SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

1) According to the American Pet Products Manufacturers Association (APPMA) 2003–2004 National Pet Owners Survey, 39% of U.S. households own at least one dog and 34% of U.S. households own at least one cat. Assume that 60% of U.S. households own a cat or a dog.

a. What is the probability that a randomly selected U.S. household owns neither a cat nor a dog?
b. What is the probability that a randomly selected U.S. household owns both a cat and a dog?
c. What is the probability that a randomly selected U.S. household owns a cat if the household has a dog?

2) A survey of families revealed that 58% of all families eat turkey at holiday meals, 44% eat ham, and 16% have both turkey and ham to eat at holiday meals.

a. What is the probability that a family selected at random had neither turkey nor ham at their holiday meal?
b. What is the probability that a family selected at random had only ham without having turkey at their holiday meal?
c. What is the probability that a randomly selected family having turkey had ham at their holiday meal?

A campus radio station surveyed students to determine the types of music they like. The survey revealed that 41% like rock, 32% like country, and 24% like jazz. Moreover, 5% like rock and country, 6% like rock and jazz, 25% like only country, and 1% like all three types of music.

a. Draw a Venn Diagram for this situation.

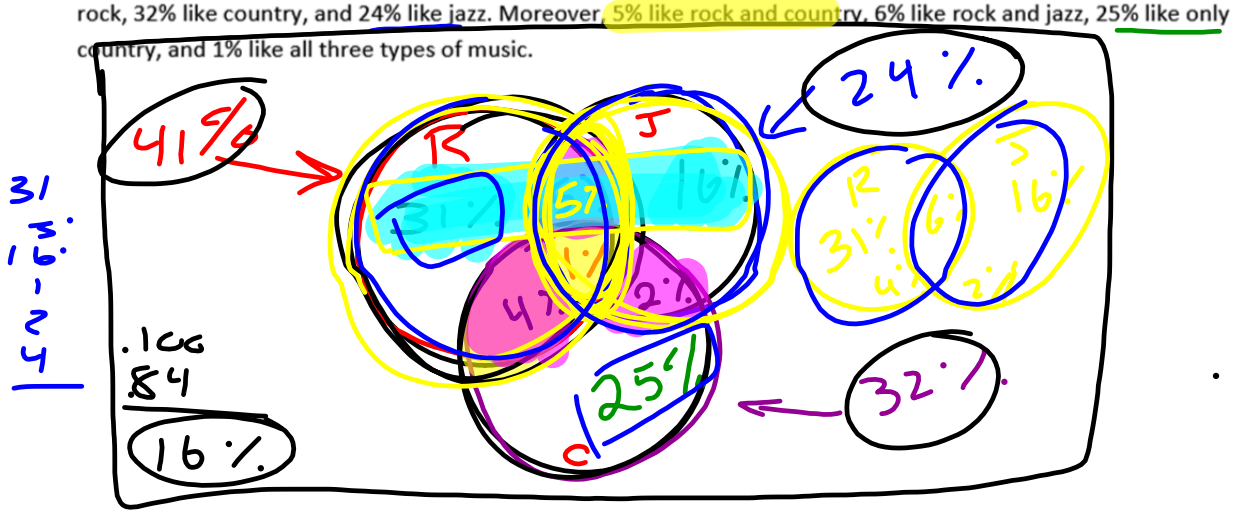
b. Find the probability a student does not like any of the three music types.

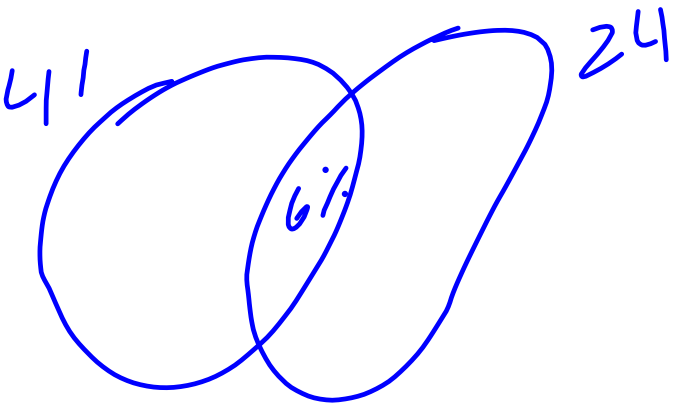
c. If a student likes jazz, what is the probability he/she also likes country?

d. What is the probability a student likes exactly two of the three music types?

e. Find the probability a student likes rock or jazz.

A campus radio station surveyed students to determine the types of music they like. The survey revealed that 41% like rock, 32% like country, and 24% like jazz. Moreover, 5% like rock and country, 6% like rock and jazz, 25% like only country, and 1% like all three types of music.





