***SET THEORY***

***Summary:***

***1.*** *A set is a collection of well defined objects****.***

***2.*** *An empty set is a set with no elements. It is denoted by curly brackets with nothing inside* ***{******} or φ.***

***3.*** *A subset is a set that is part of a larger set*

***4.*** *A universal set is a set of all other elements under consideration*

***5.*** *A Venn diagram is a set diagram that shows relations between different sets.*

***6.*** *For any two sets* ***A*** *and* ***B:***

***(i) n(ε)*** *is read as number of members in the universal set. This means number of members in all the regions of the Venn diagram*

***(ii) n(A)*** *is read as number of members in set* ***A****.*

***(iii)***  or*is read as number of members in set* ***A*** *complement. This means number of members of the universal set that are not in set* ***A.***

***(iv)*** *is read as* ***A*** *union* ***B.*** *This means members of either**set* ***A*** *or* ***B (****the entire region covering the two sets****)****.*

***(v)*** *is read as* ***A*** *intersection* ***B.*** *This means the region common to the two sets.*

***(vi)*** *is read as* ***A*** *intersection* ***B*** *complement****.*** *This means members of* ***A*** *only****.***

***(vii)*** *is read as* ***A*** *complement intersection* ***B.*** *This means members of* ***B*** *only****.***

***(ix)*** *is read as* ***A*** *complement intersection* ***B*** *complement****.*** *This means neither* ***A*** *nor* ***B.***  *is the same as* 

***(x)*** *is read as* ***A*** *union* ***B*** *complement****.*** *This means of members of the universal set that are not in set* ***B*** *only****.***

***(xi)*** *is read as* ***A*** *complement union* ***B.*** *This means of members of the universal set that are not in set* ***A*** *only****.***

***(xii)*** *is read as* ***A*** *complement union* ***B*** *complement****.*** *This means of members of the universal set that are not in the intersection****.***

***(xiii)*** *The Venn diagrams illustrating the regions relating any two sets* ***A*** *and* ***B*** *is as follows****:***





***A n B***



***n(A)***

***n(B)***

OR



**or**

***n(ε)***

***EXAMPLES:***

***1.*** *Given the sets* ***ε = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, A = {2, 3, 4, 5, 8}*** *and*

***B = {1, 3, 5, 7, 8, 9},*** *where* ***ε*** *is the universal set****,*** *find****:***

***(i)*** ***(ii)***  ***(iii)***  ***(iv)***  ***(v)*** 

***(vi)***  ***(vii)***  ***(viii)***   ***(ix)***  ***(x)*** 

***2.*** *Given the sets* ***P = {*** *All factors of* ***90}*** *and* ***Q = {*** *All factors of* ***60},*** *find****:***

***(i) n(P n Q) (ii)***  ***(iii) n(P U Q)***

***3.*** *Given the sets* ***P = {*** *All triangular numbers less than* ***40}*** *and*

***Q = {*** *All factors of* ***60},*** *find****:***

***(i) n(P n Q) (ii) n(P U Q) (iii)***  ***(iv)*** 

***4.*** *If* ***ε = { x: 0 < x < 13}, A = { x: 1 < x < 9}*** *and* ***B = { x: 4 < x < 11},*** *where* ***x*** *is an integer and* ***ε*** *is the universal set****,*** *find****:***

***(i) n(A n B) (ii) n(A U B) (iii)***  ***(iii)*** 

***5.*** *If* ***ε = { x: 1 < x < 14}, A = { x:*** ***}*** *and* ***B = { x:*** ***},*** *where* ***x*** *is an integer and****ε*** *is the universal set****,*** *find****:***

***(i) n(A n B) (ii) n(A U B) (iii)***   ***(iii)*** 

***6.*** *Given the sets* ***ε = {6, 7, 8, 9, 15, 16, 17, 18, 20, 21},***

***M = { x: x*** *are multiples of* ***3}*** *and* ***N = { x: x*** *are odd numbers****},*** *where* ***ε*** *is the universal set****,*** *find****:***

