

ALGEBRA II HANDOUT PROBABILITY

Fundamental Counting Principle

1. A pizza shop runs a special where you can buy a large pizza with one cheese, one vegetable, and one meat for \$10. You have a choice of 7 cheeses, 11 vegetables, and 6 meats. Additionally, you have a choice of 3 crusts and 2 sauces. How many different variations of the pizza special are possible?
2. Police use photographs of various facial features to help witnesses identify suspects. One basic identification kit contains 195 hairlines, 99 eyes and eyebrow, 89 noses, 105 mouths and 74 chins and checks. How many possible faces can be created with the kit?

Permutations & Combinations—Determine whether each situation requires a permutation or combination. Then determine the number of possibilities.

3. How many different arrangements of the letters in each word are possible?
(a) MATHEMATICS (b) PINEAPPLE
4. Nine candidates are running for six positions on the school board. How many different groups of people could make up the school board?
5. A computer password requires a minimum of 6 characters. How many passwords of minimum size are possible for each of the following situations?
a) First & last characters must be letters that may repeat; middle characters must be non-repeating digits.
b) Letters & numbers must alternate beginning with a letter; no letter or digit may be repeated.
6. Eight cheerleaders will be selected from 15 girls who are trying out. How many different squads of 8 girls are possible?
7. There are 10 finalists in a figure skating competition. How many ways can gold, silver, and bronze medals be awarded?
8. In a dog show, how many ways can 3 Chihuahuas, 5 Labradors, 4 poodles, and 3 beagles line up in front of the judges if the dogs of the same breed are considered indistinguishable?
9. The cast of a school play requires 4 girls and 3 boys. They will be selected from 7 eligible girls and 9 eligible boys. How many different groups of cast members are possible?
10. In how many ways can 8 actors be listed in the opening credits of a movie if one of the two leading actors must be the first name listed and the other must be the last name listed?
11. A radio disc jockey plans to play four songs between the next two commercial breaks. He has 20 top hits to choose from. In how many different orders can four of the songs be played?
12. A defensive football squad consists of 25 players. Of these, 10 are linemen, 6 are linebackers, and 9 are safeties. How many different teams of 5 linemen, 3 linebackers, and 3 safeties can be formed?
13. A music store wants to display 3 identical keyboards, 2 identical trumpets, and 2 identical guitars in its store window. How many distinguishable displays are possible?

Probability

14. The odds are 6-to-1 that the cross-town rivals will win in the championship football game on Friday night. What is the probability that the home team will win?
15. The probability of Kellyn getting an A on her final exam is $\frac{3}{4}$. What are the odds that she will **not** get an A?

16. A canister contains 20 pieces of candy: 5 strawberry flavored, 9 watermelon flavored, and 6 mint flavored. Two are selected at random. Find the probability that two watermelon candies are selected.
17. There are 5 frozen juice bars and 8 frozen yogurt bars in the freezer. Dana reaches in the freezer and grabs 2 without looking. (a) What is the probability that she selects two yogurt bars? (b) What are the odds that she selects two yogurt bars?
18. Tommy's bank contains 7 pennies, 4 nickels, and 5 dimes. His parents tell him that he can spend the first three coins that he can shake out of the bank. (a) What is the probability that all are pennies? (b) What is the probability that he gets 1 dime and 2 nickels?
19. Suppose you select 2 letters at random from the word ALGEBRA. What are the ODDS of selecting 1 vowel and 1 consonant?
20. From a deck of 52 playing cards, 5 cards are dealt. (a) What are the ODDS of selecting all aces? (b) What are the ODDS of selecting all face cards? (*Hint: Calculate the numerator and denominator separately.*) (c) What is the probability of selecting all cards from one suit?
21. The state of Ohio has a Super Lotto drawing twice a week in which 6 numbers out of 46 are drawn at random. The proceeds from the lottery help to finance education in the state. What is the probability of winning the Super Lotto?
22. In a shipment of 50 transformers, 10 are known to be defective. If 30 transformers are picked at random, what is the probability that 5 are defective?
23. Jose's wallet contains five \$1 bills, four \$5 bills, and two \$10 bills. If he randomly pulls out 3 bills, what are the ODDS that he will have two \$1 bills and one \$5 bill?