You draw one card from a deck of 52 cards. Let A = drawing a black card, B = drawing a red card, C = drawing a spade, and D = drawing an Ace. Find

a. P(A or B) = b. P(B or C) = c. P(C or D) =

d. P(A or C) = e. P(A or D) = f. P(B or D) =

2. Suppose you roll two distinguishable dice. Calculate the probability of getting doubles or a sum of 8.

P(doubles or sum of 8)

3. A fair eight-sided die is rolled once. Let A,B,C, and D be the following events:
A={ 2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.

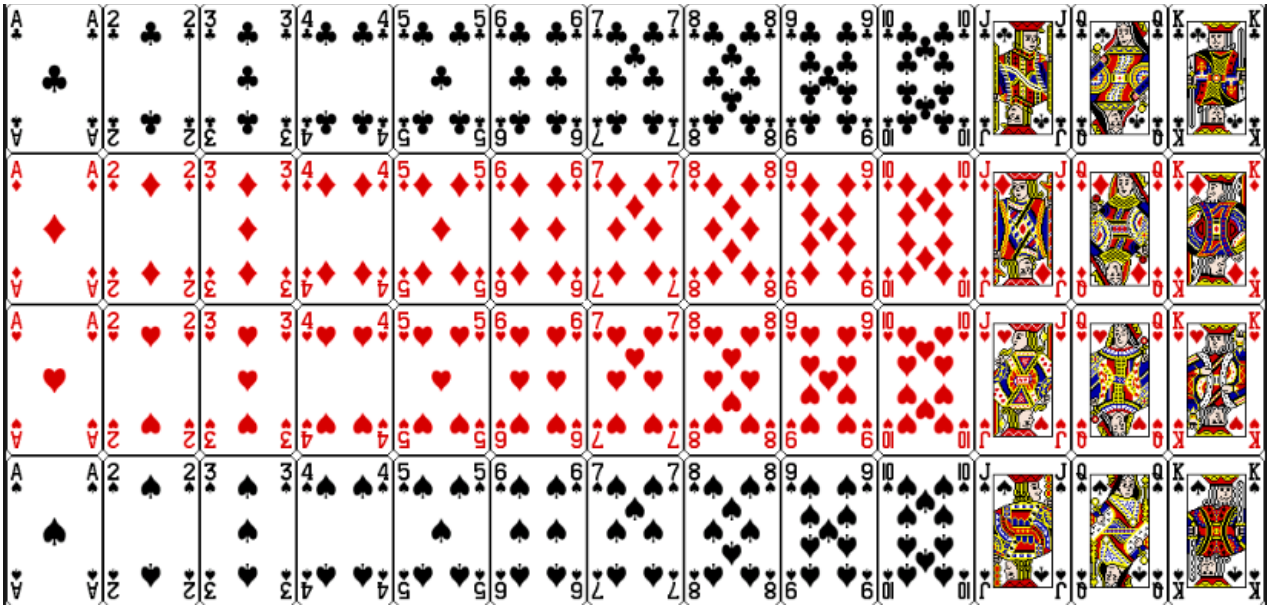
a. P(A or B) = b. P(B or C) = c. P(C or D) = d. P(A or C) =

4. In a group of 101 students 30 are freshmen and 41 are sophomores. Find the probability that a student picked from this group at random is either a freshman or sophomore.

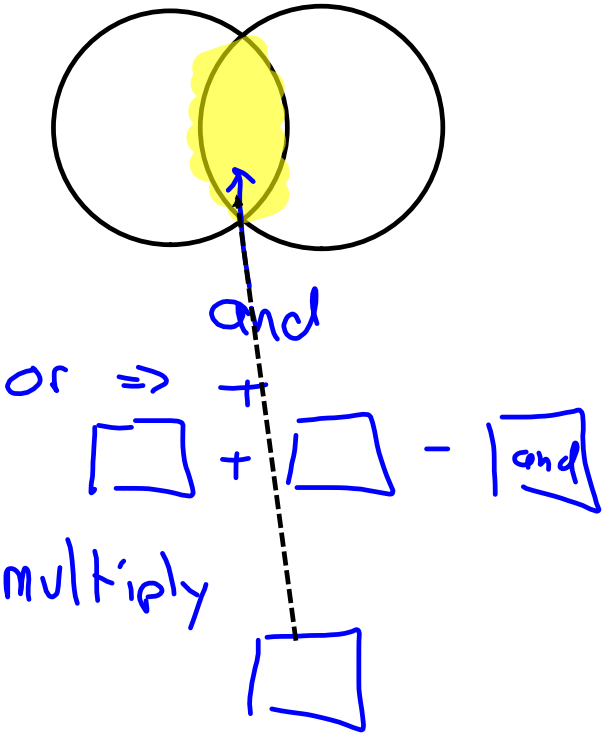
5. In a group of 101 students 40 are juniors, 50 are female, and 22 are female juniors. Find the probability that a student picked from this group at random is either a junior or female.

