

## 1.4C Venn Diagrams Involving Variables

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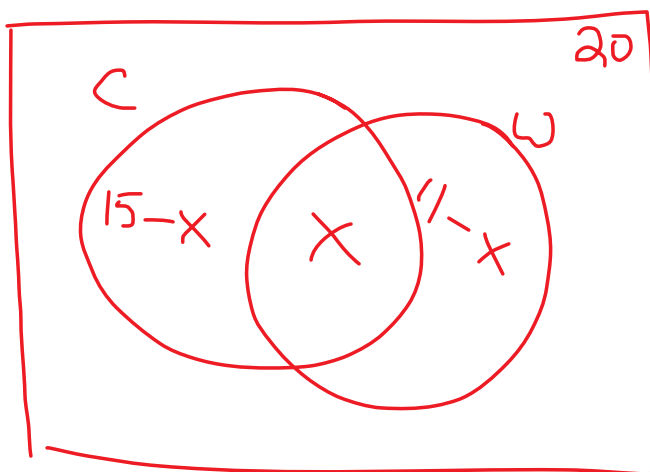
Sometimes we may be given a situation in which we need to draw a Venn Diagram, but one of the numerical values will be missing. In these cases, we can use a variable to represent the missing value.

### Example 1

There are 20 students in a Math 3201 class.

- 15 students like chocolate cake
- 11 students like white cake
- All the students like at least one of these types of cake

How many students like BOTH chocolate and white cake?



$$15 - x + x + 11 - x = 20$$

$$26 - x = 20$$

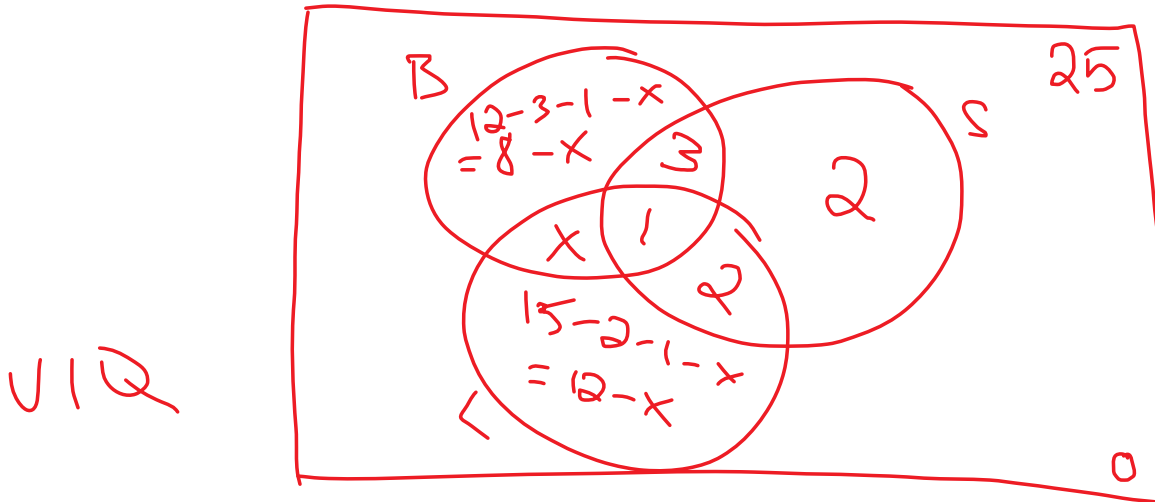
$$26 - 20 = x$$

$$6 = x$$

$$x = 6$$

### Example 2

There are twenty five dogs at the dog show. Twelve of the dogs are black, eight of the dogs have short tails, and fifteen of the dogs have long hair. There is only one dog that is black with a short tail and long hair. Three of the dogs are black with short tails and do not have long hair. Two of the dogs have short tails and long hair but are not black. If all of the dogs in the kennel have at least one of the mentioned characteristics, how many dogs are black with long hair but do not have short tails?



