Name: ______________________________ Date: ______________ Period: _______

CCGPS Analytic Geometry

Notes: Fundamental Counting Principle Tues Mar 24 2015

Homework: Set A, Page 340: #2 – 10 even and #11

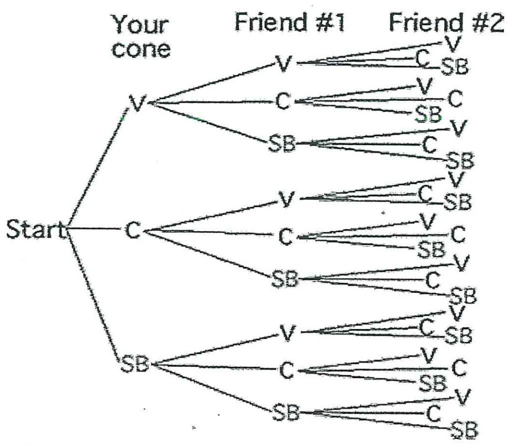
Set B, Page 341: #2 – 8a even (omit 8b)

Essential Question: How can you use the tree diagrams and the counting principle to count the number of outcomes for an event?

There are many real life situations or problems where you want to count the number of possibilities for certain events. For instance, suppose you and two friends decide to get an ice cream cone. There are 3 kinds of ice cream available (chocolate, strawberry and vanilla). How many different combinations of flavors are possible?

One way to answer this question is to use a ***tree diagram***. A *tree diagram* is a graphic organizer used to list all possibilities of a sequence of events in a systematic way. Tree diagrams are one method for calculating the total number of outcomes in a ***sample space*** (the set of all possible outcomes).

V – vanilla; C – chocolate; SB – strawberry



From counting down the right hand side of the tree diagram, you can see that there are 27 different ways for the flavors to be chosen.

Another way to count the number of possible favor combinations is to use the ***fundamental counting principle.***

The Fundamental Counting Principle:

The Multiplication Counting Principle

- If you have 2 events, 1 event can occur *m* ways and another event can occur *n* ways, then the number of ways that both can occur is **m * n**. This principle can be extended to three or more events.

Example 1 (using the example with the ice cream favors above):

- Event 1 = Your cone choice (3 options)
- Event 2 = Friend #1 cone choice (3 options)
- Event 3 = Friend #2 cone choice (3 options)

How many different ice cream choice combinations are possible?

Example 2:

At a restaurant at Cedar Point, you have the choice of 8 different entrees, 2 different salads, 12 different drinks, and 6 different desserts. How many different dinners (one choice of each) can you choose?

Example 3:

You are packing for a trip. You have 6 pairs of pants, 4 shirts, and 2 pairs of shoes. How many different outfits can you put together for the trip? When you change the shoes, shirt, or pants, the whole outfit changes.

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CCGPS Analytic Geometry **Tues Mar 24 2015**
Notes: Simple Probability and Mutually Exclusive /Overlapping Events
Homework: Simple Probability and Mutually Exclusive/Overlapping Events Worksheet

Probability is a number from 0 to 1 indicating the likelihood of an event. There are two kinds of probability: experimental and theoretical. **Theoretical probability** can be found by dividing the number of outcomes of an event by the total number of all possible outcomes. This is only possible when all outcomes are known. When the outcome possibilities are not known, then the results of an experiment are used to find the **experimental probability**.

$$\textbf{Probability of event A happening} = P(A) = \frac{\text{number of outcomes of event A}}{\text{total number of all possible outcomes}}$$

Example 1: A bag contains 6 red marbles. You draw out a marble from the bag.

a. What is the probability it is red?

b. What is the probability it is blue?

When an event is <u>guaranteed to happen</u>, its probability of occurring is ________.

When an event is <u>guaranteed to not happen</u>, its probability of occurring is ________.

Events are called **mutually exclusive** when the events cannot happen at the same time, such as rolling a 6-sided die and getting 1 or 3. The probability of either <u>one</u> of the mutually exclusive events happening can be found by adding together the probabilities of each event happening.

P(A or B) = ________ + ________

Example 2: You roll a cube with sides numbered 1 to 6. Find the probability that ...

a. ... you roll 1 or 3.

b. ... you roll 4, 5, or 6?

