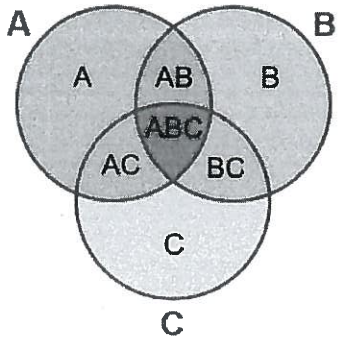
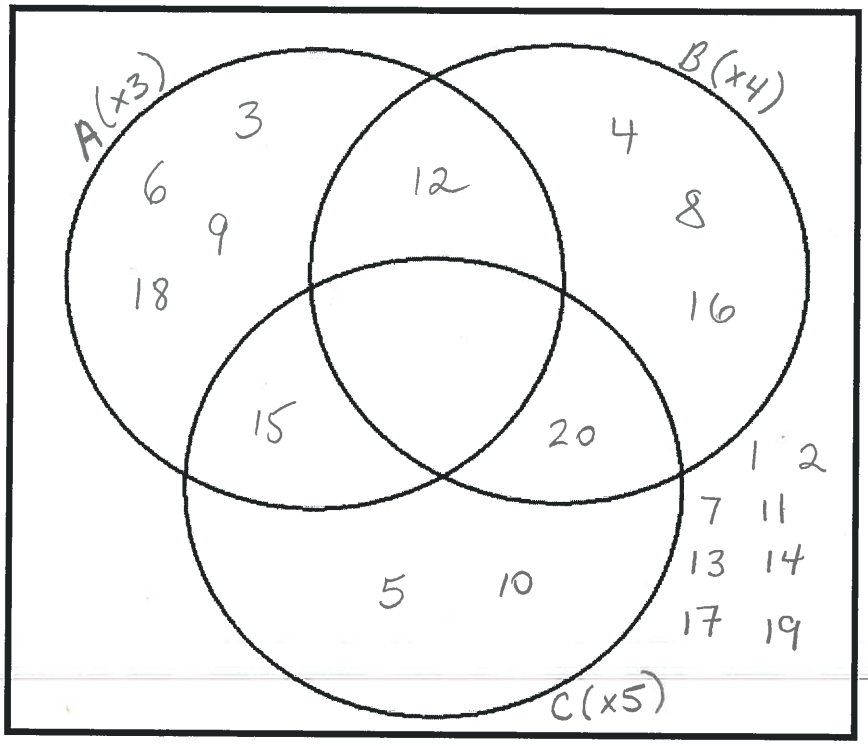
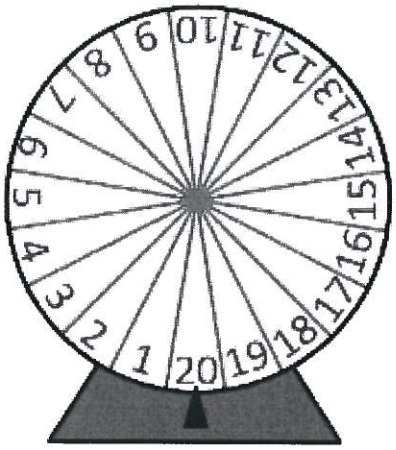
Advanced Venn Diagrams and Probability



Example 1: Given the spinner below, if Event A is spinning a multiple of 3, and Event B is spinning a multiple of 4, and event C is spinning a multiple of 5. Draw a Venn Diagram and determine the following probabilities:





A = 3, 6, 9, 12, 15, 18

B = 4, 8, 12, 16, 20

C = 5, 10, 15, 20

1. P (A)= $\frac{6}{20} = \frac{3}{10} = 0.3 = 30\%$

2. P (B)= $\frac{5}{20} = \frac{1}{4} = 0.25 = 25\%$

3. P (C) = $\frac{4}{20} = \frac{1}{5} = 0.2 = 20\%$

4. P (A\B)= $\frac{5}{20} = \frac{1}{4} = 0.25 = 25\%$

5. P (B\A)= $\frac{4}{20} = \frac{1}{5} = 0.2 = 20\%$

6. P (A\C)= $\frac{5}{20} = \frac{1}{4} = 0.25 = 25\%$

7. P (A ∩ B)= $\frac{1}{20} = 0.05 = 5\%$

8. P (A U B)= $\frac{10}{20} = \frac{1}{2} = 0.5 = 50\%$

9. P (A)'= $\frac{14}{20} = \frac{7}{10} = 0.7 = 70\%$

10. P (C | B)= $\frac{1}{5} = 0.2 = 20\%$

11. P (A | C)= $\frac{1}{4} = 0.25 = 25\%$

12. P (A | B)= $\frac{1}{5} = 0.2 = 20\%$

13. P [(A U B) | C]= $\frac{2}{4} = \frac{1}{2} = 0.5 = 50\%$

14. P [(A U C)' | B]= $\frac{3}{5} = 0.6 = 60\%$

15. $P[(A \backslash B) \mid C] = \frac{1}{4} = 0.25 = 25\%$

Example 2: Using Algebra: Given the following information, complete the Venn Diagram.