***(i) n(M n N) (ii) n(M U N) (iii)*** 

***(iv)***  ***(v)***  ***(vi)*** 

***Hint:*** *The elements of* ***M*** *and N have to be chosen from the universal set*

***7.*** *Sets* ***A*** *and* ***B*** *are such that* ***n(ε) = 30, n(A) = 18, n(B) = 14*** *and* *find****:***

***(i) n(A n B) (ii) n(A U B) (iii)***  ***(iv)*** 

***8.*** *Sets* ***P*** *and* ***Q*** *are such that* ***n(P) = 12, n(Q) = 8, n(P U Q) = 15*** *and* *find****:***

***(i) n(P n Q)***

***(ii) n(ε),*** *where* ***ε*** *is the universal set*

***9.*** *Sets* ***A*** *and* ***B*** *are such that* ***n(ε) = 40, n(A) = 25,***  *and*  *where* ***ε*** *is the universal set****.*** *Use a Venn diagram to find:*

***(i) n(A n B) (ii) n(A U B)***

***10.*** *Sets* ***M*** *and* ***N*** *are such that* ***n(ε) = 19, n(M) = 8*** *and*   *where* ***ε*** *is the universal set****.*** *Use a Venn diagram to find****:***

***(i) n(M n N) (ii)*** 

***11.*** *In a class of* ***53*** *students****, 36*** *drink tea****, 18*** *drink coffee while* ***10*** *drink neither tea nor coffee. Find how many students drink both tea and coffee*

***12.*** *In a class of* ***29*** *boys****, 22*** *liked rice and* ***18*** *liked matooke. All the boys liked at least one of the foods. Find how many liked both.*

***13.*** *In a class of* ***20*** *girls****, 5*** *play golf but not netball****, 9*** *play netball but not golf, while* ***3*** *play neither game. Find how many play****:***

***(i)*** *both games*

***(ii)*** *either game*

***(iii)*** *only one game*

***14.*** *In a class of* ***80*** *boys****, 70*** *play Tennis****, 30*** *play golf, while all those that play golf also play Tennis.*

***(i)*** *Represent the given information on a Venn diagram*

***(ii)*** *Find how many play neither game*

***15.*** *The number of people who play football* ***(F)*** *or basketball* ***(B)*** *is twice the number of those who play both* ***F*** *and* ***B.*** *If* ***n(F) = 9*** *and* ***n(B) = 6,*** *find how many play both games****.***

***EER:***

***1.*** *Sets* ***A*** *and* ***B*** *are such that* ***n(ε) = 28, n(A) = 10, n(B) = 17*** *and* ***n(A U B) = 22,*** *where* ***ε*** *is the universal set****.*** *Use a Venn diagram to find****:***

***(i) n(A n B) (ii)***  ***(iii)***  ***(iv)***  ***(v)***  ***(vi)***  ***(vii)*** 

***2.*** *Given the sets* ***M = {*** *All multiples of* ***6*** *less than* ***72}*** *and*

***N = {*** *All multiples of* ***4*** *less than* ***50} ,*** *find****:***

***(i) n(M n N) (ii) n(M U N) (iii)***  ***(iv)*** 

***3.*** *Sets* ***A*** *and* ***B*** *are such that* ***n(ε) = 23, n(A n B) = 8, n(B) = 14*** *and*  ***= 10,*** *where* ***ε*** *is the universal set****.*** *Use a Venn diagram to find****:***

***(i) n(A) (ii)***  ***(iii)***  ***(iv)*** 

***4.*** *In a class of* ***30*** *students****, 18*** *play volley ball****, 14*** *play hockey while* ***5*** *play neither. Find how many students play****:***

***(i)*** *both games*

***(ii)*** *only one game*

***5.*** *Given the sets* ***M = {*** *The first* ***10*** *rectangle numbers****}*** *and*

***N = {*** *The first* ***5*** *square numbers* ***} ,*** *find****:***

***(i) n(M n N) (ii) n(M U N) (iii)***  ***(iv)*** 

***6.*** *In a class of* ***28*** *boys****, 13*** *passed history and* ***25*** *passed physics. All the boys passed at least one subject. Find how many passed both subjects.*