Example 3: A jar contains 14 red, 9 black, and 7 white marbles. If a marble is drawn at random, find the indicated probability.

a. P (red or black)

b. P (black or white)

Events are **overlapping** when they have at least one common outcome, such as rolling a 6-sided die and getting a 3 or an odd. The probability of one or another overlapping events happening can be found by adding together the probabilities of each event happening, then subtracting out the probability of both happening at the same time.

P(A or B) = ________ + ________ - ________

Example 4: You draw a card from a standard deck of 52 cards. Find the probability that...

a. P(red or queen)

b. P(face card or diamond)

Venn diagrams and **tables** can be used to help determine whether events are mutually exclusive or not, and if the do overlap where that overlaps exist.

Name: ______________________ Date: ____________ Period: ______

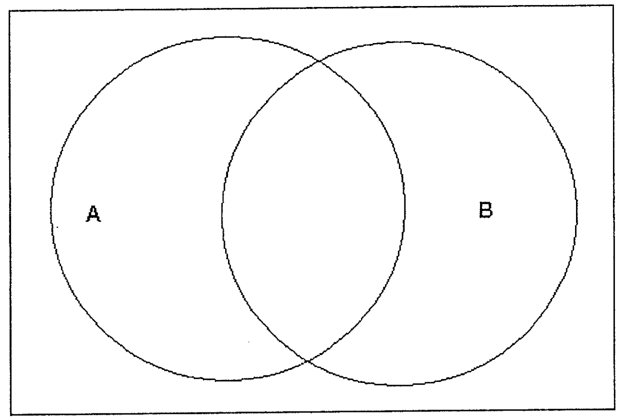
Example 5: Consider the set of all integers from 1 to 10. Place multiples of 2 in circle A and multiples of 3 in circle B. Place values which are neither multiples of 2 nor multiples of 3 inside the rectangle but outside of both circles. Use this to answer the questions.

a. How many members of the set are multiples of 2?

b. How many members of the set are multiples of 3?

c. How many members of the set are multiples of **both** 2 and 3?

d. Are the events "multiple of 2" and "multiple of 3" mutually exclusive? Explain.



e. P (multiple of 2) =

f. P (multiple of 3) =

g. P (multiple of 2 <u>and</u> 3) =

h. P(multiple of 2 <u>or</u> 3) =

Example 6: On a recent survey students were asked to pick their preference of four different television shows. The results are in the table below.

a. Fill in the blank cells by computing subtotals. In the last cell of the bottom row, place the sum of all the interior cells. What is the total number of students who participated in the survey?

	A	B	C	D	Subtotal
Male	11	5	20	16	
Female	13	22	0	10	
Subtotal					

b. P(male) =

c. P(A) =

d. P(B or C) =

e. Are the events "male" and "TV show B " mutually exclusive? Explain.

f. Are the events "female" and "TV Show C" mutually exclusive? Explain.

g. P(male or A) =

h. P(female or D) =

Name: ______________________________ **Date:** ______________ **Period:** ____

CCGPS Analytic Geometry
Worksheet: Simple Probability and Mutually Exclusive/Overlapping Events

1. Determine whether the following events are mutually exclusive or overlapping.
   a) Drawing a club or a 2 from a deck of cards

   b) Getting heads or tails when flipping a coin

   c) Getting a 2 or a prime number when rolling a die

2. Using a standard deck of 52 cards, find the indicated probability
   a) P(Jack) b) P(black or red) c) P(heart or red)

   d) P(10 or Ace) e)P (black or 9) f) P(5 or diamond)

3. A bag contains 4 white, 3 blue, and 6 red marbles. A marble is drawn from the bag. Find the indicated probability.
   a) P (white) b) P(blue or red)

   c) Are "white" and "red" mutually exclusive? Explain.

... Continued on the back ...

Name: ______________________________ **Date:** ______________ **Period:** _____

4. Students of different ages were asked to pick their preference amongst three different spring break locations. The results are listed in the table below by school level.

	Disney World	Panama City Beach	Cancun	Subtotal
Elementary	27	6	3	
High School	11	18	10	
College	4	20	19	
Subtotal				

a) Fill in the blank cells by computing subtotals. In the last cell of the bottom row, place the sum of all the interior cells. What is the total number of students who participated in the survey?

