Unit 8

Lesson 1

Ways to Count

Unit 8 – Probability Date_____ Pd____

Lesson 1 → Ways to Count

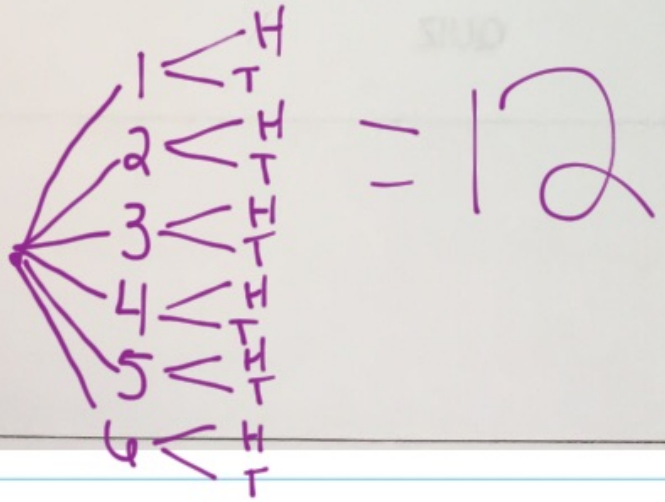
➢ Before we can calculate the probability of an event taking place, we must first be able to count the numb of outcomes that are possible from a given experiment.

❖ **Sample Space:** the set of all **possible** outcomes of an experiment
List the sample space, S, for each of the following:

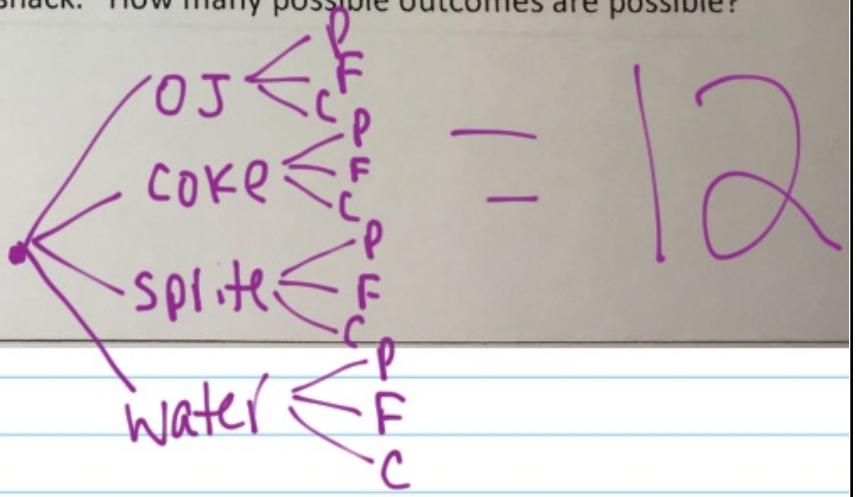
1. Rolling one die. {1, 2, 3, 4, 5, 6}	2. Drawing one marble from a jar containing 1 green marble, 2 blue marbles, and 2 pink marbles. {G, B, B, P, P}
3. Tossing two coins. {HT, HH, TH, TT}	4. Drawing two cards from a set of cards containing the letters E, F, G, H, and I. {IE, IF, IG, IH, HI, HG, HF, HE, GF, GE, GH, GI, FE, FG, FH, FI, EF, EG, EH, EI}

- Ways to Count the Size of the Sample Space:
  - **Tree Diagram**: Visual way to show all the possible outcomes

1. A student is to roll a die and then flip a coin. How many possible outcomes will there be?



2. At Cougar Club meeting, there were four drinks you could choose from: OJ, Coke, Sprite, and water and three snacks you could choose from: peanuts, fruit, and cookies. Each student may only have one drink and one snack. How many possible outcomes are possible?



- **Fundamental Counting Principle:**
  - ✓ Determines the number of possible outcomes when there are two or more characteristics.
  - ✓ If an event has m possible outcomes and another independent event has n possible outcomes, then there are $m \cdot n$ possible outcomes for the two events together.

