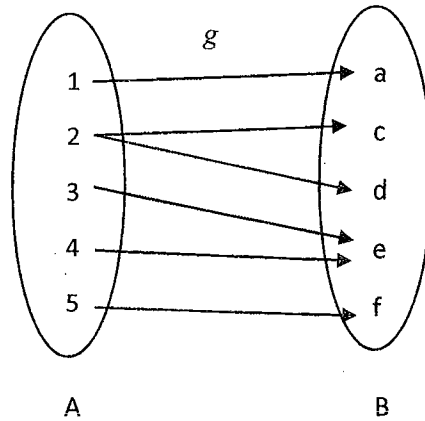
a. State whether each of the following relations represent a function or not.

i.



(05 mark)

ii.



(05 mark)

b. Which of the following relations are functions from A to B ? Write their *domain* and *range*. If it is not a function give reasons.

i. $\{(1,1), (1,2), (2,3), (-3, 4)\}$, $A = \{1, 2, -3\}$, $B = \{1, 2, 3, 4\}$ (05 mark)

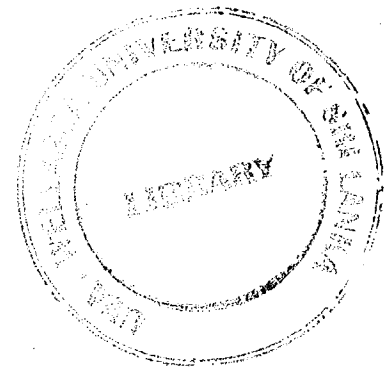
ii. $\{(a,2), (b,3), (c,2), (d, 3)\}$, $A = \{a, b, c, d\}$, $B = \{2, 3\}$ (05 mark)

c. Find the domain of each of the following functions.

i. $f(x) = 2x + 1$ (03 mark)

ii. $g(x) = \frac{1}{2x-1}$ (04 mark)

iii. $h(x) = \sqrt{x-5}$ (04 mark)



d. Sketch the graph of following functions.

- i. $y = -2$ (02 mark)
- ii. $y = 2x + 1$ (03 mark)
- iii. $y = -3x + 4$ (03 mark)
- iv. $y = 2x^2 + 1$ (05 mark)
- v. $y = x^2 - 2x + 8$ (06 mark)

3.

a. Decompose the following rational functions into partial fractions.

i. $\frac{x}{(x+3)(x-1)}$ (10 mark)

ii. $\frac{x+3}{(x^2-1)(x+5)}$ (15 mark)

iii. $\frac{3x^2+9x-20}{(x-2)(x+3)}$ (15 mark)

b. Use the **long division of polynomials** to divide $2x^3 + 9x^2 + 11x + 2$ by $x^2 + 4x + 3$.

(10 mark)

4.

a. Convert $45^\circ 12' 24''$ to a decimal in degrees. Round the answer to two decimal places.

(03 mark)

b. Convert 35.265° to the $D^\circ M'S''$ form. Round the answer to the nearest second. (03 mark)

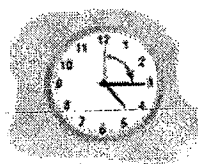
c. Convert each of the following angles in degrees to radians.

i. 150° (03 mark)

ii. -270° (03 mark)

iii. 420° (03 mark)

d. The minute hand of a clock is 6 inches long. How far does the tip of the minute hand move in 15 minutes? (05 mark)



e. An engineer is asked to design a water sprinkler that will cover a field of 100 square meters that is in the shape of a sector of a circle of radius 15 of meters. Through what angle should the sprinkler rotate? (05 mark)

f. Evaluate the following trigonometric functions of quadrant angle.

i. $\cos 300^\circ$ (03 mark)

ii. $\sin 210^\circ$ (03 mark)

iii. $\tan(-225^\circ)$ (04 mark)

iv. $\sin(780^\circ)$ (04 mark)

g. Prove the following trigonometric identity.

i. $\sin^2 \theta (1 + \cot^2 \theta) = 1$ (04 mark)

ii. $\frac{1 - 2\sin^2 \theta}{\sin \theta \cos \theta} = \cot \theta - \tan \theta$ (07 mark)