1. One card is drawn from a deck of 52 cards. Find the following...
   a. P(Queen) =
   b. P(black) =
   c. P(club) =
   d. P(Queen | black) =
   e. P(Queen | club) =
   f. P(black | club) =
   g. Are "drawing a Queen" and "drawing a black card" independent? Justify your choice.
   h. Are "drawing a Queen" and "drawing a club" independent? Justify your choice.
   i. Are "drawing a black card" and "drawing a club" independent? Justify your choice.

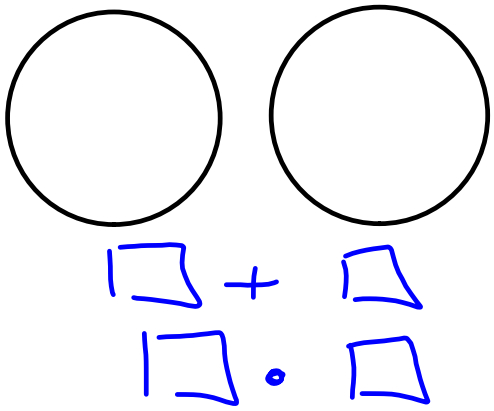
2. A fair eight-sided number cube is rolled once. Let A,B,C, and D be the following events:
A={ 2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.
   a. Find:
      i. P(A)=_____ ii. P(B)=_____ iii. P(C)=_____ iv. P(D)=_____
   b. Find:
      i. P(A|B)=_____
      ii. P(B|C)=_____
      iii. P(C|D)=_____
      iv. P(B|A)=_____
      v. P(C|A)=_____
      vi. P(D|C)=_____



Over Lap



No Over Lap



The Addition Rule

THE ADDITION RULE FOR THE PROBABILITY OF *A* OR *B*

The probability that events A or B will occur, $P(A \text{ or } B)$, is given by

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B).$$

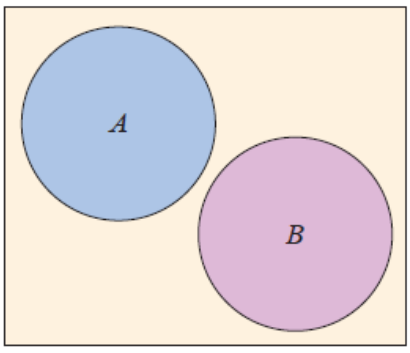
If events A and B are mutually exclusive, then the rule can be simplified to $P(A \text{ or } B) = P(A) + P(B)$. This simplified rule can be extended to any number of mutually exclusive events.

In words, to find the probability one event or the other will occur, add the individual probabilities of each event and subtract the probability they both occur.

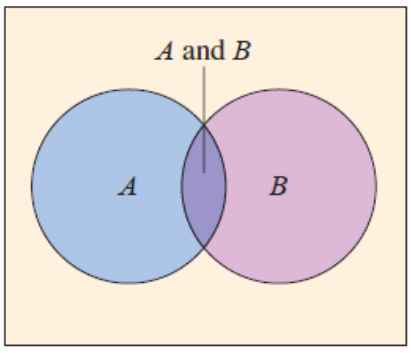
DEFINITION

Two events A and B are **mutually exclusive** if A and B cannot occur at the same time.

The Venn diagrams show the relationship between events that are mutually exclusive and events that are not mutually exclusive.



A and B are mutually exclusive.



A and B are not mutually exclusive.

$P(A) + P(B)$

You draw one card from a deck of 52 cards. Let A = drawing a black card, B = drawing a red card, C = drawing a spade, and D = drawing an Ace. Find…

a. P(A or B) = b. P(B or C) = c. P(C or D) =

d. P(A or C) = e. P(A or D) = f. P(B or D) =

2. Suppose you roll two distinguishable dice. Calculate the probability of getting doubles or a sum of 8.

3. A fair eight-sided die is rolled once. Let A,B,C, and D be the following events:
A={ 2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.

a. P(A or B) = b. P(B or C) = c. P(C or D) = d. P(A or C) =

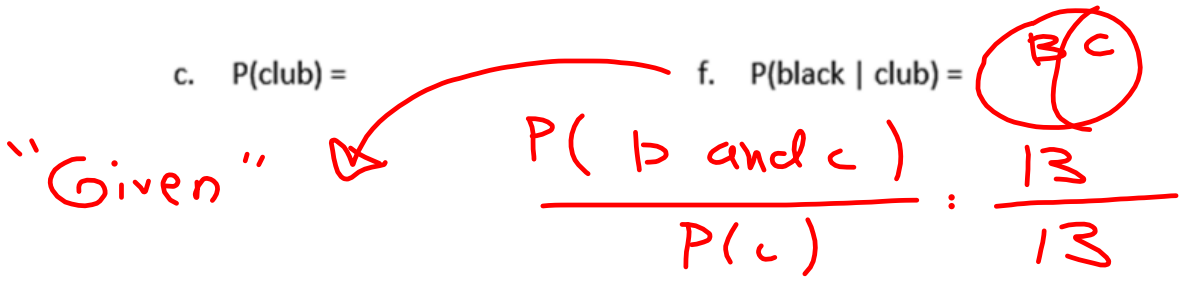
4. In a group of 101 students 30 are freshmen and 41 are sophomores. Find the probability that a student picked from this group at random is either a freshman or sophomore.

