Name: _____ Date: _____ Class: _____

Math 2 Unit 9 Notes and Homework Packet

Day 1: Intro to Probability

Sample Space: Set of all possible outcome

List the sample space, S, for each:

1. Tossing a coin: S = {H, T} {Heads, Tails}
2. Rolling a dice: S = {1, 2, 3, 4, 5, 6}
3. Drawing a marble from a bag with 2 reds, 3 blues, and 1 white: S = {red, blue, white}

Examples:

1. A die is rolled once.
   a. What is the probability of rolling a 4: P(4): 1/6
   b. P(even): 3/6 = 1/2
   c. P(>4): 2/6 = 1/3
   d. P(<1 and >4): 0/6
   e. P (10): 0/6

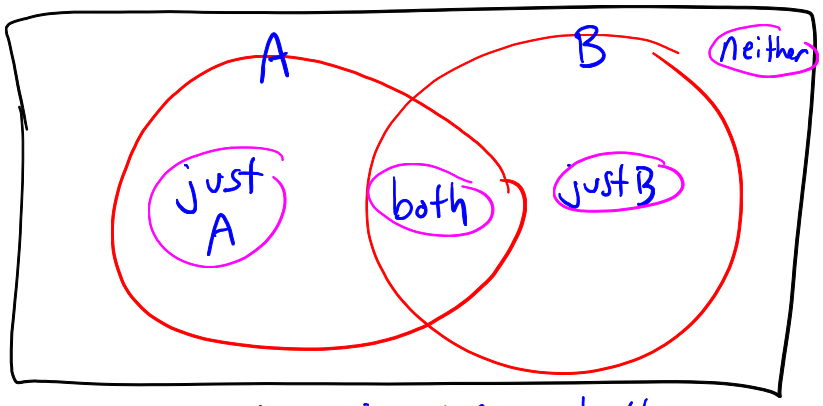
e. A card is drawn from a standard deck of cards (Ace is low)

Diamonds (red)
Hearts (red)
Spades (black)
Clubs (black)

52

a. P(Club): 13/52 = 1/4
b. P(Ace): 4/52 1/13
c. P(2 of hearts): 1/52
d. P(heart <4): 3/52
e. P(not a red): 26/52 = 1/2
f. P(king or black): 28/52 7/13
   P(K) + P(black) - P(both) 4 + 26 - 2
g. P(face or club): 22/52 11/26
   12 + 13 - 3
h. P(face and a club): 3/52

Venn Diagrams - Orginazational tool using intersecting circles.



Total

A = just A + both

B = just B + both

1. 200 students are in the freshman class. 50 students wore hats on a field trip, 100 students wore sunglasses, and 30 people wore both.
   a. How many students did not wear sunglasses or a hat?

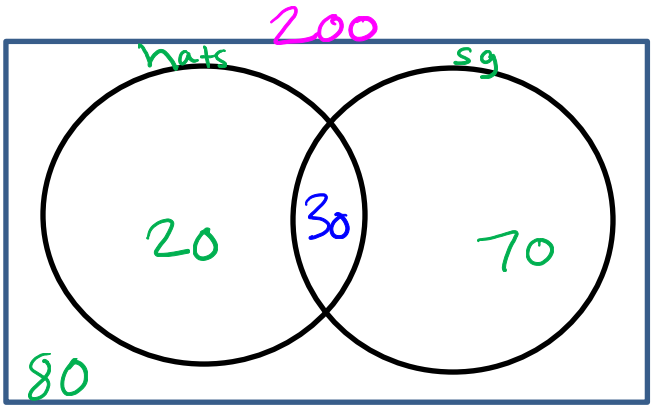
      80

   b. What is the probability that the student didn't wear sunglasses?

      $\frac{100}{200} = \frac{1}{2}$

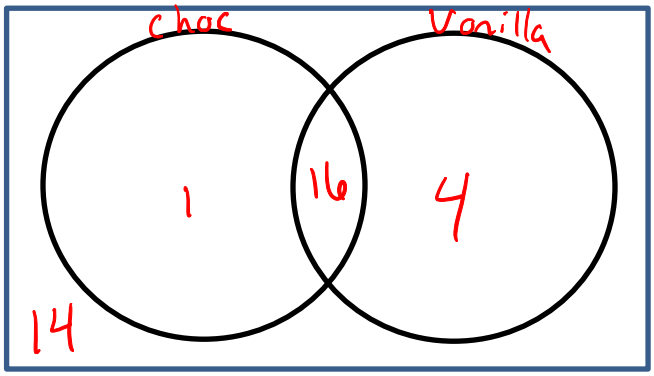
   c. What is the probability that the student wore only a hat?