Probability with AND and OR

24. Ken has 11 coasters in a kitchen drawer. Six are cork and five are plastic. He selects three at random to use in the family room. (a) What is the probability that all three are cork or all three are plastic? (b) What is the probability that at least 2 are plastic?
25. The Scrabble tiles A, B, E, I, J, K, and M are placed face down in the lid of the game and mixed up. Two tiles are chosen at random. (a) What is the probability of selecting 2 vowels if no replacement occurs? (b) What is the ODDS of selecting A followed by B if replacement occurs?
26. Two cards are drawn from a deck of cards. (a) What is the probability that both are black or both are face cards? (b) What are the ODDS that both are aces or both are red?
27. Christine helps her dad do the dishes. There are 5 bowls, 5 glasses, and 6 plates sitting ready to be washed. She accidentally knocks two items of the counter and breaks them. (a) What is the probability of breaking a bowl, then a glass? (b) What is the probability of breaking a bowl and a glass?
28. The numbers 1-25 are written on Ping-Pong balls and placed in one hopper. The numbers 20 through 40 are also written on Ping-Pong balls and placed in a different hopper. One ball is chosen at random from each spinning hopper. (a) What is the probability that neither is a 20? (b) What is the probability that each is greater than 10?
29. A box of chocolates contains eight milk chocolates and six dark chocolates. Two of the milk chocolates and three of the dark chocolates have caramel inside. The remaining chocolates have crème filling. You randomly select and eat 3 chocolates. (a) What is the probability that all three are caramel filled or all three are crème filled? (b) What is the probability that all three are milk chocolate or all three are crème filled?

30. A jar contains 5 peanut butter cookies, 3 caramel delights, and 7 lemon cookies. Billy grabs 3 and eats them. (a) What is the probability that he eats one of each? (b) What are the ODDS that he eats a lemon cookie, then a caramel delight, and then another lemon cookie? (c) What is the probability that he selects at most one peanut butter cookie?
31. A bag contains 6 purple jerseys numbered 1-6 and 4 blue jerseys numbered 1-4. Two jerseys are selected from the bag. (a) What is the probability that both jerseys purple or both jerseys are numbered 3, 4, or 5?
32. Mathnificent, a math apparel & gift store, is celebrating its 10th anniversary with a coupon grab bag. In the bag are four 15% off coupons, two 25% off coupons and one 50% off coupon. A customer selects a different coupon for each item purchased. If a customer purchases 3 items, what is the probability that she gets at least two 15% off coupons?

Binomial Probability

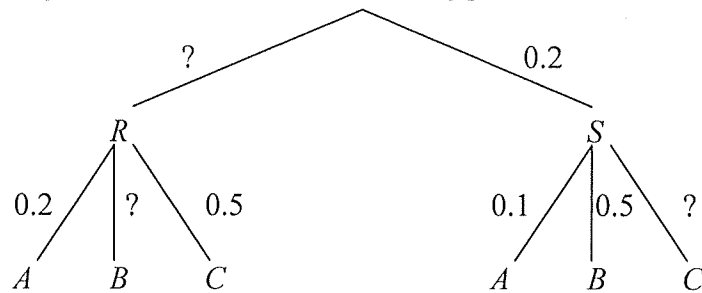
33. A coin is tossed four times. (a) Find the probability of flipping 2 heads and 2 tails. (b) Find the probability of 3 or more heads.
34. Sandra Wilder carries samples of perfume in her purse. Two of the samples are a floral scent and one is a citrus scent. If she applies perfume 3 times during a day, what is the probability that she uses a floral perfume twice?
35. Mark guesses at all 10 true/false questions on his sociology test. (a) What is the probability that he gets 7 correct? (b) What is the probability he gets all the questions wrong?
36. The probability that a traffic signal at Darby Avenue is green is $\frac{3}{5}$. What is the probability that exactly three of the next seven cars will have to stop?
37. JoJo MacMahon plays for the Pickerington Badgers baseball team. He is now batting 0.200 (meaning 200 hits in 1000 times at bat). For his next 5 times at bat, (a) what is the probability that he gets exactly 3 hits? (b) what is the probability he gets at least 4 hits?
38. Five of every 8 pitches thrown by Elias Ramos are strikes. What is the probability that at least 3 of the next 5 pitches will be strikes?
39. A preschool class has 7 students. What is the probability that no more than two were born on a weekend?

