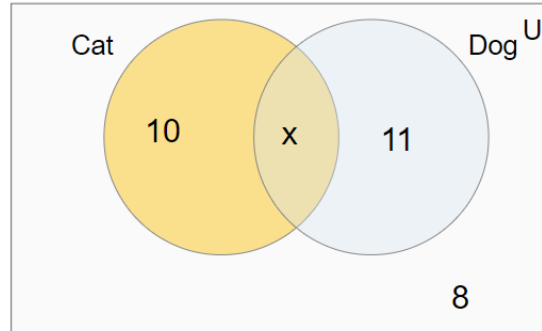


Probability of Non-Mutually Exclusive Events Practice

Use the following information to answer the first question.

A grade 6 teacher surveyed her class of 32 students regarding who owned a cat or a dog or neither. A partially completed Venn diagram below shows the number of students in certain regions.



Consider the following probability statements if 1 random student was selected:

Statement 1	The probability of owning both a cat and a dog is $\frac{3}{32}$ .
Statement 2	The probability of owning a cat or a dog is $\frac{3}{4}$ .
Statement 3	The probability of owning a dog is $\frac{11}{32}$ .
Statement 4	The probability of not owning a cat is $\frac{19}{32}$ .

1. The false statement is

A) 1

B) 2

C) 3

D) 4

Use the following information to answer the next question.

A survey was undertaken at a Senior's residence to determine who drank certain beverages for breakfast. The choices were coffee only, tea only, both coffee and tea, or neither. Use the diagram below and the following information to answer this question.



- 73% drink coffee
- 22% drink only tea

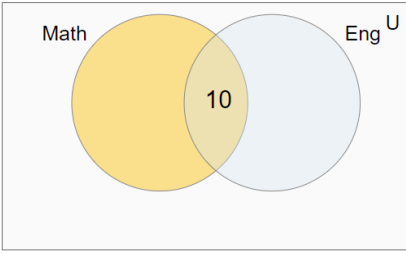
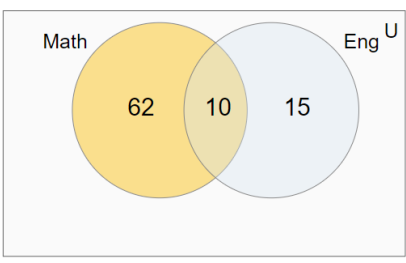
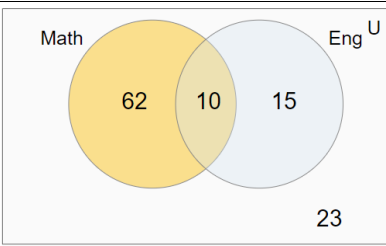
2. The percentage of seniors who drink neither coffee or tea for breakfast is
- A) 5%                      B) 6%                      C) 7%                      D) 8%
3. In a group of students, the probability that a student chosen at random walks to school is 0.40 and the probability that a student has brown hair is 0.25. If the probability that a student has brown hair or walks to school is 0.47, then the probability, to the nearest hundredth, that a student has brown hair and walks to school is \_\_\_\_\_.
4. On Tuesday, the weather forecaster says there is a 35% chance of rain on Wednesday and a 30% chance of rain on Thursday. The forecaster also says there is a 10% chance of rain on both Wednesday and Thursday. The probability that there will be rain on only 1 of these days is
- A) 15%                      B) 25%                      C) 35%                      D) 45%

Use the following information to answer the next question.

For one semester at a small rural high school, the following data was determined related to grade 12 students taking Math and English.

- 10% took both
- 62% took Math
- 25% took English
- 23% took neither

Analyze the following steps to creating a Venn diagram and the answer to the question: “What is the probability that a randomly selected student took Math or English”?

Step 1	
Step 2	
Step 3	
Step 4	
Final Answer	The probability of taking Math or English is 0.87.

5. The step in which an error was made **and** the correct answer to the question are

- A) Step 2 **and** 0.97
- B) Step 2 **and** 0.77
- C) Step 3 **and** 0.97
- D) Step 3 **and** 0.77

Use the following information to answer the next question.

There are 12 black, 9 red, 15 yellow, 6 green, and 10 orange candies in a particular package of candy.

6. If one candy is randomly selected, then the probability to the nearest hundredth, that it is a yellow or orange candy is \_\_\_\_\_.