5. In a group of 101 students 40 are juniors, 50 are female, and 22 are female juniors. Find the probability that a student picked from this group at random is either a junior or female.

1. One card is drawn from a deck of 52 cards. Find the following...
   a. P(Queen) = d. P(Queen | black) =
   b. P(black) = e. P(Queen | club) =
   c. P(club) = f. P(black | club) =
   g. Are "drawing a Queen" and "drawing a black card" independent? Justify your choice.
   h. Are "drawing a Queen" and "drawing a club" independent? Justify your choice.
   i. Are "drawing a black card" and "drawing a club" independent? Justify your choice.

2. A fair eight-sided number cube is rolled once. Let A,B,C, and D be the following events:
A={ 2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.
   a. Find:
      i. P(A)=_____ ii. P(B)=_____ iii. P(C)=_____ iv. P(D)=_____
   b. Find:
      i. P(A|B)=_____ iv. P(B|A)=_____
      ii. P(B|C)=_____ v. P(C|A)=_____
      iii. P(C|D)=_____ vi. P(D|C)=_____

1. One card is drawn from a deck of 52 cards. Find the following...
a. P(Queen) = d. P(Queen | black) =
b. P(black) = e. P(Queen | club) =
c. P(club) = f. P(black | club) =



5. In a group of 101 students 40 are juniors, 50 are female, and 22 are female juniors. Find the probability that a student picked from this group at random is either a junior or female.

$\frac{40}{101} + \frac{50}{101} - \frac{22}{101}$

$P(J) + P(F) - P(J \text{ and } F)$

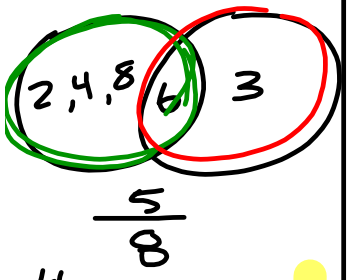
4. In a group of 101 students 30 are freshmen and 41 are sophomores. Find the probability that a student picked from this group at random is either a freshman or sophomore.

$n = 101$

$\frac{30}{101} + \frac{41}{101} = \frac{71}{101}$

3. A fair eight-sided die is rolled once. Let A,B,C, and D be the following events:
A={ 2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.

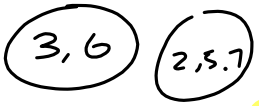
a. P(A or B) =



$\frac{5}{8}$

$\frac{4}{8} + \frac{2}{8} - \frac{1}{8} : \frac{5}{8}$

b. P(B or C) =



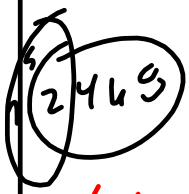
$\frac{2}{8} + \frac{3}{8} : \frac{5}{8}$

c. P(C or D) =

$\frac{5}{8}$

$\frac{3}{8} + \frac{4}{8} - \frac{2}{8}$

d. P(A or C) =



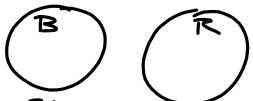
$\frac{4}{8} : \frac{3}{4}$

You draw one card from a deck of 52 cards. Let A = drawing a black card, B = drawing a red card, C = drawing a spade, and D = drawing an Ace. Find…

a. P(A or B) = b. P(B or C) = c. P(C or D) =

d. P(A or C) = e. P(A or D) = f. P(B or D) =

a) P(black or red)

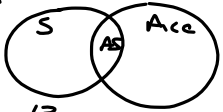


$\frac{26}{52} + \frac{26}{52} = \frac{52}{52} = 1$

b) P(red or spade)

$\frac{26}{52} + \frac{13}{52} : \frac{39}{52}$

c) P(spade or ace)



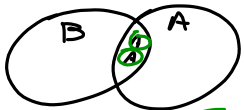
$\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = 16/52$

d) P(black or spade)

$\frac{26}{52} + \frac{13}{52} - \frac{13}{52}$

$\frac{26}{52} : \frac{1}{2}$

e) P(black or Ace)