***7.*** *Sets* ***A*** *and* ***B*** *are such that* ***n(ε) = 35, n(A n B) = 8, n(A) = 17*** *and* *where* ***ε*** *is the universal set****.*** *Use a Venn diagram to find****:***

***(i)***  ***(ii)*** 

***8.*** *Given the sets* ***M = {*** *All multiples of* ***3*** *less than* ***20}*** *and*

***N = {*** *All odd numbers less than* ***20} ,*** *find* ***n(M n N)***

***9.*** *In a class of* ***50*** *boys****, 23*** *passed history****, 35*** *passed physics and* ***2*** *passed neither subject****.*** *Find how many passed****:***

***(i)*** *both subjects.*

***(ii)*** *only one subject.*

***10.*** *Given the sets* ***M = {*** *All integers greater than* ***4*** *but less than* ***10}*** *and*

***N = {*** *All multiples of* ***3*** *between* ***1*** *and* ***20},*** *find****:***

***(i) n(M n N) (ii) n(M U N) (iii)*** 

***11.*** *Given the sets* ***T = {*** *All triangle numbers less than* ***20}*** *and*

***F = {*** *All factors of* ***12} ,*** *find the members of* ***T n F.*** *Hence find* ***n(T n F)***

***12.*** *Given the sets* ***P = {*** *All factors of* ***24}*** *and* ***Q = {*** *All factors of* ***30},*** *find*



***13.*** *Two sets* ***A*** *and* ***B*** *are such that* ***n (A) = 12, n (B) = 13, n (AUB) = 20*** *and*

***n(ε) = 24,*** *find****:***

***(i) n (A∩B')******(ii) n (A'∩B')******(iii)n (AUB')***

***14.*** *If* ***n (ε) = 60, n (A') = 32, n (A∩B) = 10*** *and* ***n (AUB)' = 17,*** *find****:***

***(i) n (B)******(ii) n (A∩B')*** ***(iii)n (AUB)***

***SENIOR THREE***

***1.*** *Sets* ***A, B*** *and* ***C*** *are such that* ***n(ε) = 100, n(A) = 46, n(B) = 40, n(C) = 49, n(A n B) = 14, n(A n C) = 17, n(B n C) = 15*** *and*  *Use a Venn diagram to find****:***

***(i) n(A n B n C)***

***(ii) n(A U B U C)***

***(iii)*** 

***(iv)*** 

***(v)*** 

***2.*** *In a class of* ***53*** *students****,******30*** *study Art****,******20*** *study French and* ***15*** *study Computer****. 6*** *study both Art and French****, 4*** *study Art and Computer****,******5*** *study French and Computer****.*** *Each student studies at least one of the three subjects*

***(a)****Represent the information on Venn diagram*

***(b)****Find the number of the students who study****:***

***(i)*** *all the three subjects*

***(ii)*** *at least two subjects.*

***(c)*** *Find the probability that a student chosen at random studies****:***

***(i)*** *only one subject*

***(ii)*** *French only*

***(iii)*** *French but not Computer*

***3.*** *In a class of* ***30*** *students****, 18*** *play Tennis****, 15*** *play Golf and* ***13*** *play Hockey****.*** *The number of students who play all the three games are equal to those who play neither game****. 10*** *play both Tennis and Hockey****, 8*** *play Tennis and Golf****,******3*** *play only Golf and Hockey****.***

***(a)****Represent the information on Venn diagram*

***(b)*** *Find the number of the students who play****:***

***(i)*** *all the three games*

***(ii)*** *at most one game*

***(c)*** *Find the probability that a student chosen at random plays at least two games*

***3.*** *In a class of* ***56*** *students****, 28*** *play Tennis****, 24*** *play Chess and* ***32*** *play Hockey****.******10*** *play both Tennis and Chess****, 6*** *play both Chess and Hockey****, 4*** *play all the three games****.***