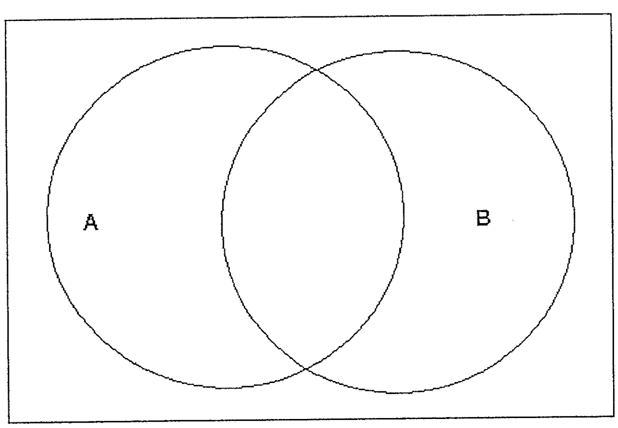
b) Are "Cancun" and "Disney World" mutually exclusive? Explain.

c) Are "High School" and "Panama City Beach" mutually exclusive? Explain.

d) P(Elementary or Cancun)

e) P(Disney World or Panama City Beach)

5. Consider the set of all integers from 1 to 10. Fill in the Venn diagram below with all 10 integers in the set. Place <u>prime numbers</u> in circle A and <u>even numbers</u> in circle B. Place values which are neither even or prime inside the rectangle but outside of both circles. Then, answer the following questions.

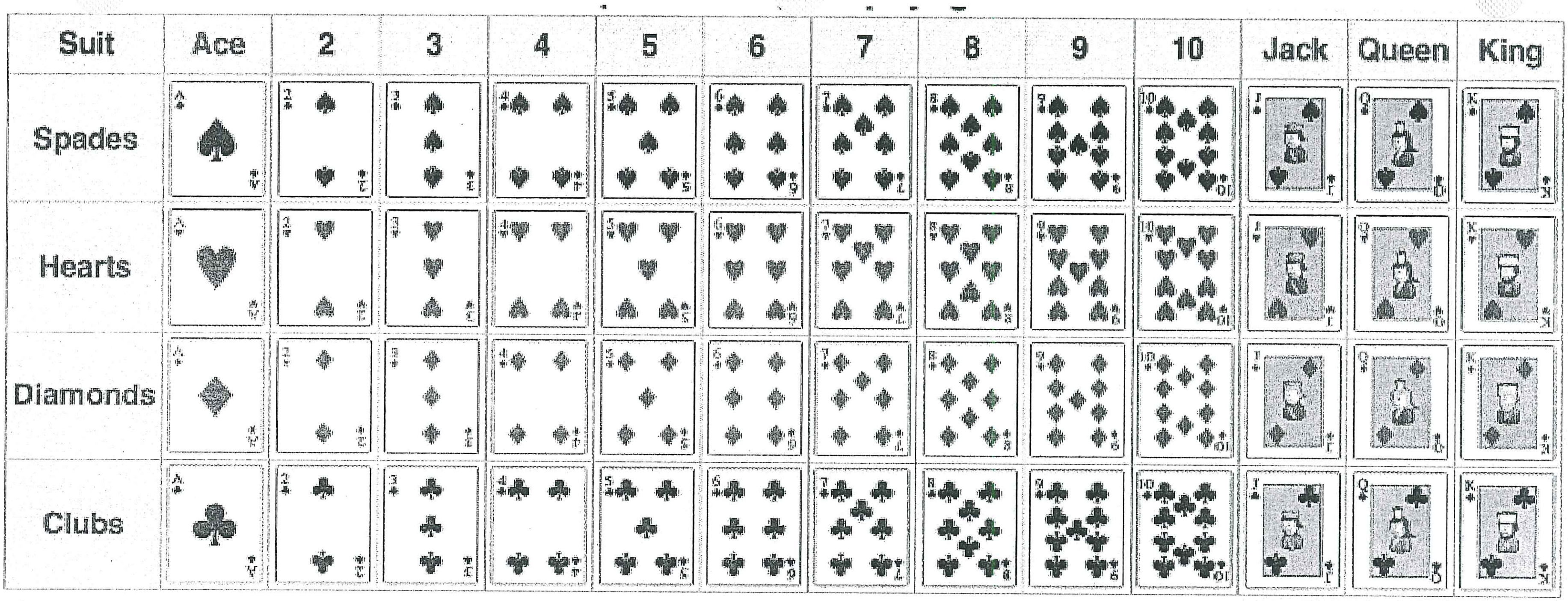


a. P(prime)

b. P(even)

c. P(prime or even)

d. Are "prime" and "even" mutually exclusive? Explain.