EX1: A student is to roll a die and then flip a coin. How many possible outcomes will there be?

$6 \times 2 = 12$

EX2: At a Cougar Club meeting, there were four drinks you could choose from: OJ, Coke, Sprite, and water and three snacks you could choose from: peanuts, fruit, and cookies. Each student may only have one drink and one snack. How many combinations are possible?

$4 \times 3 = 12$

EX3: For a college interview, Robert has to choose what to wear from the following: 4 slacks, 3 shirts, 2 pairs of shoes and 5 ties. How many possible outfits does Robert have from which to choose? $4 \times 3 \times 2 \times 5 = 120$

EX4: Find the number of ways to arrange the letters ABC. $3 \times 2 \times 1 =$

EX5: A combination lock will open when the right choice of three numbers (from 1 to 30, inclusive) is selected. How many different lock combinations are possible assuming no number is repeated?

If not repeat $30 \times 29 \times 28$ Could repeat $30 \times 30 \times 30$

EX6: From a club of 24 members, a President, Vice-President, Secretary, Treasurer and Historian are to be elected. In how many ways can the offices be filled?

$24 \times 23 \times 22 \times 21 \times 20 = 5,100,480$

EX7: A collector has 10 rare books to arrange on a shelf. How many different arrangements are possible?

$10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $10!$

EX8: How many different ways can the letters in the word ***SNOW*** arranged?

$4 \times 3 \times 2 \times 1 = 24$

- **Venn Diagram:** a visual representation of sets and their relationships to each other using overlapping circles.
  - ✓ ***Intersection of two sets*** $(A \text{ and } B)$: the set of all elements in both set A **AND** set B $(A \cap B)$
  - ✓ ***Union of two sets*** $(A \text{ or } B)$: the set of all elements in set A **OR** set B $(A \cup B)$