***(a)****Represent the information on a Venn diagram*

***(b)*** *Find the number of the students who play**both Tennis and Hockey only*

***(c)*** *Find the probability that a student chosen at random plays****:***

***(i)*** *at least two games*

***(ii)*** *only one game*

***4.*** *In a class of* ***100*** *students****,******15*** *take Art only****,******12*** *take French only and* ***8*** *take Computer only****. 10*** *take both Art and French****, 40*** *take Art and Computer****,******20*** *take French and Computer****, 65*** *take Computer****.***

***(a)****Represent the information on Venn diagram*

***(b)*** *Find the number of the students who take****:***

***(i)*** *all the three subjects*

***(ii)*** *Art*

***(iii)*** *French*

***(c)*** *Find the probability that a student chosen at random takes neither subject*

***5.*** *In a class of* ***52*** *students****,*** *an equal number of students visited Arua and Kasese.* ***24*** *visited Mbale****, 11*** *visited both Mbale and Arua****, 12*** *visited Arua and Kasese****, 13*** *visited Mbale and Kasese****. 8*** *visited all the three towns and* ***4*** *visited neither town****.***

***(a)****Represent the information on Venn diagram*

***(b)****Find the number of the students who****:***

***(i)*** *visited Kasese*

***(ii)*** *did not visit Arua*

***(c)*** *Find the probability that a student chosen at random visited at least two towns*

***3.*** *In a class of* ***72*** *students****,*** *each student must at least take of the subjects Art* ***(A),*** *Computer* ***(C)*** *and French* ***(F).*** *None of the students takes* ***F*** *and* ***C,******26*** *take* ***F*** *only****.*** *Of the* ***35*** *students taking* ***A, 20*** *take the subject alone. The number of students taking* ***F*** *and* ***A*** *is three more than those taking* ***A*** *and* ***C.***

***(a)****Represent the information on Venn diagram*

***(b)****Use the Venn diagram to find the number of the students who take;*

***(i)****Art and Computer*

***(ii)*** *Computer.*

***(c)****What is the probability that a student chosen at random takes only one subject.*

***15.*** *In the Venn diagram below****,*** *sets* ***P*** *and* ***Q*** *are such that* ***n(PUQ) = 16, n(P') = 7,*** *and* ***n(Q') = 6.***

***7***

***P***

***Q***

***a***

***b***

***c***

*Find the values of* ***a,******b*** *and* ***c.*** *Hence obtain* ***n(ε)***

***5.*** *Study the Venn diagram below****:***

***4***

***n(P) = 24***

***n(Q) = 26***

***n(R) = 28***

***6***

***3***

***11***



***a***

***b***

***c***

***11***

***2***

*Find****:***

***(i)*** *the values of* ***a, b*** *and* ***c***

***(ii) n(ε),*** *where* ***ε*** *is the universal set*

***7.*** *Sets* ***A, B*** *and* ***C*** *are such that* ***n(A) = 23, n(B) = 24, n(C) = 25, n(A n B n C) = 5,***  *and*  *Use a Venn diagram to find****:***

***(i)*** 

***(ii)*** 

***(iii)*** 

***(iv) n(ε) ,*** *where* ***ε*** *is the universal set****.***

***6.*** *Study the Venn diagram below****:***

***6***

***n(A) = 19***

***n(B) = 20***

***n(C) = 11***

***7***

***1***

***11***



***p***

***q***

***r***

***2***

***4***

*Find****:***

***(i)*** *the values of* ***p, q*** *and* ***r***

***(ii) n(ε),*** *where* ***ε*** *is the universal set*

***14.*** *In a class of* ***42*** *students****,******15*** *like Chemistry* ***(C),******19*** *like Physics* ***(P),*** *and* ***28*** *like Mathematics* ***(M). 6*** *students like both Physics and Chemistry****,******10*** *students like both Mathematics and Chemistry and* ***8*** *like Physics and Mathematics but not Chemistry****.*** *Given that the number of students who like all the three subjects is equal to those who do not like any of the subjects****.***