$$\cancel{8-x} + 3 + 1 + \cancel{x} + 2 + 2 + 12 - x = 25$$

$$28 - x = 25$$

$$28 - 25 = x$$

$$3 = x$$

$$x = 3$$

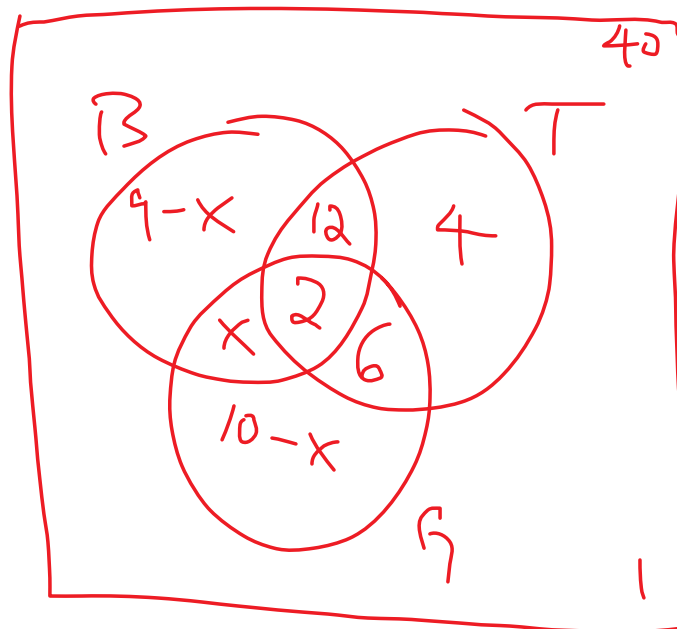
**Your Turn:**

1. 40 members in a sports club were surveyed:

- 2 play all three sports
- 23 play ball hockey
- 24 play tennis
- 18 play golf
- 14 play tennis and ball hockey
- 8 play tennis and golf
- 1 member makes the refreshments and does not play any sport

} Look for "not"  
in order to determine  
the need to subtract  
to fill sections

Determine the number of people who play ball hockey and golf.



$$9 - x + 12 + 4 + x + 2 + 6 + 10 - x = 39$$

$$43 - x = 39 \quad \therefore 2 + 4 = 6$$

$$43 - 39 = x$$

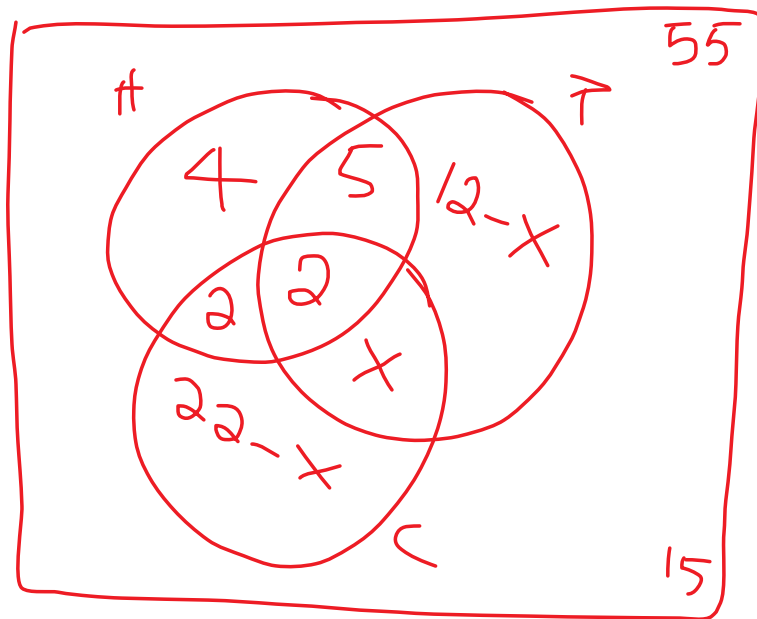
$$4 = x$$

$$x = 4$$

2. In a survey of 55 people, the following results were recorded:

- 13 people like Hawaiian pizza
- 19 people like pepperoni pizza
- 26 people like cheese pizza
- 15 people do not like pizza
- 5 people like Hawaiian pizza and pepperoni pizza, but not cheese pizza
- 2 people like all types of pizza
- 2 people like Hawaiian pizza and cheese pizza, but not pepperoni pizza

Determine how many people like only cheese pizza. It may be helpful to illustrate the information using a Venn diagram.



$$4 + 5 + 12 - x + 2 + 2 + x + 22 - x = 40$$

$$47 - x = 40$$

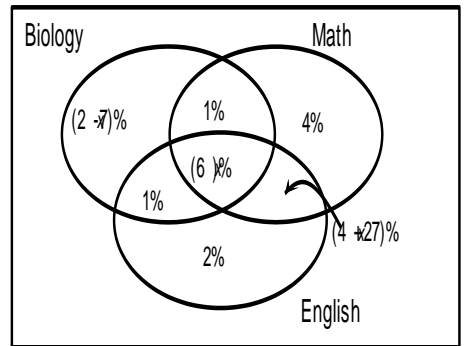
$$47 - 40 = x$$

$$x = 7$$

$$22 - 7 = 15$$

15 people like only cheese pizza.

3. 200 students wrote exams in Math, Biology and English. The Venn Diagram below represents the percentage of those who wrote the exams. Algebraically determine the percentage of students who wrote all three exams, and determine the number of students that this represents.



$$2x - 7 + 1 + 4 + 1 + 6x + 4x + 27 + 2 = 100$$

$$12x + 28 = 100$$

$$12x = 100 - 28$$

$$\frac{12x}{12} = \frac{72}{12}$$

$$x = 6$$

$6(6) = 36\%$  of students wrote all 3 exams.

$$200 \times 0.36 = 72 \text{ students.}$$