ANSWERS

1. 2772
2. 13,349,986,650
3. a) 4,989,600 b) 30,240
4. 84
5. a) 3,407,040 b) 11,232,000
6. 6435
7. 720
8. 12,612,600
9. 2940
10. 1440
11. 116,280
12. 423,360
13. 210
14. $\frac{1}{7}$
15. $\frac{1}{3}$
16. $\frac{18}{95} \approx 0.189$
17. (a) $\frac{14}{39} \approx 0.359$ (b) $\frac{14}{25} \approx .56$
18. (a) $\frac{1}{16} \approx 0.063$, (b) $\frac{3}{56} \approx 0.0536$
19. $\frac{4}{3} \approx 1.33$
20. (a) 0 (b) $\frac{792}{2,598,168} = \frac{33}{108,257}$
(c) 0.00198
21. $\frac{1}{9,366,819}$
22. ≈ 0.215
23. (a) $\frac{8}{25} \approx 0.32$
24. (a) $\frac{2}{11} \approx 0.181$ (b) $\frac{14}{33} \approx 0.424$
25. (a) $\frac{1}{7} \approx 0.143$ (b) $\frac{1}{48} \approx 0.0208$
26. (a) $\frac{188}{663} \approx 0.284$ (b) $\frac{55}{166} \approx 0.331$
27. (a) $\frac{5}{48} \approx 0.104$ (b) $\frac{5}{24} \approx 0.208$
28. (a) $\frac{32}{35} \approx 0.914$ (b) $\frac{3}{5} \approx 0.6$
29. (a) $\frac{47}{182} \approx 0.258$ (b) $\frac{30}{91} \approx 0.330$
30. (a) $\frac{3}{13} \approx 0.231$ (b) $\frac{3}{62} \approx 0.0484$ (c) $\frac{69}{91} \approx 0.758$
31. $\frac{22}{45} \approx 0.489$
32. $\frac{22}{35} \approx 0.629$
33. (a) $\frac{3}{8} \approx 0.375$ (b) $\frac{5}{16} \approx 0.313$
34. $\frac{4}{9} \approx 0.444$
35. (a) $\frac{15}{128} \approx 0.117$ (b) $\frac{1}{1024} \approx 0.000977$
36. $\frac{4536}{15,625} \approx 0.290$
37. (a) $\frac{32}{625} \approx 0.0512$ (b) $\frac{21}{3125} \approx 0.00672$
38. ≈ 0.725
39. $\frac{559,375}{823,543} \approx 0.679$

ALGEBRA II HANDOUT CONDITIONAL PROBABILITY

1. Copy the tree diagram below and find the missing probabilities.



- a. Find $P(RC)$. b. Find $P(SA)$. c. Find $P(C)$. d. Find $P(R|A)$ e. Find $P(S|B)$

Read each of the following problems, construct a tree diagram, and answer the questions. Show in symbols the probability you believe you are finding.

2. At Radical High School 20% of the students are seniors (Sr), 31% are juniors (J), 26% are sophomores (So), and 23% are freshmen (F). The sophomore class is 58% male (M) while the freshman class is 61% female (F). The junior class is 55% female and the senior class is 53% male.
- What percent of the student body are female sophomores?
 - What percent of the student are male seniors?
 - What percent of the student body is female?
 - If one male is randomly selected, what is the probability that he is a junior?
 - If one female is randomly selected, what is the probability that she is a sophomore?
3. Ninety-five percent of the sneakers manufactured by a shoe company have no defects (N). In order to find the 5% that do have defects (D), inspectors carefully look over every pair of sneakers. Still, the inspectors sometimes make mistakes because 8% of the defective pairs pass inspection (P) and 1% of the good pairs fail the inspection test (F).
- What percent of the pairs of sneakers pass inspection?
 - What percent of the pairs of sneakers are defective pairs that pass inspection?
 - What percent of the pairs of sneakers fail the inspection but have no defects?
 - What percent of the pairs of sneakers are correctly inspected?
 - If a pair of sneakers that passed inspection is randomly selected, what is the probability that it is defective?
 - What is the probability that a pair has no defects if it failed the inspection?

EXPECTED VALUE

4. An automobile insurance company has determined the probabilities for various claim amounts for drivers ages 16 through 21, shown in the table below. Calculate the expected value of an average claim. Describe what this means in practical terms.

Amount of Claim	Probability
\$0	0.70
\$2000	0.15
\$4000	0.08
\$6000	0.05
\$8000	0.01
\$10,000	0.01

5. A game is played using one die. If the die is rolled and shows 1, 2, or 3, the player wins nothing. If the die shows 4 or 5, the player wins \$3. If the die shows 6, the player wins \$9. If there is a charge of \$1 to play the game, what is the game's expected value. Describe what this means in practical terms.

ANSWERS

1. a) 0.4 b) 0.02 c) 0.48 d) 0.889 e) 0.294
2. a) $P(\text{SoF}) = 10.92\%$ b) $P(\text{SrM}) = 10.6\%$ c) $P(\text{F}) = 51.4\%$
d) $P(\text{J|M}) = 0.287$ e) $P(\text{So|F}) = 0.212$
3. a) $P(\text{P}) = 94.45\%$ b) $P(\text{DP}) = 0.4\%$ c) $P(\text{NF}) = 0.95\%$
d) $P(\text{DF or NP}) = 98.65\%$ e) $P(\text{D|P}) = 0.00424$ f) $P(\text{N|F}) = 0.171$
4. \$1100; The average claim will be \$1100. The company needs to charge a premium greater than \$1100 in order to make a profit.
5. \$1.50; In the long run, a player could expect to win \$1.50 per game. Note: This would not be true if the player only plays a few games.