Use the following information to answer the next question.

Based on data gathered in the previous season, the probability of Bob scoring more than 10 points in a game is 0.55. The probability of Bob or Alvin scoring more than 10 points in a game is 0.79. The probability of both of them scoring more than 10 points is 0.18.

7. The probability of Alvin scoring more than 10 points in a game is

- A) 0.24
- B) 0.37
- C) 0.42
- D) 0.51

Use the following information to answer the next question.

In a particular European country, data was collected to determine what percentage of the population over 75 required glasses and/or hearing aids.

- 80% wear glasses.
- 36% have hearing aids.
- 20% use both.

8. A) Display the information in a Venn diagram.

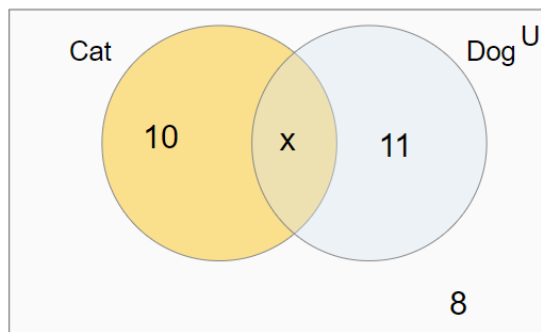
B) Use a formula to determine the probability of randomly selecting a person over the age of 75 from this country who has glasses or a hearing aid.

C) What percentage of the population of this group uses neither glasses nor a hearing aid?

## Probability of Non-Mutually Exclusive Events Practice Solutions

Use the following information to answer the first question.

A grade 6 teacher surveyed her class of 32 students regarding who owned a cat or a dog or neither. A partially completed Venn diagram below shows the number of students in certain regions.



Consider the following probability statements if 1 random student was selected:

Statement 1	The probability of owning both a cat and a dog is $\frac{3}{32}$ .
Statement 2	The probability of owning a cat or a dog is $\frac{3}{4}$ .
Statement 3	The probability of owning a dog is $\frac{11}{32}$ .
Statement 4	The probability of not owning a cat is $\frac{19}{32}$ .

1. The false statement is

A) 1

B) 2

C) 3

D) 4

### Solution

The sum of all 4 regions in the Venn diagram must add up to all the students which is 32.

$$(10) + (11) + (8) + (x) = 32$$

$$29 + x = 32$$

$$x = 3$$

There were 3 students who owned a cat and a dog.

### Statement 1

The probability of owning both a cat and a dog is  $\frac{3}{32}$ . This statement is **true**.

### Statement 2

The probability of owning a cat or a dog is the sum of 10 (only a cat) + 3 (owning both) + 11 (only a dog), divided by the total number of students of 32.

$$P(\text{cat or a dog}) = \frac{10+3+11}{32} = \frac{24}{32} = \frac{3}{4}$$

This statement is **true**.

### Statement 3

The probability of owning a dog is the sum of both(3) + only(11) divided by 32.

$$P(\text{dog}) = \frac{14}{32}, \text{ not } \frac{11}{32}.$$

This statement is **false**.

### Statement 4

The sum of only dog(11) + neither (8) represents the number of students not owning a cat. Thus, the probability is  $\frac{19}{32}$ .

This statement is **true**.

Statement 3 is false.

The correct answer is C.

Use the following information to answer the next question.

A survey was undertaken at a Senior's residence to determine who drank certain beverages for breakfast. The choices were coffee only, tea only, both coffee and tea, or neither. Use the diagram below and the following information to answer this question.



- 73% drink coffee
- 22% drink only tea

2. The percentage of seniors who drink neither coffee or tea for breakfast is

- A) 5%                      B) 6%                      C) 7%                      D) 8%

**Solution**

To find only coffee, subtract 11% from 73%.

$$73\% - 11\% = 62\%$$

Coffee or tea is the sum of only coffee(62) + both (11) and only tea(22).