A = 15

B = 10

C = 20

A ∩ B = 5

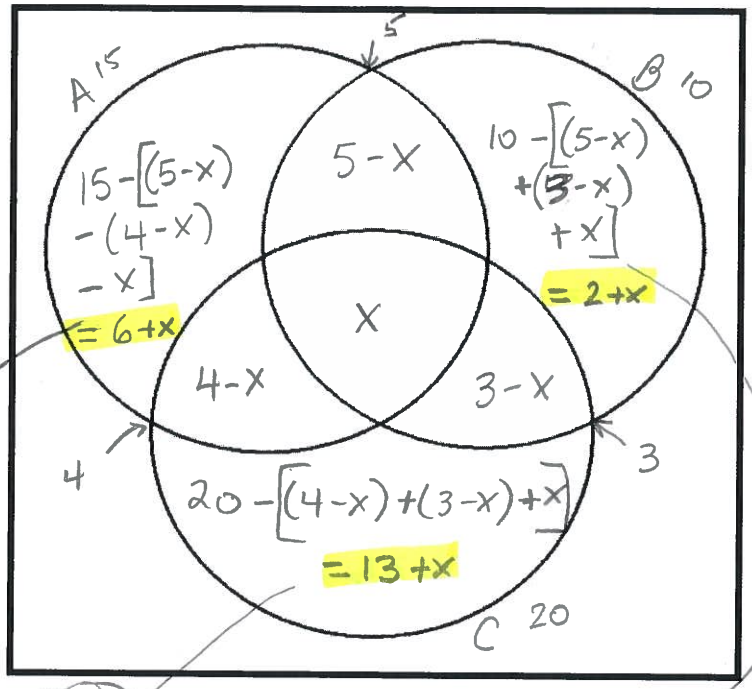
A ∩ C = 4

B ∩ C = 3

A ∩ B ∩ C = x

U = 35

A U B U C = 35



A $15-[(5-x)+(4-x)+x]$

$= 15-[5-x+4-x+x]$

$= 15-(9-x)$

$= 15-9+x$

$= 6+x$

B $10-[(5-x)+(3-x)+x]$

$= 10-[5-x+3-x+x]$

$= 10-[8-x]$

$= 10-8+x$

$= 2+x$

C $20-[(4-x)+(3-x)+x]$

$= 20-[4-x+3-x+x]$

$= 20-[7-x]$

$= 20-7+x$

$= 13+x$

AUBUC

$6+x+5-x+4-x+x+2+x+3-x+13+x$

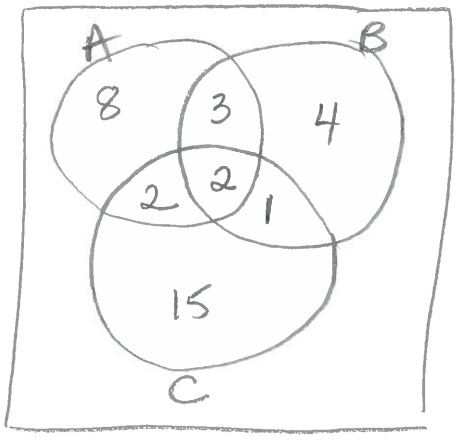
$= 33+x$

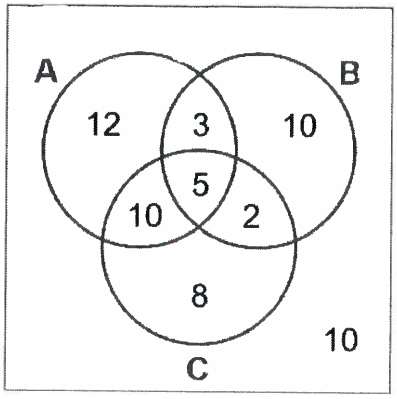
$AUBUC = 35$

$35 = 33+x$

$35-33 = x$

$2 = x$





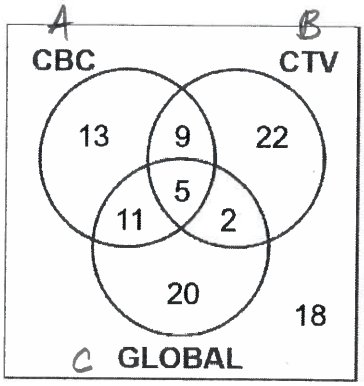
Example 3: The Venn diagram represents the responses to a survey. What is the probability associated with A\C and how many people were involved in the survey?