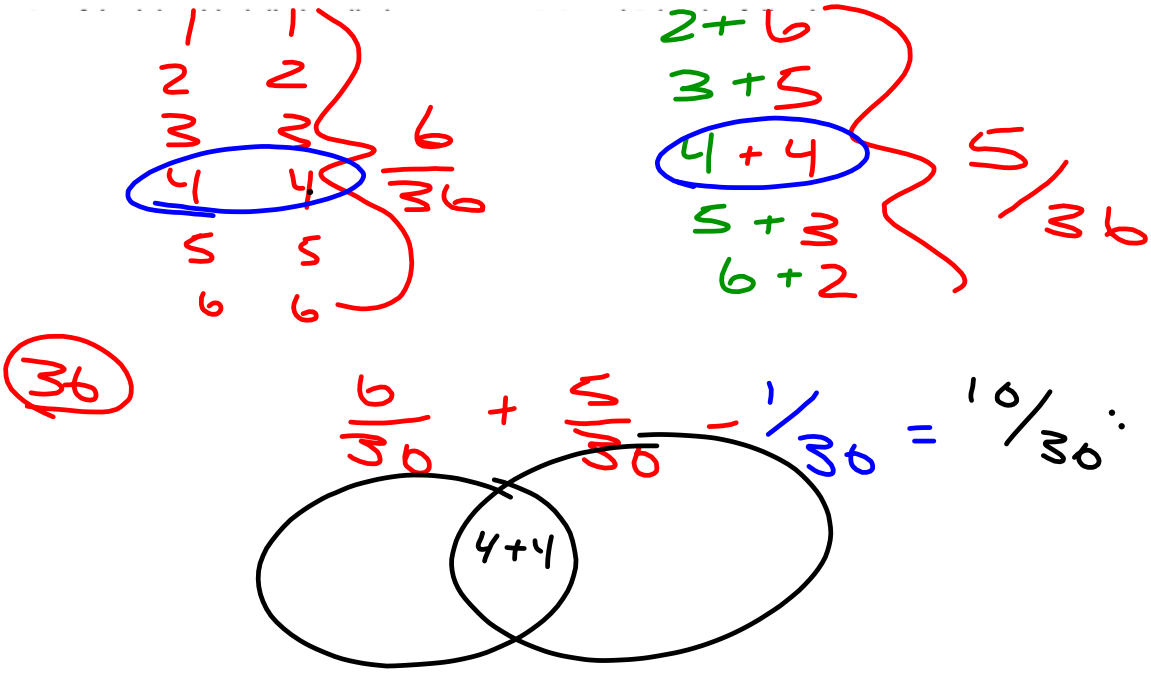


$\frac{26}{52} + \frac{4}{52} - \frac{2}{52}$

d. P(A or C) = e. P(A or D) = f. P(B or D) =

2. Suppose you roll two distinguishable dice. Calculate the probability of getting doubles or a su

P(doubles or sum of 8)



. You draw one card from a deck of 52 cards. Let A = drawing a Jack, B = drawing a red card, C = drawing a heart, and D = drawing a 10. Find…

a. P(A and B) = b. P(B and C) = c. P(C and D) =
d. P(A and C) = e. P(A and D) = f. P(B and D) =

2. Suppose you roll two distinguishable dice. Calculate the following probabilities.
a. P(doubles) = b. P(sum of 8) =
c. P(doubles and a sum of 8) = d. P(rolling a 2 and then a 5) =
e. P(at least one 6) =

3. Suppose you are using three dice.
a. P(triples) =
b. P(rolling at least one 2) =
c. On a single die, P(rolling a two, five times in a row) =

4. A fair eight-sided die is rolled once. Let A,B,C, and D be the following events:
A={ 2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.

a. P(A and B) = b. P(B and C) = c. P(C and D) = d. P(A and C) =

5. P(at least one girl out of a family with five children) =

6. When driving to class, a student must pass two traffic lights that operate independently. For each light, there is a 0.4 probability that it is green. If he must reach both lights when they are green in order to make class on time, what is the probability that he will be on time?

7. In a Riverhead, New York, case, nine different crime victims listened to voice recordings of five different men. All nine victims identified the same voice as that of the criminal. If the voice identifications were made independently and by random guesses, find the probability that all nine victims would select this particular person. Does this constitute reasonable doubt?

Suppose 58% of a company's employees are female. Of the females, 3% earn a salary over $100,000. Six percent of males earn a salary over $100,000.

a.) Create a tree diagram representing this situation, listing all probabilities.

b.) If one employee is selected at random, what is the probability it is a female who earns over $100,000?

c.) What percent of all employees earn over $100,000?

d.) What is the probability that a randomly selected employee who earns over $100,000 is male?

7. In a Riverhead, New York, case, nine different crime victims listened to voice recordings of five different men. All nine victims identified the same voice as that of the criminal. If the voice identifications were made independently and by random guesses, find the probability that all nine victims would select this particular person. Does this constitute reasonable doubt?