General Characteristics

a) 52 cards in a deck

b) 13 cards in each suit (13 spades , 13 Hearts , 13 Diamonds, 13 Clubs)

c) Red cards: Hearts and Diamonds

d) Black cards: Spades and Clubs

e) Face cards are the Jack, Queen, and King

f) 26 total black cards

g) 26 total red cards

Name: ______________________________ Date: ______________ Period: ______ Key

CCGPS Analytic Geometry

Notes: Fundamental Counting Principle

Homework: Set A, Page 340: #2 – 10 even and #11

Set B, Page 341: #2 – 8a even (omit 8b)

Essential Question: How can you use the tree diagrams and the counting principle to count the number of outcomes for an event?

There are many real life situations or problems where you want to count the number of possibilities for certain events. For instance, suppose you and two friends decide to get an ice cream cone. There are 3 kinds of ice cream available (chocolate, strawberry and vanilla). How many different combinations of flavors are possible?

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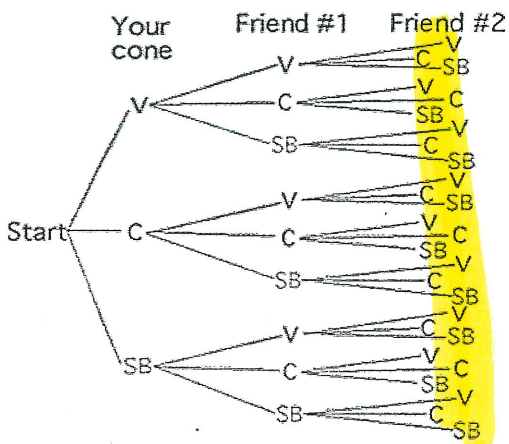
V – vanilla; C – chocolate; SB – strawberry



From counting down the right hand side of the tree diagram, you can see that there are 27 different ways for the flavors to be chosen.

Another way to count the number of possible favor combinations is to use the ***fundamental counting principle.***

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Example 1 (using the example with the ice cream favors above):

- Event 1 = Your cone choice (3 options)
- Event 2 = Friend #1 cone choice (3 options)
- Event 3 = Friend #2 cone choice (3 options)

How many different ice cream choice combinations are possible?

3 * 3 * 3 = 27 different orders

Example 2:

At a restaurant at Cedar Point, you have the choice of 8 different entrees, 2 different salads, 12 different drinks, and 6 different desserts. How many different dinners (one choice of each) can you choose?

8 entrees * 2 salads * 12 drinks * 6 desserts = 1152 different dinners

Example 3:

You are packing for a trip. You have 6 pairs of pants, 4 shirts, and 2 pairs of shoes. How many different outfits can you put together for the trip? When you change the shoes, shirt, or pants, the whole outfit changes.

6 * 4 * 2 = 48 different outfits

Name: ______________________ Date: ______________ Period: ________

CCGPS Analytic Geometry **Tues Mar 24 2015**
Notes: Simple Probability and Mutually Exclusive /Overlapping Events
Homework: Simple Probability and Mutually Exclusive/Overlapping Events Worksheet

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$$\textbf{Probability of event A happening} = P(A) = \frac{\text{number of outcomes of event A}}{\text{total number of all possible outcomes}}$$

Example 1: A bag contains 6 red marbles. You draw out a marble from the bag.

a. What is the probability it is red? 1

b. What is the probability it is blue? 0

When an event is guaranteed to happen, its probability of occurring is 1.

When an event is guaranteed to not happen, its probability of occurring is 0.

Events are called **mutually exclusive** when the events cannot happen at the same time, such as rolling a 6-sided die and getting 1 or 3. The probability of either one of the mutually exclusive events happening can be found by adding together the probabilities of each event happening.

P(A or B) = P(A) + P(B)

Example 2: You roll a cube with sides numbered 1 to 6. Find the probability that ...

a. ... you roll 1 or 3.

$\frac{1}{6}+\frac{1}{6}=\frac{2}{6}=\frac{1}{3}$ $\boxed{33\% \text{ or } 0.33}$

b. ... you roll 4, 5, or 6?

$\frac{1}{6}+\frac{1}{6}+\frac{1}{6}=\frac{3}{6}=\frac{1}{2}$ 50%

Example 3: A jar contains 14 red, 9 black, and 7 white marbles. If a marble is drawn at random, find the indicated probability.

