

Answer on question 36848 – Math - Number Theory

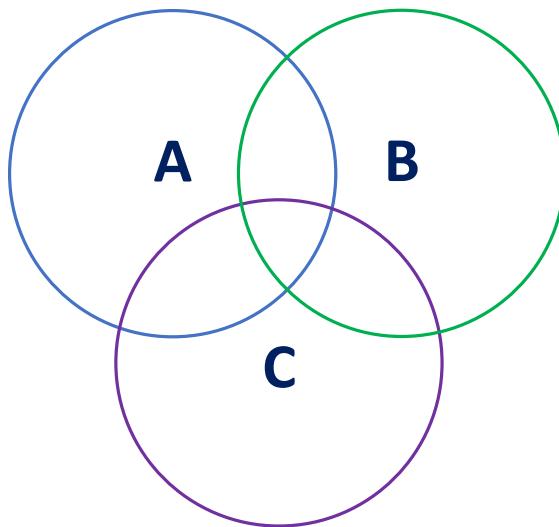
Out of 250 students who failed in an examination, it was revealed that 128 failed in mathematics, 87 failed in physics and 134 failed in chemistry. 31 failed in mathematics and physics, 54 failed in chemistry and mathematics, 30 failed in chemistry and physics. Find how many candidates failed in:

- (a) In all the three subjects
- (b) In mathematics but not in physics
- (c) In chemistry but not in mathematics
- (d) In physics but not in chemistry or in mathematics
- (e) In chemistry or in mathematics but not in physics

Hint: Use venn diagram to simplify your work.

Solution.

Let's draw a Venn diagram:



A – failed in math,

B – failed in physics

C – failed in chemistry

$A \cap B$ – failed in math and physics,

$B \cap C$ – failed in physics and chemistry,

$C \cap A$ – failed in chemistry and math.

So we have

$|A|=128$, $|B|=87$, $|C|=134$, $|A \cup B \cup C|=250$, $|A \cap B|=31$, $|A \cap C|=54$, $|B \cap C|=30$ and $|A \cup B \cup C|=250$

- (a) Using the following formula:

$$|A \cup B \cup C|=|A|+|B|+|C|-|A \cap B|-|A \cap C|-|B \cap C|+|A \cap B \cap C|$$

We obtain

$$250 = 128 + 87 + 134 - 31 - 54 - 30 + |A \cap B \cap C|$$

$|A \cap B \cap C| = 16$ students failed all three subjects.

(b) We should find $|A \setminus B|$.

It is easy to see from the picture that

$$\begin{aligned}|A \setminus B| &= |A| - |A \cap B| = 128 - 31 = \\ &= 97 \text{ students failed in mathematics but not in physics.}\end{aligned}$$

(c) We should find $|C \setminus A|$.

It is easy to see from the picture that

$$\begin{aligned}|C \setminus A| &= |C| - |A \cap C| = 134 - 128 = \\ &= 6 \text{ students failed in chemistry but not in mathematics.}\end{aligned}$$

(d) According to the Venn diagram the number of students failed in physics but not in chemistry or in mathematics equals

$$|B| - |A \cap B| - |B \cap C| + |A \cap B \cap C| = 87 - 31 - 30 + 16 = 42.$$

(e) According to the Venn diagram the number of students failed in physics but not in chemistry or in mathematics but not in physics equals

$$\begin{aligned}|A| + |B| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C| &= \\ &= 128 + 87 - 31 - 54 - 30 + 16 = 116.\end{aligned}$$

Answer:

- (a) 16 students;
- (b) 97 students;
- (c) 6 students;
- (d) 42 students;
- (e) 116 students.