EX1: Given the following sets, find $(A \cap B)$ and $(A \cup B)$

A = {1, 3, 5, 7, 9, 11, 13, 15}

B = {0, 3, 6, 9, 12, 15}

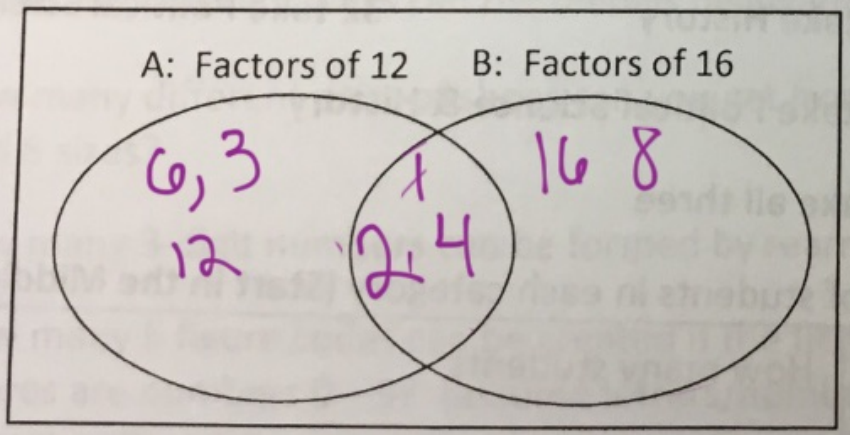
A and B

$(A \cap B) = \{3, 9, 15\}$

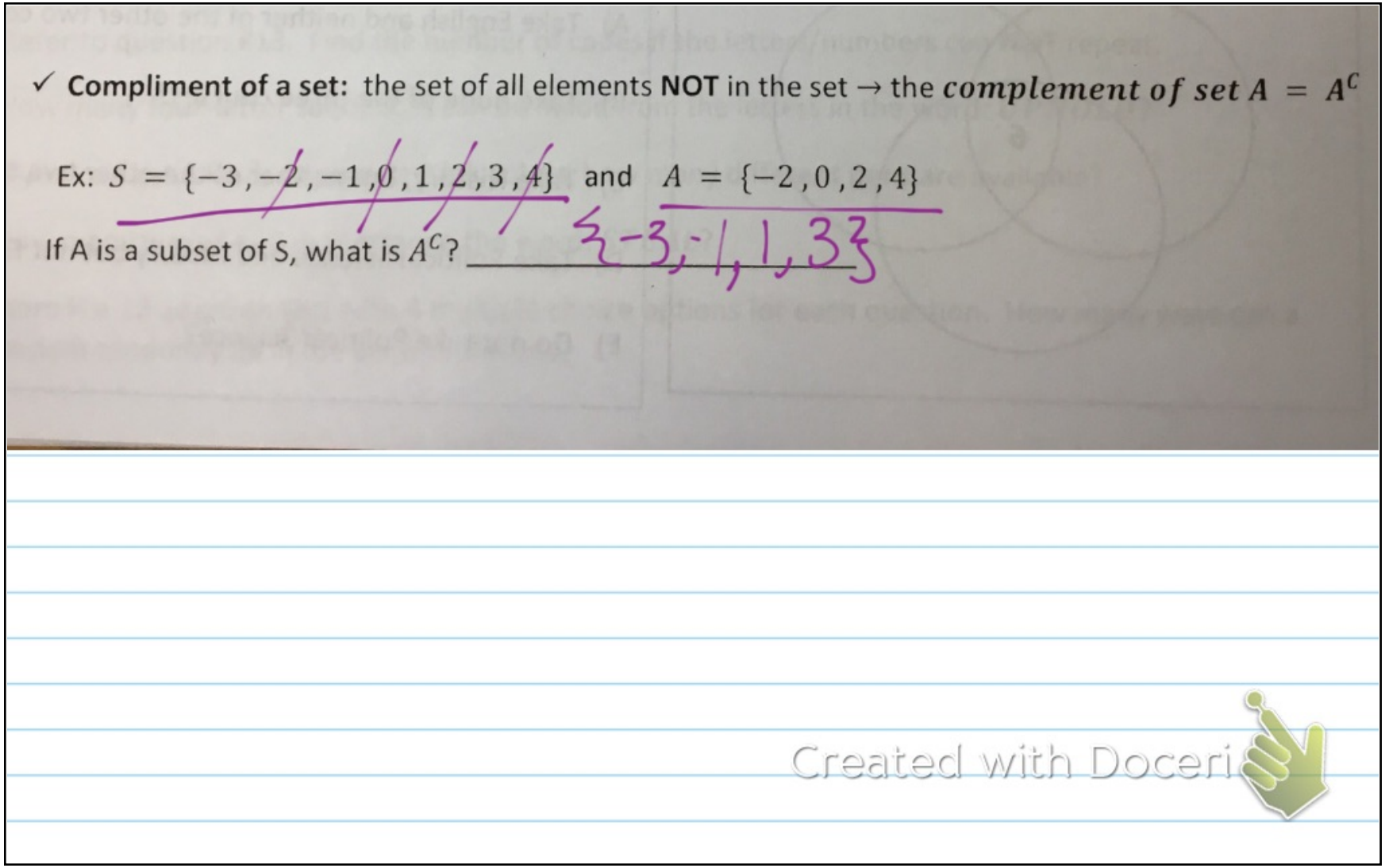
A or B

$(A \cup B) = \{0, 1, 3, 5, 6, 7, 9, 11, 12, 13, 15\}$

EX2: Use the Venn Diagram to answer the following questions:



1. What are the elements of set A? {6, 3, 12, 1, 4, 2}
2. What are the elements of set B? {1, 2, 4, 8, 16}
3. What is $(A \cap B)$? {1, 2, 4}
4. What is $(A \cup B)$? {1, 2, 4, 6, 3, 12, 16, 8}