Total: 30 marbles

a. P (red or black)

$\frac{14}{30}+\frac{9}{30}=\frac{23}{30}$ or 0.77 or 77%

b. P (black or white)

$\frac{9}{30}+\frac{7}{30}=\frac{16}{30}=.53=53\%$

Events are **overlapping** when they have at least one common outcome, such as rolling a 6-sided die and getting a 3 or an odd. The probability of one or another overlapping events happening can be found by adding together the probabilities of each event happening, then subtracting out the probability of both happening at the same time.

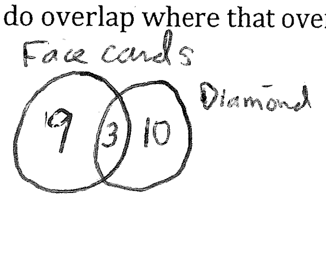
P(A or B) = P(A) + P(B) - P(A and B)

Example 4: You draw a card from a standard deck of 52 cards. Find the probability that...

a. P(red or queen) $\frac{26}{52}+\frac{4}{52}-\frac{2}{52}=\frac{28}{52}=\frac{7}{13}\approx 0.538=53.85\%$

b. P(face card or diamond) $\frac{12}{52}+\frac{13}{52}-\frac{3}{52}=\frac{22}{52}=\frac{11}{26}=0.423$ $\boxed{42.31\%}$

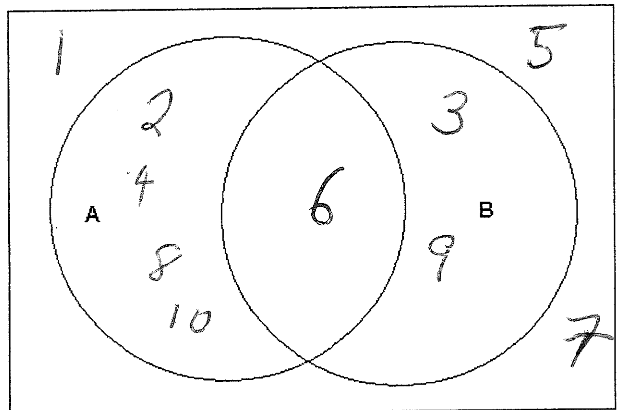
Venn diagrams and **tables** can be used to help determine whether events are mutually exclusive or not, and if the do overlap where that overlaps exist.



Name: ______________________ Date: ____________ Period: ______

1 2 3 4 5 6 7 8 9 10

Example 5: Consider the set of all integers from 1 to 10. Place multiples of 2 in circle A and multiples of 3 in circle B. Place values which are neither multiples of 2 nor multiples of 3 inside the rectangle but outside of both circles. Use this to answer the questions.



a. How many members of the set are multiples of 2? 5

b. How many members of the set are multiples of 3? 3

c. How many members of the set are multiples of **both** 2 and 3? 1

d. Are the events "multiple of 2" and "multiple of 3" mutually exclusive? Explain.

no, 6 is shared multiple of 2 and 3

e. P (multiple of 2) = $\frac{5}{10} = \frac{1}{2}$ **f.** P (multiple of 3) = $\frac{3}{10}$ **g.** P (multiple of 2 and 3) = $\frac{1}{10}$

h. P(multiple of 2 or 3) = $\frac{5}{10} + \frac{3}{10} - \frac{1}{10} = \frac{7}{10}$

Example 6: On a recent survey students were asked to pick their preference of four different television shows. The results are in the table below.

a. Fill in the blank cells by computing subtotals. In the last cell of the bottom row, place the sum of all the interior cells. What is the total number of students who participated in the survey?

	A	B	C	D	Subtotal
Male	11	5	20	16	52
Female	13	22	0	10	45
Subtotal	24	27	20	26	97

b. P(male) = $\frac{52}{97} = 0.54$ **c.** P(A) = $\frac{24}{97} = 0.25$ **d.** P(B or C) = $\frac{27}{97} + \frac{20}{97} = \frac{47}{97} = 0.48$

e. Are the events "male" and "TV show B" mutually exclusive? Explain.

