Language Students Puzzle

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This is a slightly challenging problem from Dan Griller ([1]).

Every pupil at the Euler Academy studies French or Spanish. At the start of the year, one third of the French students also studied Spanish, and 2 fifths of the Spanish students also studied French. After one term, six of the double-linguists dropped French, so that now only a quarter of the French students study Spanish. How many pupils are at the Euler Academy?

Just to be clear, "French students" means Euler Academy pupils studying French, and similarly for "Spanish students."

Solution

Let F be the original number of pupils studying French and S the original number studying Spanish. Let d be the number of students originally studying both French and Spanish (Figure 1). Then the number of pupils N at the Euler Academy is given by

$$N = F + S - d, \qquad (1)$$

since the number of students studying both French and Spanish is counted twice in F + S.

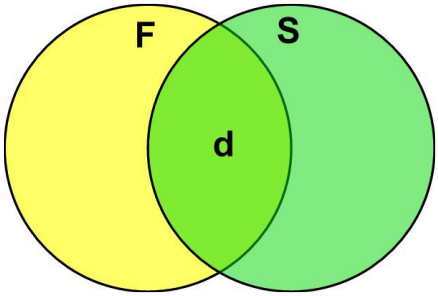

Figure 1

Then we have from the problem statement that

$$d = {}^{1}/_{3}\, F = {}^{2}/_{5}\, S. \qquad (2)$$

Plugging equation (2) into equation (1) yields the number of pupils is

$$N = 3\, d + {}^{5}/_{2}\, d - d = {}^{9}/_{2}\, d \qquad (3)$$

After the first term we have $(d - 6) = {}^{1}/_{4}\,(F - 6)$

or $4\, d - 24 = 3\, d - 6$

or $d = 18$ students

Substituting this value into equation (3) yields the total number of pupils at Euler Academy is

$$N = {}^{9}/_{2}\, 18 = 81 \text{ students}$$

References

[1] Griller, Daniel, *Elastic Numbers: 108 Puzzles for the Serious Problem Solver*, Rational Falcon, 2017. Diamond Problem #13. (Scale of difficulty: Bronze, Silver, Gold, Diamond.)