$P(A \setminus C) = \frac{15}{60}$ ← $12+3+10+5+10+2+8+10$

$= \frac{1}{4}$ = 60 people were involved in the survey

$= 0.25$

$= 25\%$



Example 4: One hundred students were surveyed at a university to determine if they visited the websites of any of the following 3 news agencies: CBC, GLOBAL NEWS, or CTV. The results of the survey are shown in the Venn Diagram. Find the probability that:

a) A student uses all 3 websites.
b) A student does not use the Global News website.
c) A student uses either CBC or CTV but not both.

a) $P(A \cap B \cap C) = \frac{5}{100} = 0.05 = 5\%$

b) $P(C') = \frac{13+9+22+18}{100}$

$= \frac{62}{100}$

$= 0.62$

$= 62\%$

c) $P[(A \setminus B) \cup (B \setminus A)] = \frac{13+11+22+2}{100}$

$= \frac{48}{100}$

$= 0.48$

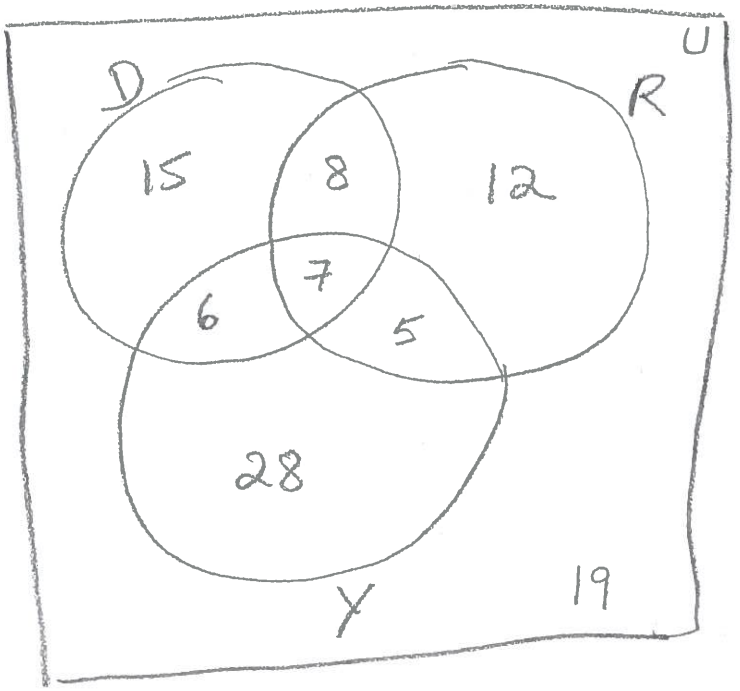
$= 48\%$

Example 5: One hundred senior high school students were surveyed to find out which optional courses they planned to take:

- (D) Digital Film-Making
- (R) Rock Band
- (Y) Yoga, Health and Well-Being

Create a Venn Diagram to show the following results:

28 chose (Y) only	8 chose (D) and (R)
15 chose (D) only	5 chose (R) and (Y)
12 chose (R) only	7 chose (D) (R) and (Y)
6 chose (Y) and (D)	The rest chose none of these



Calculate the probability of a student choosing: (D), (R), (Y).

$15+8+6+7+12+5+28=81$

$100-81=19$

$P(D)=\frac{15+8+6+7}{100}=\frac{36}{100}=0.36=36\%$

$P(R)=\frac{8+7+5+12}{100}=\frac{32}{100}=0.32=32\%$

$P(Y)=\frac{6+7+5+28}{100}=\frac{46}{100}=0.46=46\%$

Example 6: Complete the Venn Diagram below knowing that:

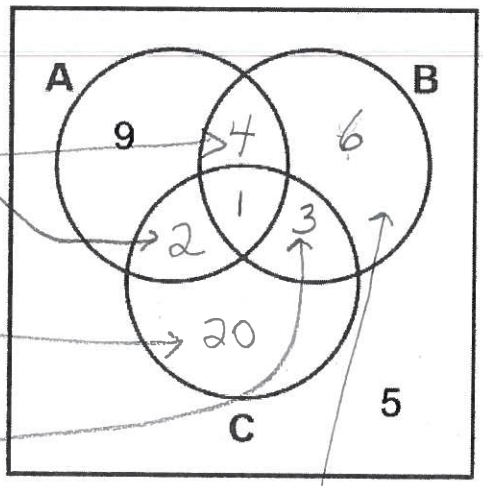
$P(A')=\frac{17}{25}=\frac{34}{50}$ $\therefore P(A)=\frac{50-34}{50}=\frac{16}{50}$

$P(A\cap B\cap C)=\frac{1}{50}$

$P(A\backslash C)=\frac{13}{50}$

$P(C\backslash B)=\frac{22}{50}$

$P(C)=\frac{13}{25}=\frac{26}{50}$



$50-9-4-2-1-3-26-5$

$=6$