There are 5 male who prefer show B, so no, not mutually exclusive.

f. Are the events "female" and "TV Show C" mutually exclusive? Explain.

yes, there are no female who watch show C

g. P(male or A) =

$\frac{52}{97} + \frac{24}{97} - \frac{11}{97} = \frac{65}{97}$

0.67

or 67%

h. P(female or D) = P(female) + P(D) − P(female or D)

$\frac{45}{97} + \frac{26}{97} - \frac{10}{97} = \frac{61}{97} \approx 0.63$

Name: ______________________ Date: ____________ Period: _____

Key

CCGPS Analytic Geometry
Worksheet: Simple Probability and Mutually Exclusive/Overlapping Events

1. Determine whether the following events are mutually exclusive or overlapping.
   a) Drawing a club or a 2 from a deck of cards overlapping

   $\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52}$

   b) Getting heads or tails when flipping a coin mutually exclusive

   $\frac{1}{2} + \frac{1}{2} = 1$

   c) Getting a 2 or a prime number when rolling a die 2, 3, 5

   $\frac{3}{6} + \frac{1}{6} - \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$

2. Using a standard deck of 52 cards, find the indicated probability
   a) P(Jack) $\frac{4}{52}$

   b) P(black or red) $\frac{52}{52}$

   c) P(heart or red) $\frac{13}{52} + \frac{26}{52} - \frac{13}{52} = \frac{26}{52}$

   d) P(10 or Ace) $\frac{4}{52} + \frac{4}{52}$

   e) P (black or 9) $\frac{13}{52} + \frac{9}{52}$

   f) P(5 or diamond) $\frac{4}{52} + \frac{13}{52} - \frac{1}{52}$

3. A bag contains 4 white, 3 blue, and 6 red marbles. A marble is drawn from the bag. Find the indicated probability. 13 total
   a) P (white) $\frac{4}{13}$

   b) P(blue or red) $\frac{3}{13} + \frac{6}{13} = \frac{9}{13}$

   c) Are "white" and "red" mutually exclusive? Explain.

   yes, no marbles can be white and red at the same time

... Continued on the back ...

Name: ______________________ Date: ____________ Period: _____

4. Students of different ages were asked to pick their preference amongst three different spring break locations. The results are listed in the table below by school level.

	Disney World	Panama City Beach	Cancun	Subtotal
Elementary	27	6	3	36
High School	11	18	10	39
College	4	20	19	43
Subtotal	42	44	32	118

a) Fill in the blank cells by computing subtotals. In the last cell of the bottom row, place the sum of all the interior cells. What is the total number of students who participated in the survey?

b) Are "Cancun" and "Disney World" mutually exclusive? Explain.

yes, no one can prefer Cancun and Disney World

c) Are "High School" and "Panama City Beach" mutually exclusive? Explain.

no, overlap of 18

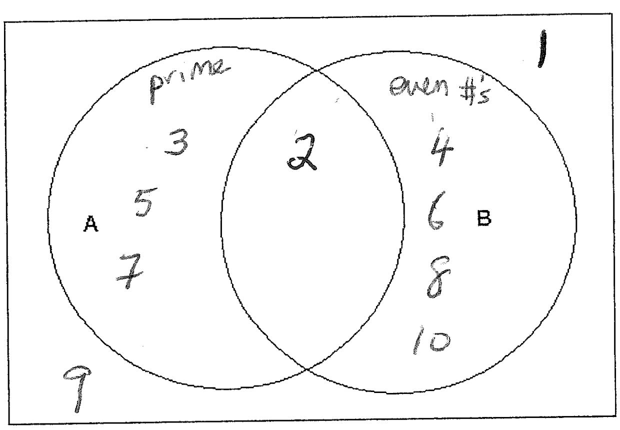
d) P(Elementary or Cancun)

$\frac{36}{118} + \frac{32}{118} - \frac{3}{118} = \boxed{\frac{65}{118}}$

e) P(Disney World or Panama City Beach)

$\frac{42}{118} + \frac{44}{118} = \boxed{\frac{86}{118}}$

5. Consider the set of all integers from 1 to 10. Fill in the Venn diagram below with all 10 integers in the set. Place prime numbers in circle A and even numbers in circle B. Place values which are neither even or prime inside the rectangle but outside of both circles. Then, answer the following questions.



a. P(prime) $\frac{4}{10}$

b. P(even) $\frac{5}{10}$

c. P(prime or even)

$\frac{4}{10} + \frac{5}{10} - \frac{1}{10} = \frac{8}{10}$

d. Are "prime" and "even" mutually exclusive? Explain.

No, 2 is shared (prime and even)