$$62\% + 11\% + 22\% = 95\%.$$

Since all 4 regions must add to 100%, to find the last region (neither),

$$100\% - 95\% = 5\%.$$

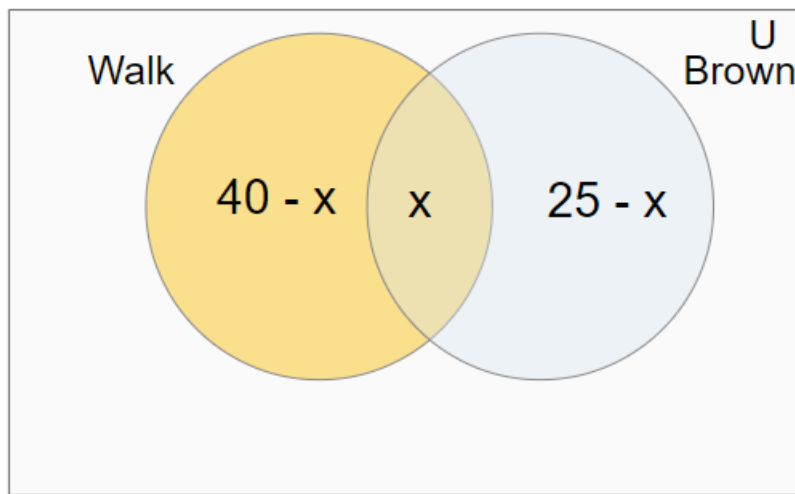
**The correct answer is A.**

3. In a group of students, the probability that a student chosen at random walks to school is 0.40 and the probability that a student has brown hair is 0.25. If the probability that a student has brown hair or walks to school is 0.47, then the probability, to the nearest hundredth, that a student has brown hair and walks to school is 0.18.



### Solution

Let  $x$  = the percentage that both walk to school and have brown hair.

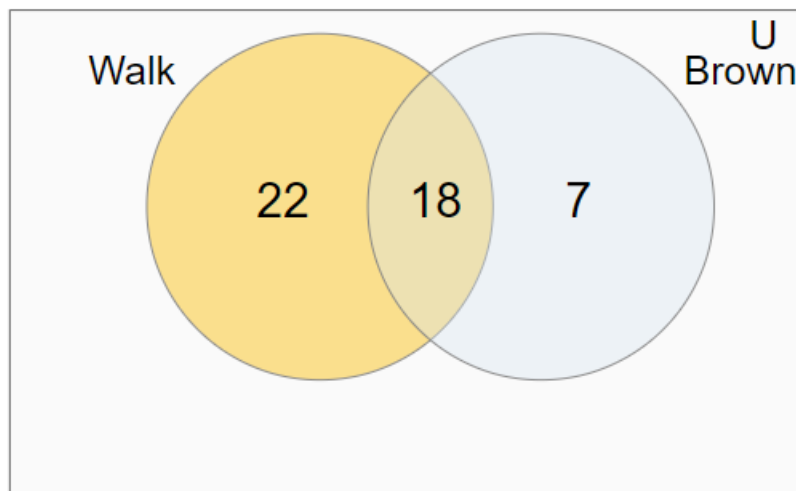


Since the probability of walking to school or having brown hair is 47%, we can now write an equation to solve for  $x$ .

$$(40 - x) + (x) + (25 - x) = 47$$

$$65 - x = 47$$

$$x = 18$$



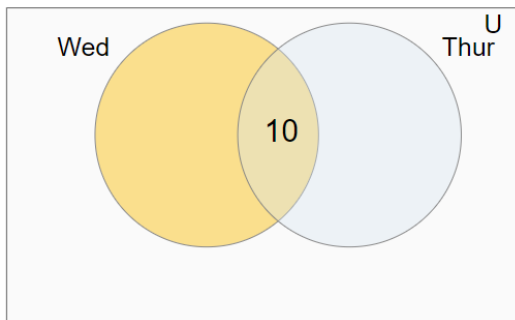
The probability that a student has brown hair and walks to school is 0.18.

4. On Tuesday, the weather forecaster says there is a 35% chance of rain on Wednesday and a 30% chance of rain on Thursday. The forecaster also says there is a 10% chance of rain on both Wednesday and Thursday. The probability that there will be rain on only 1 of these days is

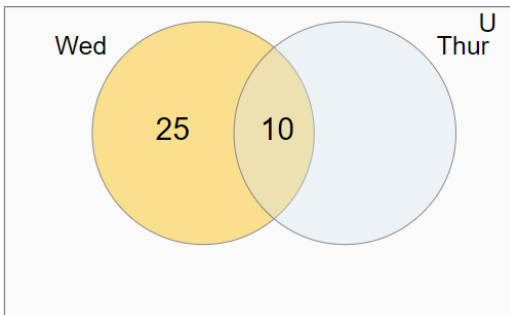
A) 15%                      B) 25%                      C) 35%                      D) 45%

