1) Please answer the following questions:

Leith

a) Solve for $x : x^2 = 24 - 10x,\ x \in W$

W = whole numbers
$= \{1, 2, 3, \ldots\}$

$x^2 = 24 - 10x$

$x^2 + 10x - 24 = 0$

x	12	$12x$
x	-2	$-2x$
x^2	-24	$10x$

$(x+12)(x-2) = 0$

$x = 2$ $\quad$ $x = -12$ (rejected, -12 is not whole number)

$\therefore x = 2$

b) Let $X = \{2, 4, 5, 6\}$ and $Y = \{3, 4, 7, 8\}$, find the following:

$$(X - Y) \cup (Y - X)$$

$X - Y = \{2, 5, 6\}$

$Y - X = \{3, 7, 8\}$

$(X-Y) \cup (Y-X) = \{2, 3, 5, 6, 7, 8\}$

c) Each student in a class of 40 plays either Mobile Legend, DOTA or CS GO. 18 play Mobile Legend, 20 play CS GO, and 27 play DOTA. 7 play Mobile Legend and CS GO, 12 play CS GO and DOTA, and 4 play Mobile Legend, DOTA and CS GO. Find the number of students who play

3. Mobile Legend and DOTA
4. Mobile Legend and DOTA but not CS GO.

(10 markah/*marks*)

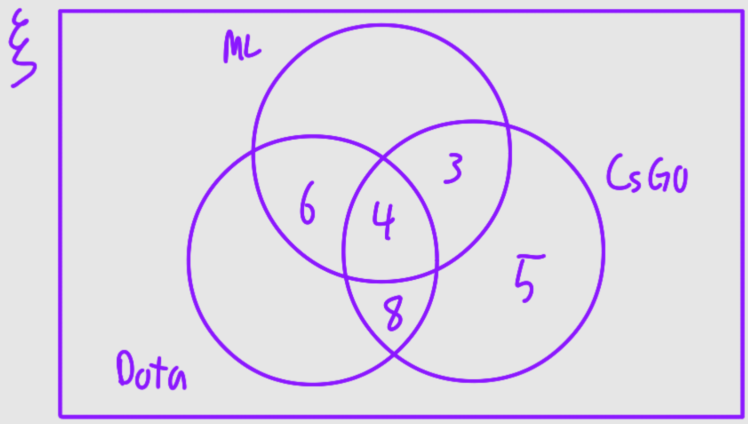
Leith

$n(S) = 40$ $\quad$ $n(DOTA) = 27$

$n(ML) = 18$ $\quad$ $n(ML \cup CsGO) = 7$

$n(CsGO) = 20$ $\quad$ $n(CsGO \cup Dota) = 12$

$n(ML \cup DOTA \cup CSGO) = 4$



$40 = 18 + 20 + 27 - 7 - 12 + 4 - M \cap D$

$M \cap D = 10$

People who play mobile legend and Dota

$= 10$

People who play mobile legend and Dota but not Csgo

$= 10 - 4$

$= 6$

2 **Please answer the following questions** Zetti

a

Is the following relation a function? Justify your answer. If it is a function, determine whether it is a one-to-one function or not.

a. $R_1 = \{(2,3), (\frac{1}{2}, 0), (2,7), (-4,6)\}$
b. $R_2 = \{(x, |x|) : x \in R\}$

a. Not a function, it has one to many relation

b. function

one-to-one function as every input has only one input

b

A relation R is defined on the set of positive integers as aRb if "a/b", which means that a is a factor of b. Show and explain whether the relation R is:
(1) Refleksif/ *Reflexive*
(2) Simetrik/ *Symmetric*
(3) Transitif/ *Transitive*
(4) Setara/ *Equivalence*

$\frac{a}{b}$

(10 markah/*marks*)

(1) $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$

Reflexive

(2) $\frac{4}{2}$, $\frac{2}{4}$ ← problem

If a is a factor of b, but b is not a factor of a.

Not symmetric

(3) $\frac{a}{b}$ and $\frac{b}{c}$, then $\frac{a}{c}$

k, m = integers

$b = ak$, $c = bm$, Thus, $c = akm$

Transitive

(4) Not equivalence, as it is reflexive, not symmetric and transitive.

3 Please answer the following questions along with its sub-questions

Leith

a) Using truth tables, determine if statements $(p \vee \sim p) \wedge (q \vee r)$ and $(q \vee r)$ are logically equivalent

p	q	r	$p \vee \neg p$	$q \vee r$	$(p \vee \neg p) \wedge (q \vee r)$
T	T	T	T	T	T
T	T	F	T	T	T
T	F	T	T	T	T
T	F	F	T	F	F
F	T	T	T	T	T
F	T	F	T	T	T
F	F	T	T	T	T
F	F	F	T	F	F

b Let P be the statement "Mathematics is easy" and Q be the statement "I do not need to study". Write down in words the following statements, and simplify if possible:

(1) $P \vee Q$
(2) $P \wedge Q$
(3) $\sim\sim Q$
(4) $\sim P \wedge Q$
(5) $P \Rightarrow Q$

(10 markah/*marks*)

① $P \vee Q$
= Mathematics is easy or I do not need to study.