$n = 9$ victims

men = 5

$\frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5}$

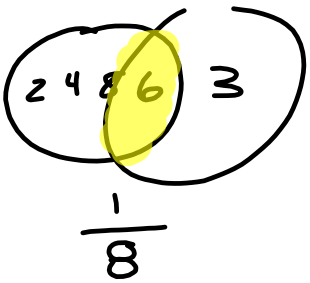
$\bigcirc \cdot \bigcirc \cdot \bigcirc \bigcirc \cdot \bigcirc \cdot \bigcirc \cdot \bigcirc \cdot \bigcirc$

* .000000512

99.0000

4. A fair eight-sided die is rolled once. Let A,B,C, and D be the following events:
A={2,4,6,8}, B={3,6}, C={2,5,7}, and D={1,3,5,7}. Assume that each face has the same probability.

a. P(A and B) =



$\frac{1}{8}$

b. P(B and C) =

= ∅

and

$\frac{2}{8}$ $\frac{3}{8}$

c. P(C and D) =

$\frac{2}{8}$

$\frac{1}{4}$

and

d. P(A and C) =

$\frac{1}{8}$

P(Roll 5 and Heads)

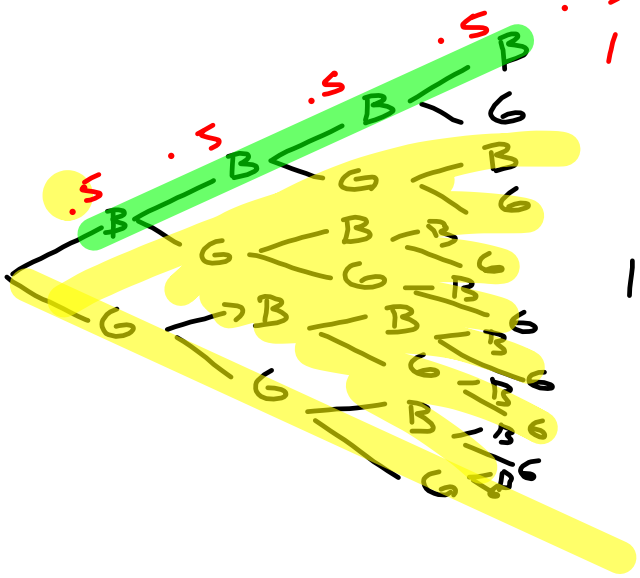
$\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$

H T

1 2 3 4 5 6 1 2 3 4 5 6

H1 H2 H3 ... T1 T2 T2 ...

5. P(at least one girl out of a family with five children) =



$1 - (.5)^5$

1 − P(All Boys)

Suppose 58% of a company's employees are female. Of the females, 3% earn a salary over $100,000. Six percent of males earn a salary over $100,000.

a.) Create a tree diagram representing this situation, listing all probabilities.

b.) If one employee is selected at random, what is the probability it is a female who earns over $100,000?

Suppose 58% of a company's employees are female. Of the females, 3% earn a salary over $100,000. Six percent of males earn a salary over $100,000.

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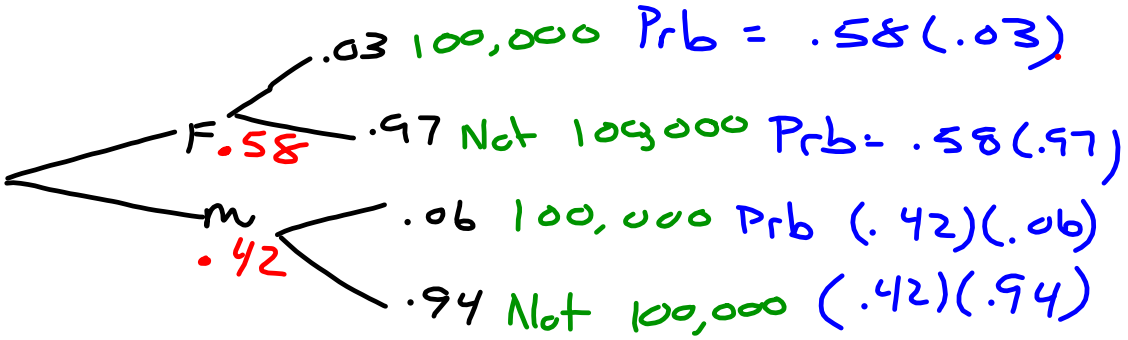