**Solution**

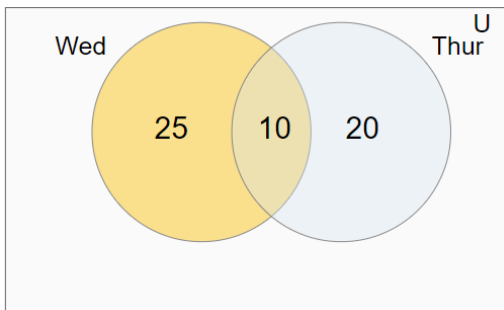
Draw a Venn diagram and indicate that there is a 10% chance of rain on both days.



With a 35% chance of rain on Wednesday, we know that the probability of only raining on Wednesday is 35% - 10%, or 25%.



With a 30% chance of rain on Thursday, we know that the probability of only raining on Thursday is 30% - 10%, or 20%.



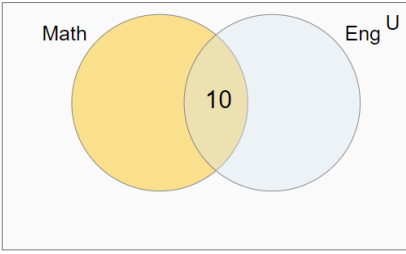
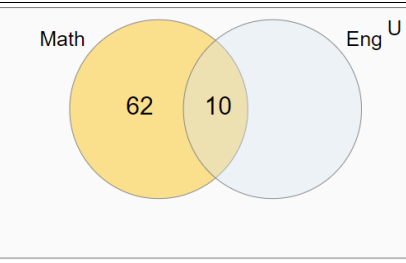
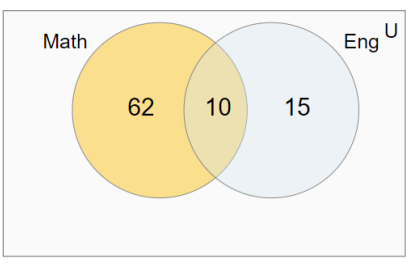
For rain on only 1 of these days would be the sum of 25 and 20. The probability of rain on only one of these days is 45%.  
**The correct answer is D.**

Use the following information to answer the next question.

For one semester at a small rural high school, the following data was determined related to grade 12 students taking Math and English.

- 10% took both
- 62% took Math
- 25% took English
- 23% took neither

Analyze the following steps to creating a Venn diagram and the answer to the question: “What is the probability that a randomly selected student took Math or English”?

Step 1	
Step 2	
Step 3	
Step 4	
Final Answer	The probability of taking Math or English is 0.87.

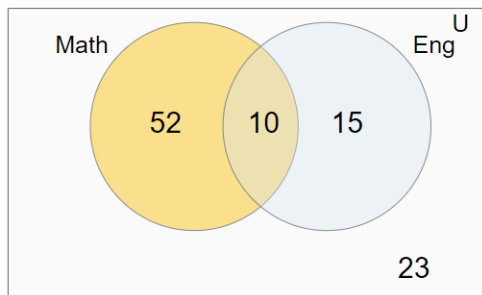
5. The step in which an error was made **and** the correct answer to the question are
- A) Step 2 **and** 0.97
  - B) Step 2 **and** 0.77
  - C) Step 3 **and** 0.97
  - D) Step 3 **and** 0.77

**Solution**

Step 1 is correct.

Step 2 is incorrect. Instead of placing 62 in the 'only math' region, it should be 52. The number 62% represents the total of the 'only math' region and the 'both' region.

The correct completed Venn diagram should be:



The probability of taking Math or English is represented by the sum of the numbers 52 + 10 + 15, which is equal to 77.

**The correct answer is B.**

Use the following information to answer the next question.

There are 12 black, 9 red, 15 yellow, 6 green, and 10 orange candies in a particular package of candy.

6. If one candy is randomly selected, then the probability to the nearest hundredth, that it is a yellow or orange candy is 0.48.

### Solution

Although these practice questions deal primarily with non-mutually exclusive events, this question deals with mutually exclusive events. Only 1 candy is selected at random and thus it is not possible to select two different colors with one selection.