✓ **Compliment of a set:** the set of all elements **NOT** in the set → the ***complement of set*** $A = A^C$
Ex: $S = \{-3, -2, -1, 0, 1, 2, 3, 4\}$ and $A = \{-2, 0, 2, 4\}$
If A is a subset of S, what is A^C? $\{-3, -1, 1, 3\}$
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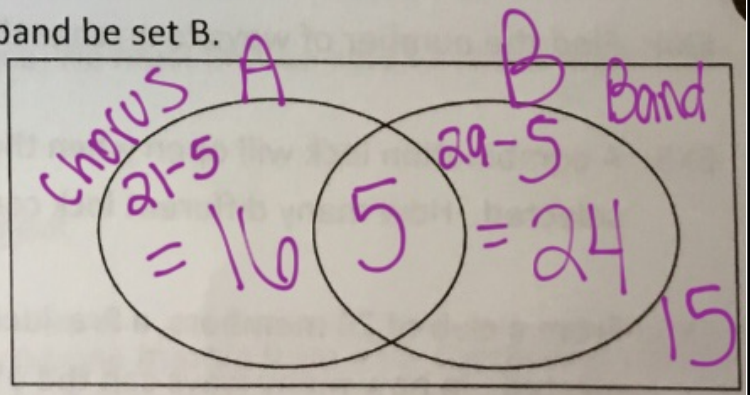
EX3: In a class of 60 students, 21 sign up for chorus, 29 sign up for band, and 5 take both. Fifteen students in the class are not enrolled in either band or chorus.

A. Put this information into a Venn diagram. If the sample space, S, is the set of all students in the class, let students in chorus be set A and students in band be set B.

B. What is $(A \cap B)$? 5

C. What is $(A \cup B)$? 16+24+5=45

D. What is $(A \cup B)^C$? 15



60 - 16 - 5 - 24 = 15

EX4: A survey of clowns revealed the following information:

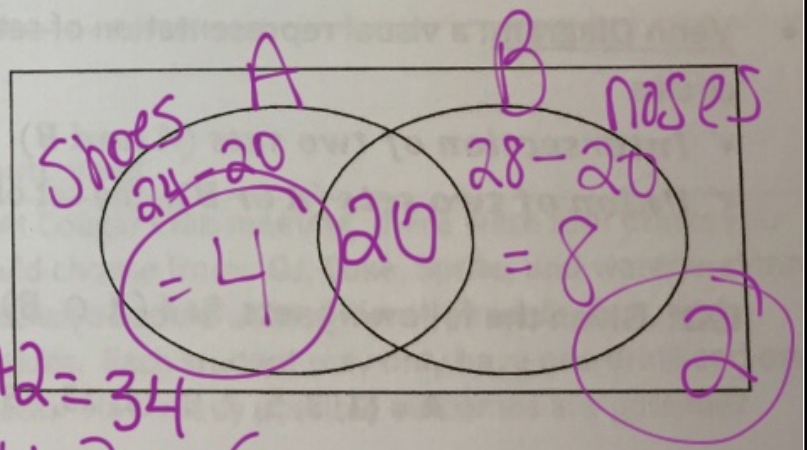
- 24 wear funny shoes
- 20 wear both of these items
- 28 wear a big nose
- 2 wear neither of these things

A. Put this information into a Venn diagram. If the sample space, S, is the set of all clowns surveyed, let funny shoes be set A and noses be set B.