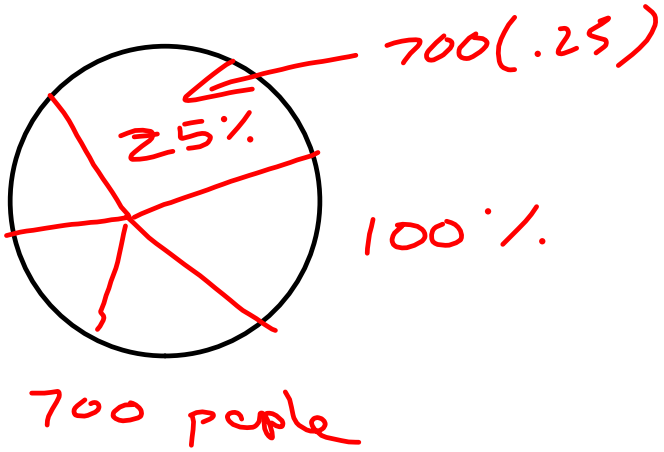

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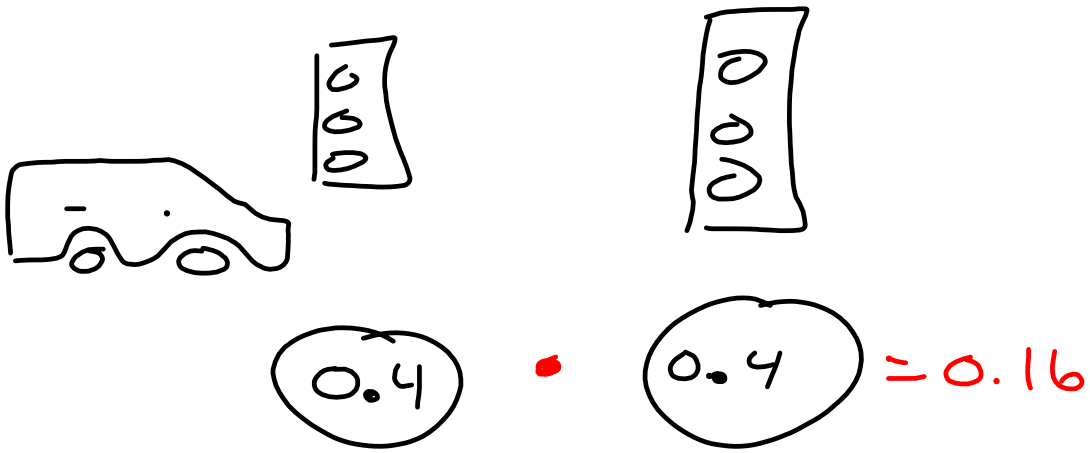


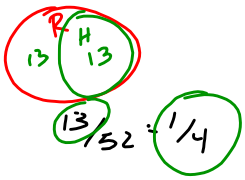
. You draw one card from a deck of 52 cards. Let A = drawing a Jack, B = drawing a red card, C = drawing a heart, and D = drawing a 10. Find…

a. P(A and B) = b. P(B and C) = c. P(C and D) =
d. P(A and C) = e. P(A and D) = f. P(B and D) =

a) P(Jack and red)

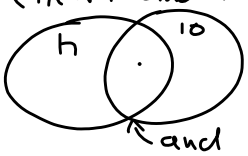
$2/52 = 1/26$

b) P(red and heart)



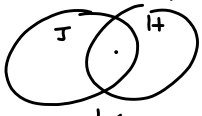
$13/52 = 1/4$

c) P(heart and 10)



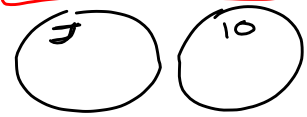
$1/52$

d) P(Jack and heart)



$1/52$

e) P(Jack and 10)



$\frac{4}{52} \cdot \frac{4}{52} = \frac{16}{52^2}$

f) P(R and 10)