      $\frac{20}{200} = \frac{1}{10}$



200 − 120 = 80

2. 35 people were surveyed. 17 like chocolate ice cream, 20 like vanilla ice cream, and 16 like both.



16
+ 4
+ 1
21

35

35 − 21

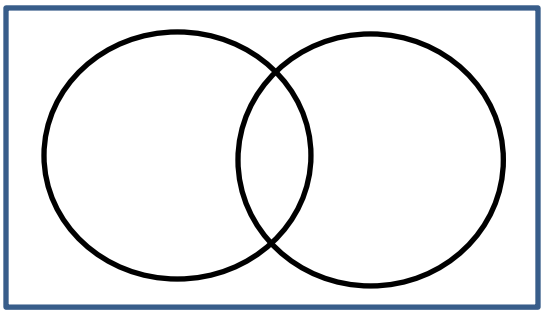
   a. How many people like only like chocolate ice cream? 1

   b. How many people like chocolate OR vanilla ice cream, but not both? 5

   c. How many people do not like chocolate or vanilla ice cream? 14

Homework 9.1

1. There are 35 people in a class that won a pizza party. 21 like cheese pizza, 15 like peperoni, 7 like both.

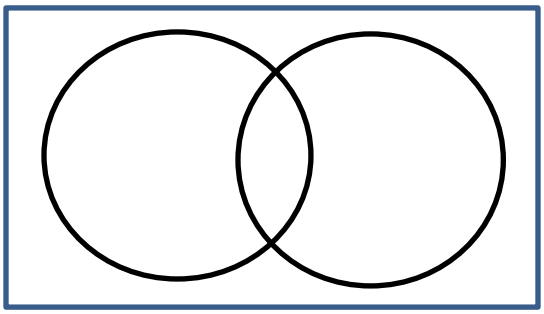


   a. How many people do not like cheese or pepperoni pizza?

   b. What is the probability that if the teacher selects 1 student they will like cheese?

   c. What is the probability that if one student is selected that they won't like pepperoni pizzas?

2. 99 people were surveyed. 45 people like SUVs, 78 people like Trucks, and 34 people like both.



   a. How many people do not like SUVs or Trucks?

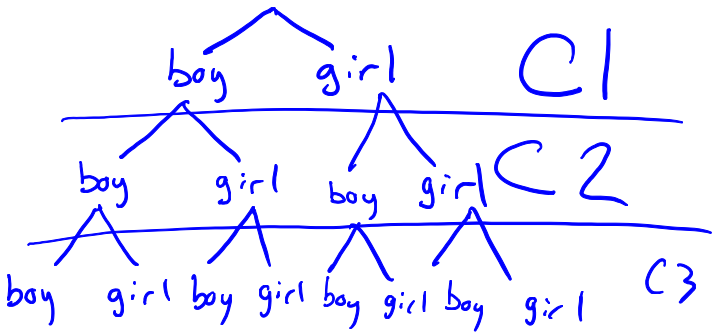
   b. How many people like SUVs OR Trucks, but not both?

Day 2: Tree Diagrams and the Fundamental Counting Principle

Tree Diagrams: Organizational tool using branching to count possibilities of multiple events

1. Draw a tree diagram to represent a family that has 3 children.

1. Total possibilities: 8 final row
2. P(3 boys) $\frac{1}{8}$
3. P(oldest is a girl) $\frac{4}{8}$ $\frac{1}{2}$
4. P(2 boys and 1 girl) $\frac{3}{8}$
5. P(at least one boy) $\frac{7}{8}$



2. Draw a tree diagram to represent a restaurant that has 3 sandwich options, 3 side options, 2 drink options, and 2 dessert options.

Total possibilities: _____

Fundamental Counting Principle:

Fundamental Counting Principle - _____

If one event has x outcomes and another event has y outcomes, the possible outcomes for BOTH events is $x \cdot y$

Examples:

1. The cafeteria offers 3 different types of pizza, 5 types of chips, and 2 types of milk. How many different lunches are possible if a lunch has pizza, chips, and milk?

   $3 \cdot 5 \cdot 2 =$ 30 lunch options

2. You have 8 shirts, 4 sweatshirts, and 5 pairs of pants. How many possible outfits can be formed if you pick a shirt, a sweatshirt and a pair of pants?

   $8 \cdot 4 \cdot 5 =$ 160 outfits

3. You are making a salad and you can choose between 2 types of lettuce, 4 types of veggies, and 10 dressings. You can choose one of each. How many different salads could you make?

   $2 \cdot 4 \cdot 10 =$ 80 salads

5 questions each question has 5 answer choices

4. A math teacher is making a quiz with 5 multiple choice questions. The possible choices for answers are A, B, C, D, and E. How many different ways could you select answers to the quiz?

