Set Theory: Tutorial

Question 1

1. Let U= {Positive integers}, A= {1, 3, 5, 7, 9} and B= {2, 4, 6, 8, 10}
   State whether each of the following is true or false.
   i. $5 \in A$
   ii. $1 \in B$
   iii. $-2 \notin U$
   iv. $B \subseteq U$
   v. $\Phi \subseteq A$

2. Answer the questions given considering the following sets.
   U= {a, b, c, d, e, f, g, h, i, j}
   P= {a, e, i}
   Q= {b, e, g}

   Find the following sets.
   i. Q'
   ii. $P \cup Q$
   iii. $P \cap Q'$
   iv. Find all the subsets of Q

Question 2

1. Fill in the blanks with the correct symbol from $\in$, $\notin$, $\subseteq$, $=$ or $\neq$.
   Recall Z is the set of all integers, Z^+ is the set of all positive integers and Φ is the empty set { }.

   i. 3 ___ {1, 3, 5}
   ii. { 3 } ___ {1, 3, 5}
   iii. Φ ___ {1, 3, 5 }
   iv. {5, -2, 8} ___ {-2, 5, 8 }
   v. { 5, 2, 8 } ___ {-2, 5, 8}
   vi. 2 ___ Z
   vii. { 2 } ___ Z
   viii. -2.5 ___ Z

   ix. -1 ___ A where $A=\{ x \mid x \in Z, \ x < 7\}$
   x. -1 ___ B where $B=\{ x \mid x \in Z^+, \ x <7\}$

2. U= { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
   P= {1, 3, 5, 7, 9}
   Q= {2, 4, 6}
   R= {6, 8} Now, answer the following questions

   i. Find the subsets of Q
   ii. Find the proper subsets of R
   iii. Find the following sets.
      i. P'
      ii. Q'
      iii. P ∪ R
      iv. P ∩ R
      v. P - Q

Question 3

1. Fill in the blanks with ∈, ∉, ⊆, = or ≠. Recall that Z is the set of all integers and ϕ is the empty set.

i.	{2}	----------	{2, 4, 6}
ii.	-6	----------	Z
iii.	Ø	----------	Z
iv.	35	----------	{5, 10, 15, …}
v.	35	----------	{5, 10, 15}

2. Given the universal set U= { 2, 3, 5, 7, 11, 13, 17, 19, 23, 29} , A= {2, 5, 11, 17, 23}, B= {3, 5, 13, 17, 19}, C= {3, 7, 13, 29}, find the following sets.
   i. A ∩ B
   ii. A ∪ C'
   iii. B ∩ (A ∪ C)
   iv. A' – B'
   v. (A ∪ B') – C

3. If A={x, y} and B={1, 2, 3}, find A x B? If A= {2, 4, 5}, B= {1, 2}, C= {2, 3} find the following:
      a. A x (B ∩ C)
      b. (A x B) ∩ (A x C)

Question 4

Represent the given information in Separate Venn Diagrams. U is the universal set.

1. U={1, 2, 3, 4, 5, 6, 7, 8, 9}, A={2, 3, 5}, B={1, 4, 6, 8}
2. U={1, 2, 3, 4, 5, 6, 7, 8, 9}, S={1, 5, 7, 8, 9}, T={5, 8}
3. A={1, 2, 3, 7}, B={1, 2, 4, 8}, C={3, 4, 5, 6}
4. U={1, 2, 3, 4, 5, 6, 7, 8, 9}, X={1, 2, 3}, Y={1, 2, 6, 7, 8, 9}, Z={4, 5, 6, 7}

Question 5

A Group of Students who presented themselves for an examination in Music had to face a vocal test and an instrument test. Consider A, B to be the following sets:

A={Students who passed the vocal test}
B={Students who passed the instrument test }

If 70 Students passed the vocal test, 75 passed the instrument test and 55 passed both tests,

1. Find the no. of students who passed vocal test or instrument test?
2. Find the no. of students who passed one test only?
3. If 100 students faced the examination, find the no. of students who failed?

Question 6

A Bank offers three types of accounts A, B, and C for its account holders. 325 account holders have A account type. 300 have B account type and 260 have C account type. 190 have both A and B account types. 170 have both B and C account types. A and C account types are held by 175. 30 people have different accounts other than A, B and C. If there are 500 account holders in the bank, find the no. of account holders who have all three account types (A, B and C)?