Probability (Yellow or Orange) = P(Yellow) + P(Orange)

$$\frac{15}{52} + \frac{10}{52} = \frac{25}{52} = 0.4807 \dots$$

To the nearest hundredth, the probability of selecting 1 candy at random that is yellow or orange is 0.48.

[NOTE: Although the numbers have been changed, this is a very similar question from one found on a 2013 diploma exam. There were 59% of students who answered this question correctly]

Use the following information to answer the next question.

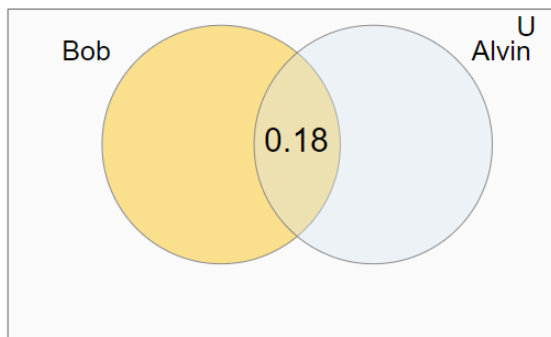
Based on data gathered in the previous season, the probability of Bob scoring more than 10 points in a game is 0.55. The probability of Bob or Alvin scoring more than 10 points in a game is 0.79. The probability of both of them scoring more than 10 points is 0.18.

7. The probability of Alvin scoring more than 10 points in a game is

- A) 0.24      B) 0.37      C) 0.42      D) 0.51

### Solution

Show that the probability of both of them scoring more than 10 points in a game is 0.18.



The probability of Bob scoring more than 10 points in a game is 0.55. Subtract 0.18 from this number to find the probability of only Bob scoring more than 10 points,

$$0.55 - 0.18 = 0.37$$

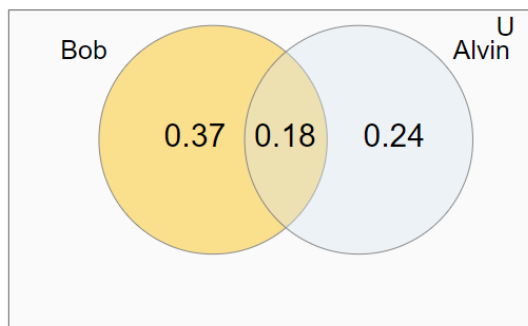


The probability of Bob or Alvin scoring more than 10 points in a game is the sum of the Bob only (0.37) + both (0.18) + Alvin only.

$$0.79 = 0.37 + 0.18 + \text{Alvin only}$$

$$0.79 = 0.55 + \text{Alvin only}$$

$$0.24 = \text{Alvin only}$$



The probability of Alvin scoring more than 10 points in a game is  $0.18 + 0.24$ , or 0.42.

**The correct answer is C.**

Use the following information to answer the next question.

In a particular European country, data was collected to determine what percentage of the population over 75 required glasses and/or hearing aids.

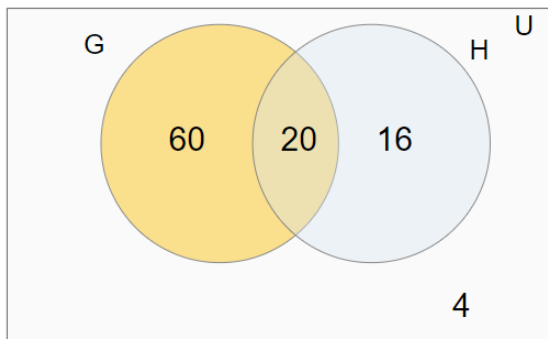
- 80% wear glasses.
- 36% have hearing aids.
- 20% use both.

8. A) Display the information in a Venn diagram.

**Solution**

Let G = glasses

Let H = hearing aid



B) Use a formula to determine the probability of randomly selecting a person over the age of 75 from this country who has glasses or a hearing aid.

**Solution**

$$P(G \text{ or } H) = P(G) + P(H) - P(G \text{ and } H)$$

$$P(G \text{ or } H) = 0.80 + 0.36 - 0.20$$

$$P(G \text{ or } H) = 0.96$$

The probability of randomly selecting a person over the age of 75 from this country who has glasses or a hearing aid is 0.96, or 96%.

C) What percentage of the population of this group uses neither glasses nor a hearing aid?

$$100\% - 96\% = 4\%$$

There was 4% of the population that uses neither glasses nor a hearing aid.