② $P \wedge Q$
= Mathematics is easy and I do not need to study.

③ Q
= I do not need to study.

④ $\neg P \wedge Q$
= Mathematics is not easy and I do not need to study.

⑤ $P \Rightarrow Q$ Leith

= If Mathematics is easy then I do not need to study.

4 Please answer the following questions along with its sub-questions

a) Solve the following system of equations using Cramer's Method

$$\begin{cases} x + 2y - z = 7 \\ 2x - 3y - 4z = -3 \\ x + y + z = 0 \end{cases}$$

$$\begin{bmatrix} 1 & 2 & -1 \\ 2 & -3 & -4 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 7 \\ -3 \\ 0 \end{bmatrix}$$

$$|D| = \begin{vmatrix} 1 & 2 & -1 \\ 2 & -3 & -4 \\ 1 & 1 & 1 \end{vmatrix}$$

$$= 1[(-3)(1)-(-4)(1)] - 2[2(1)-(-4)(1)] - 1[2(1)-(-3)(1)]$$

$$= -16$$

$$|D_x| = \begin{vmatrix} 7 & 2 & -1 \\ -3 & -3 & -4 \\ 0 & 1 & 1 \end{vmatrix}$$

$$= 7[(-3)(1)-(-4)(1)] - 2[-3(1)-(-4)(0)] - 1[-3(1)-(-3)(0)]$$

$$= 16$$

$$|D_y| = \begin{vmatrix} 1 & 7 & -1 \\ 2 & -3 & -4 \\ 1 & 0 & 1 \end{vmatrix}$$

$$= 1[-3(1)-(-4)(0)] - 7[2(1)-(-4)(1)] - 1[2(0)-(-3)(1)]$$

$$= -48$$

Zeith

$$|D_z| = \begin{vmatrix} 1 & 2 & 7 \\ 2 & -3 & -3 \\ 1 & 1 & 0 \end{vmatrix}$$

$$= 1[-3(0)-(-3)(1)] - 2[2(0)-(-3)(1)] + 7[2(1)-(-3)(1)]$$

$$= 32$$

$$x = \frac{|D_x|}{|D|} \qquad y = \frac{|D_y|}{|D|} \qquad z = \frac{|D_z|}{|D|}$$

$$= \frac{16}{-16} \qquad = \frac{-48}{-16} \qquad = \frac{32}{-16}$$

$$= -1 \qquad = 3 \qquad = -2$$

b) A question paper has two parts P and Q, each containing 10 questions. If a student needs to choose 8 from part P and 4 from part Q, in how many ways can he do that?

(10 markah/*marks*)

$${}^{10}C_8 \times {}^{10}C_4 = 9450 \text{ ways}$$

5 Either draw a graph with the following specified properties, or explain why no such graph exists:

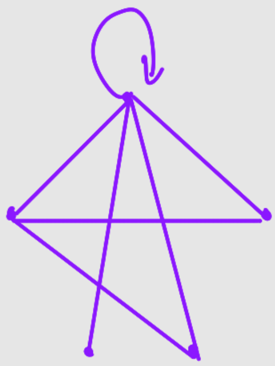
a) A graph with four vertices having the degrees of its vertices 1, 2, 3 and 4.

handshaking Theorem

Impossible, even vertices (4) need odd degree

b) A simple graph with five vertices with degrees 2, 3, 3, 3, and 5.

Impossible, simple graph cannot have a loop



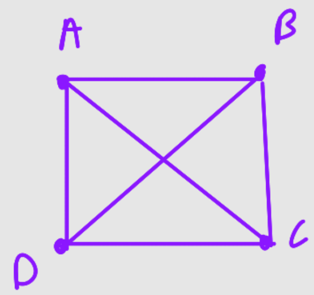
Zeith

c A simple graph in which each vertex has degree 3 and which has exactly 6 edges.

$\sum$ degrees of vertices = 2 × number of edge

n = num of vertices $3n = 2 \times 6$

$n = 4$



d) A graph with four vertices having the degrees of its vertices 1, 1, 2 and 6.

(10 markah/*marks*)

Handshaking theorem ✓

$\sum$ degrees $= 2E$

$2E = 1+1+2+6$

$= 10$

$E = 5$ (valid)

Maximum degree constraint X

4 vertices, degree at max $4-1=3$

impossible