B. What is $(A \cap B)$? 20

C. What is $(A \cup B)$? 20+4+8 = 32

D. What is $(A \cup B)^C$? 2



E. How many clowns were surveyed? 20+4+8+2=34

F. How many clowns **did not** wear a big nose? 4+2=6

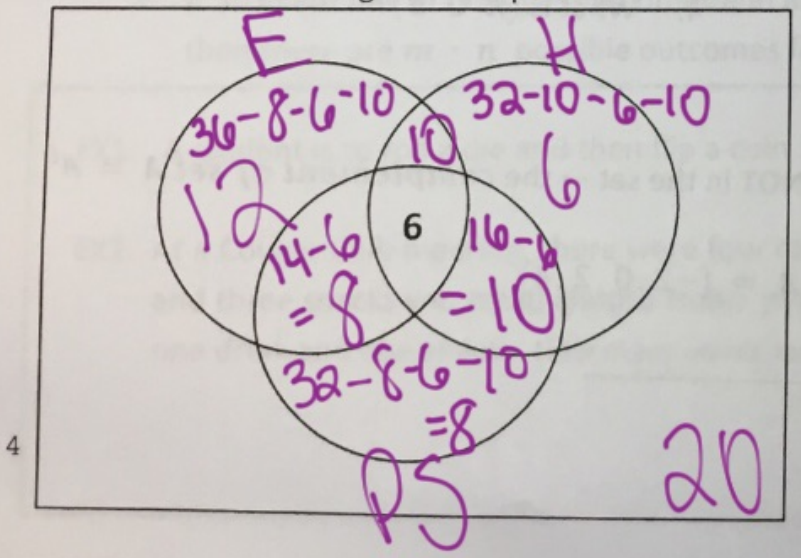
EX5: A survey of 80 sophomores at a certain college showed the following:

~~36 take English~~ ~~32 take History~~ **32 take Political Science**

~~16 take History and English~~ ~~16 take Political Science & History~~

~~14 take Political Science & English~~ ~~6 take all three~~

➢ Draw a Venn Diagram to represent the number of students in each category (**Start in the Middle**):



How many students:

A) Take English and neither of the other two courses? 12

B) Take none of the three courses? 20

C) Take History, but neither of the other two cours[illegible] 4

D) Take Political Science and History but not English? 10

E) Do not take Political Science? 12+10+6+20 = 48

4

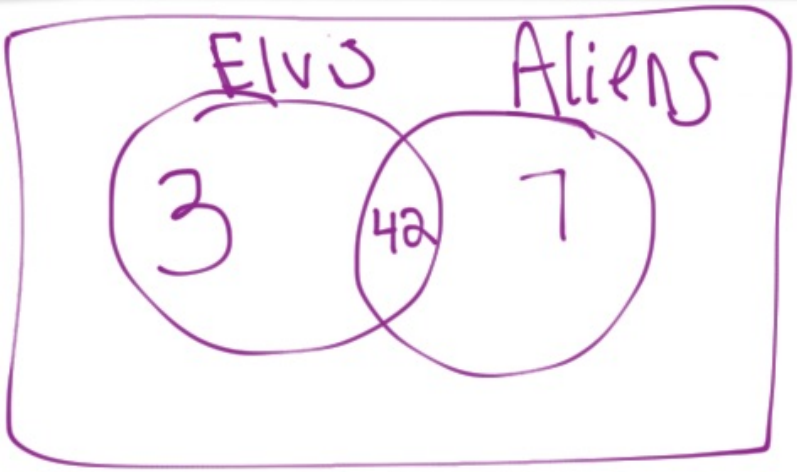
7. A survey of 64 informed voters revealed the following information:

45 believe that Elvis is still alive

49 believe that they have been abducted by space aliens

42 believe both of these things

How many voters believe **neither** of these things?



64 - 3 - 42 - 7

= 12

➢ ***Use a two-way table to help you answer each question.***

28.

	8th grade	9th grade	Total
Soccer	40	105	145
Basketball	84	37	121
Total	124	142	266

A) How many 8th grade students are there? 124

B) How many 9th grade students choose soccer? 105

C) How many students choose basketball? 121

29.

Students currently taking Math 2 (H)

	Math 3 (H)	Math 3	Math 2	Total
Male	45	32	8	85
Female	50	11	14	75
Total	95	43	22	160

A) How many female students are there? 75

B) How many students will take Math 3 (H)? 95

C) How many male students will repeat Math 2? 8

30. Android vs. I Phone

	Android	iPhone	Total
Male	2	8	10
Female	1	17	18
Total	3	25	28

A) How many students from this class prefer the Android? 3

B) How many students from this class prefer the iPhone? 25

C) How many students are female? 18

D) How many students are male? 10

E) How many female students prefer the Android? 1

F) How many male students prefer the iPhone? 8

HW: 5 and 6