$5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 = 3125$ different ways

5. A certain car comes in two body styles with a choice of two engines, a choice of two transmissions, and a choice of seven colors. What is the minimum number of cars a dealer must stock to have one car of every possible combination?

$2 \cdot 2 \cdot 2 \cdot 7 = 56$ cars

Homework 9.2

1. The math club is electing new officers. There are 3 candidates for president, 4 candidates for vice-president, 4 candidates for secretary, and 2 candidates for treasurer. How many different combinations of officers are possible?

2. You go to the cafeteria for lunch and have a choice of 4 entrees, 5 sides, 5 drinks, and 4 desserts. Assuming you have one of each category, how many different lunches could be made?

3. You go to the home electronics store to buy a new television. You have the following choices: rear projection, lcd, dlp, crt, or plasma; full screen or wide screen; 13”, 19” 27”, 32”, 36”, 41”, 51”, or 63”. How many different televisions does the store have to offer?

4. For Christmas, you ask for a new phone, a new pair of headphones, and a new charger. Santa has 21 different phone options, 34 different headphone options, and 12 different charger options to give you. How many different combinations of a phone, a pair of headphones, and a charger are there?

5. You wake up in the morning and go to the pantry to look for breakfast. You have a choice of Pop-Tarts, muffins, granola bars, or cereal. To drink you have a choice of whole milk, 2% milk, skim milk, orange juice, apple juice, and water. Your mother insists that you take a multi-vitamin with your breakfast. You can choose from Flintstones vitamins, One-a-Day vitamins, or Chock’s Vitamins. How many different breakfasts made up of an entrée, drink, and vitamin could you make?

6. You go to Wal-Mart to buy batteries. You can choose from EverReady, Duracell, or Ray-OVac. Once you decide on the brand you then have to decide whether to get alkaline or nonalkaline batteries. Finally you must decide between AAA, AA, C, or D batteries. How many different kinds of batteries are available for you to buy?

7. You go to the snack bar to buy a bagel and a drink for lunch. You can choose from a plain bagel, a blueberry bagel, or a raisin bagel. The choices for a drink include water or a sports drink. How many different lunches could be made with these choices?

Day 3: Permutations: Order matters

Permutation: a way in which a set of things can be arranged

To find how many permutations can be made from a set of data, determine # of options & # of decisions

FACTORIAL: ! = factorial $6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

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

Examples:

1. How many different ways can you arrange the letters in the word LATE?

4 decisions $\underline{4} \cdot \underline{3} \cdot \underline{2} \cdot \underline{1}$ 4 choices

$4! =$ 24 ways

2. 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?

3 choices → 3 blanks

30 options → start at 30

$\underline{30} \cdot \underline{29} \cdot \underline{28} = 24360$ combinations

OR $\frac{30!}{(30-3)!}$

3. 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?

5 choices → 5 blanks

24 options → start at 24 $\underline{24} \cdot \underline{23} \cdot \underline{22} \cdot \underline{21} \cdot \underline{20} = 5{,}100{,}480$

You can also use your calculator!!! I will show you in calc, but do this for now

Evaluate: 1. $_{24}P_{5}$ (start at 24, 5 blanks) 2. $_{10}P_{8}$ 3. $_{4}P_{1}$

$\underline{24} \cdot \underline{23} \cdot \underline{22} \cdot \underline{21} \cdot \underline{20} = 5{,}100{,}480$

$\underline{10} \cdot \underline{9} \cdot \underline{8} \cdot \underline{7} \cdot \underline{6} \cdot \underline{5} \cdot \underline{4} \cdot \underline{3}$

1,814,400

$\underline{4} = 4$

Without Repetition:

1. Without repetition, a 3 digit number is formed by selecting from the digits 4, 5, 6, 7, 8, and 9. 6 options

→ means you have one less choice each blank

a. How many 3 digit numbers are possible?

$\underline{6} \cdot \underline{5} \cdot \underline{4}$ 120

b. How many 5 digit numbers are possible?

$\underline{6} \cdot \underline{5} \cdot \underline{4} \cdot \underline{3} \cdot \underline{2} = 720$

2. There were seven students running in a race. How many different arrangements of first, second, and third place are possible?

7 options 3 choices $\underline{7} \cdot \underline{6} \cdot \underline{5}$ 210

Repetition: Some arrangements of data have repeating numbers or letters. We must take care of those!

To account for repetition, after drawing your blanks, divide by the factorial of the amount of times to number or letter shows up.