***(a)*** *Represent the above information on a Venn diagram****.***

***(b)*** *Find the number of students who like****:***

***(i)*** *all the three subjects****.***

***(ii)*** *at least two of the subjects****.***

***(c)*** *Find the probability that a student selected at random**likes other subjects****.***

***6.*** *The Venn diagram below shows a group of students playing Hockey* ***(H)*** *or Tennis* ***(T)***

***H***

***T***

***x - 2***

***4***

***8***

***x***

*If the probability that a student picked at random from the group plays both or none of the games is* ***0⋅4,*** *find the****:***

***(i)*** *value of* ***x.***

***(ii)*** *number of students playing both of the games.*

***6.*** *In the Venn diagram below****, 20*** *students play either Hockey* ***(H)*** *or Tennis* ***(T)***

**H**

**T**

**4**

**a**

**b**

**c**

*If* ***14*** *and* ***12*** *students do not play Hockey and Tennis respectively****,*** *find the****:***

***(i)*** *values of* ***a, b*** *and* ***c.***

***(ii)*** *probability that a student picked at random plays neither of the games*

***5.*** *In a sports club* ***19*** *members play Hockey* ***(H),******18*** *play Rugby* ***(R),******17*** *play*

*Tennis* ***(T)*** *and* ***5*** *play neither of the games****. 10*** *play both* ***H*** *and* ***R, 6*** *play both*

***H*** *and* ***T, 7*** *play both* ***R*** *and* ***T, 20*** *play only one game****.***

***(a)*** *Represent the above information on a Venn diagram****.***

***(b)*** *Find the number of members****:***

***(i)*** *who play all the three games****.***

***(ii)*** *in the club****.***

***(iii)*** *who play at most one game****.***

***(c)*** *Find the probability**that a member picked at random plays at least two games*

**14.** In a class of **42** students**,** **15** like Chemistry **(C),** **19** like Physics **(P),**

and **28** like Mathematics **(M). 6** students like both Physics and

Chemistry**,** **10** students like both Mathematics and Chemistry and

**8** like Physics and Mathematics but not Chemistry**.** Given that the

number of students who like all the three subjects is equal to those

who do not like any of the subjects**.**

**(a)** Represent the above information on a venn diagram**.**

**(b)** Find the number of students **:**

**(i)** who like all the three subjects**.**

**(ii)** atleast two of the subjects**.**

**(c)** Find the probability that a student selected at random from the class

likes other subjects**.**

***16.*** *In a class of* ***40*** *students****,******18*** *play Hockey* ***(H), 15*** *play Tennis* ***(T)*** *and* ***22*** *play football* ***(F). 7*** *play Hockey and Tennis****, 9*** *play Tennis and Football****,******8*** *play Hockey and Football and four students play all the three games.*

***(a)*** *Represent the given information on a venn diagram*

***(b)*** *Find the number of students who****:***

***(i)*** *did no play any of the games*

***(ii)*** *played exactly two of the games*

***(c)*** *Determine the probability that a student selected at random plays only one game.*

1. A group of tourists was asked which countries they visited in East Africa. It was found out that 90 tourists visited Tanzania, The number of tourists who visited Kenya was more than those who visited Tanzania by four, and the number of those who visited Uganda was less than those who visited Kenya by ten. Twenty four tourists visited only Uganda, forty six visited only Kenya and those who visited only Tanzania were ten more than those who visited only Uganda. It was found out that all tourists visited at least each of the countries while fifty eight visited only two countries and seventy four visited at least two countries.
2. Represent the above information clearly on a venn diagram (03 marks)
3. Using the venn diagram, find the number of tourists who
4. visited all the three countries
5. were in the group (07 marks)

If a tourist was selected from the group at random, find the probability that the tourist selected visited Uganda and Tanzania.