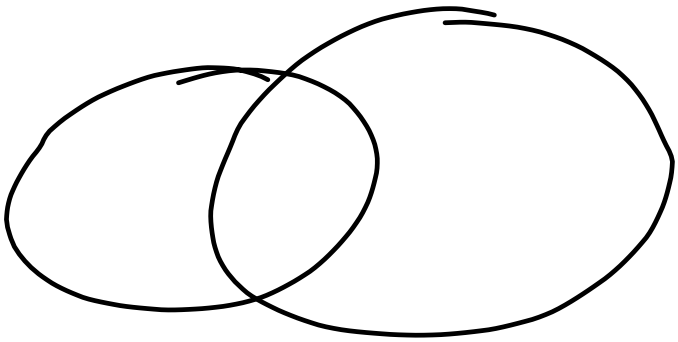
$2/52 = 1/26$

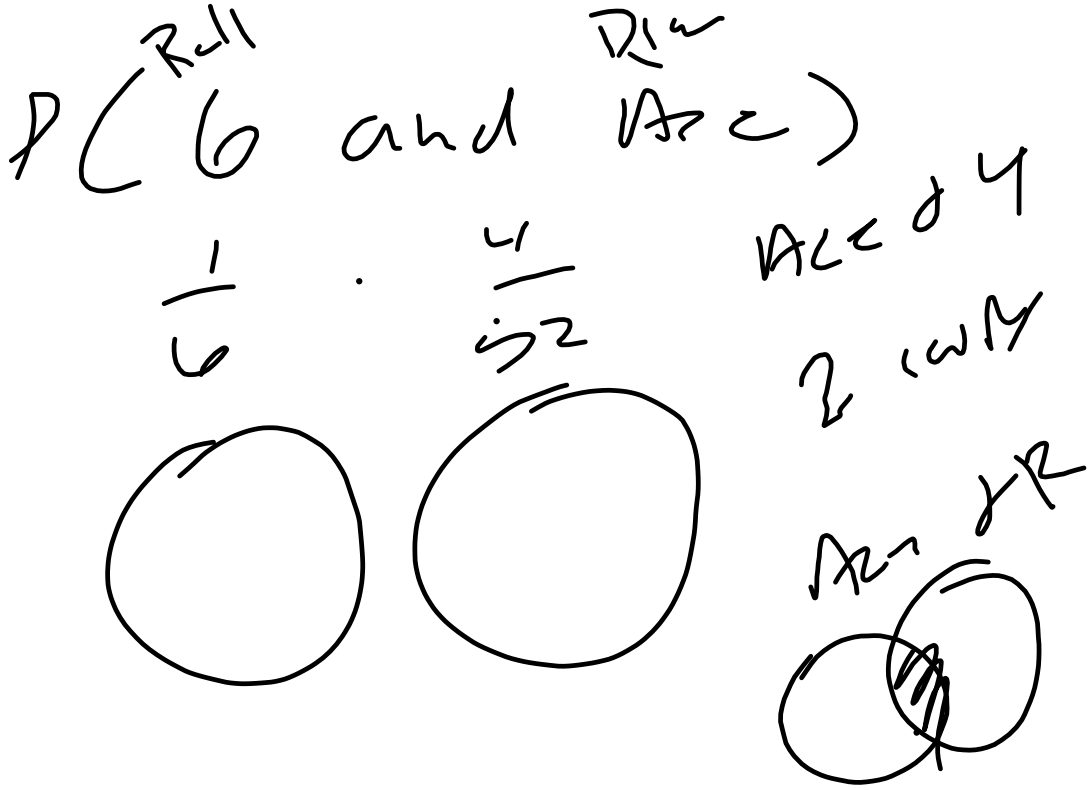
. You draw one card from a deck of 52 cards. Let A = drawing a Jack, B = drawing a red card, C = drawing a heart, and D = drawing a 10. Find… $\frac{4}{52} \cdot \frac{25}{51}$

a. P(A and B) = b. P(B and C) = c. P(C and D) =
d. P(A and C) = e. P(A and D) = f. P(B and D) =

$\frac{4}{52} \cdot \frac{25}{51} = \frac{100}{52(51)}$

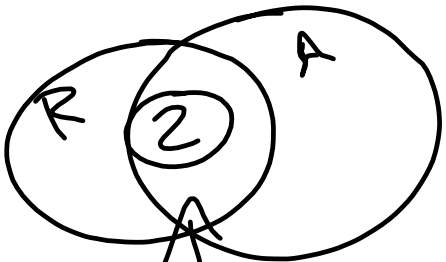
Jack Red





Probability:

and ⇒ P(Red and Ace)

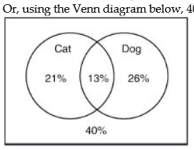


$\frac{26}{52} \cdot \frac{4}{51} =$ ——

= 2/52 : 1/13

1) a. $P(\text{neither cat nor dog}) = 1 - P(\text{cat} \cup \text{dog}) = 1 - 0.6 = 0.4$

Or, using the Venn diagram below, 40%



b. $P(\text{cat} \cup \text{dog}) = P(\text{cat}) + P(\text{dog}) - P(\text{cat} \cap \text{dog})$

$0.60 = 0.34 + 0.39 - P(\text{cat} \cap \text{dog})$

$P(\text{cat} \cap \text{dog}) = 0.13$

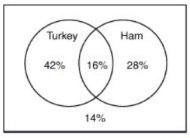
c. $P(\text{cat} \mid \text{dog}) = \dfrac{P(\text{cat} \cap \text{dog})}{P(\text{dog})} = \dfrac{0.13}{0.39} = \dfrac{1}{3}$

2) a. $P(\text{neither ham nor turkey}) = 1 - P(\text{ham} \cup \text{turkey})$

$= 1 - [P(\text{ham}) + P(\text{turkey}) - P(\text{ham} \cap \text{turkey})]$

$= 1 - [0.44 + 0.58 - 0.16] = 1 - 0.86 = 0.14$

Or, using the Venn diagram below, 14%



b. $P(\text{ham only}) = P(\text{ham}) - P(\text{ham} \cap \text{turkey}) = 0.44 - 0.16 = 0.28$

Or, using the Venn diagram above, 28%

c. $P(\text{ham} \mid \text{turkey}) = \dfrac{P(\text{ham} \cap \text{turkey})}{P(\text{turkey})} = \dfrac{0.16}{0.58} = 0.2759$

d. No, the events are not disjoint, since some families (16%) have both ham and turkey at their holiday meals.