1. How many **different** 5-letter words can be formed from the word APPLE ? 5 choices

$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$... but P appears twice so $\frac{120}{2!} = \frac{120}{2 \cdot 1} = \frac{120}{2} = 60$

2. How many different 4 letter arrangements can be formed from the letters in the word "HAPPINESS"?

$9 \cdot 8 \cdot 7 \cdot 6 = 3024$, but P is twice, S is twice so $\frac{3024}{2!} = \frac{1512}{2!} = 756$ 9 options

3. A woman is planting her flower bed. She has 4 Tulips, 3 Daffodils, and 5 Marigolds. In how many ways can she arrange these plants in a row in her garden?

$4+5+3 = 12$ options and 12 decisions $12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 479001600$

$\frac{479001600}{4!} = \frac{19958400}{3!} = \frac{3326400}{5!} = 27720$

Homework 9.3

Permutations

1. Evaluate 6!
2. Evaluate $\frac{8!}{3!}$
3. Evaluate ${}_{20}P_5$

4. 64 basketball teams are entered in a tournament. Since only 4 teams will make it to the Final Four round, how many ways could the four spots be assigned?

5. A group of 5 people went to a rock concert. They found a row with 9 empty seats. How many ways can the people be seated in the row?

6. How many different ways can the letters of the word BOOKKEEPER be arranged?

7. I have 14 pieces of M&M"s. I have 3 yellow, 4 brown, 5 blue, and 2 green pieces. How many different ways can I arrange the candy pieces?

8. You are allowed to have 3 letters and 4 numbers on a North Carolina license plate. If repetition is allowed, how many plates can you make?

9. Using the information for #7, how many license plates could you make if repetition is not allowed?

Day 4: Combinations

Combination: Non ordered sequence of objects

Permutations vs Combination: Which one would you use?

Yes Not

1. The number of different groups of 3 books can be placed in a backpack. No (combination)
2. The number of ways 3 books can be arranged on a shelf. Yes Permutation
3. Eight students are running for class officers. We want to elect a president, vice-president, secretary, and treasurer. Yes, Permutation
4. Selecting 8 toys to bring with you on vacation. No combination
5. Making a list of people alphabetically by last name. Yes

You can use your calculator for combinations!!!

Evaluate: 1. ${}_{12}C_3$ 2. ${}_{10}C_2$ 3. ${}_6C_6$

C 220 45 1

P 1320

Examples:

NO

1. To play a particular card game, each player is dealt five cards from a standard deck of 52 cards. How many different hands are possible?

5 choices 52 options

${}_{52}C_5 = 2598960$

NO

2. A student must answer 3 out of 5 essay questions on a test. In how many different ways can the student select the questions?

3 choice
5 options

${}_5C_3 = 10$

Yes!

3. A basketball team consists of two centers, five forwards, and four guards. In how many ways can the coach select a starting line up of one center, two forwards, and two guards?

~~2 | 5·4 | 4·3 480~~

4. A restaurant has 6 different kinds of hamburgers on the menu and 5 different kinds of soda. How many different ways can someone select 2 different hamburgers and a soda for lunch?

burger No | Soda

${}_6C_2 = 15 \cdot 5 = 75$

5. Anthony is going to college this year. When he went to sign up for his classes he had a choice of 4 math classes and 5 computer classes. He must sign up for 3 math class and 2 computer classes. How many ways can he do this?

No

Math ${}_4C_3$ | ${}_5C_2$ computer

$4 \cdot 10 = 40$

Homework 9.4 Fundamental Counting Principle, Permutations and Combinations

1. ${}_5P_2$ **2.** ${}_9P_4$ **3.** ${}_{11}P_5$

4. ${}_8C_4$ **5.** ${}_{11}C_5$ **6.** ${}_{20}C_2$

Determine if the following is a Permutation or a Combination. Then solve.

7. How many ways can you plant a rose bush, a lavender bush and a hydrangea bush in a row?

8. If there is a randomly generated 3-letter arrangement of the letters in the word FRANCE, how many outcomes could there be?

9. In how many ways can 3 pizza toppings be selected from a group of 12 toppings?

10. How many ways can you line up 5 people out of a class or 32 if each person gets a different prize?

11. If a girl has 5 skirts, 8 shirts, and 6 pairs of shoes, how many outfits can she wear?

12. Three people run for class president, 4 for vice-president, and 2 for secretary. How many ways can the 3 officers be selected?

13. For a school lunch you can get a hamburger, hot dog, or chicken sandwich. To drink you can get a soft drink or a milkshake. How many lunches can be made of 1 sandwich and 1 drink are there?

14. On vacation, you're allowed to bring 2 puzzles, 1 card game, and 5 packs of stickers. If you have 6 puzzles, 4 card games, and 9 packs of stickers to choose from, how many different groups of toys can you bring?

15. How many different ways can you arrange the letters in the phrase SURVIVOR IS THE BEST SHOW to make a new phrase?