Name _____ Class _____ Date _____

Independent and Dependent Events

There are 3 chips in a bag. You draw 2 chips from the bag.

Experiment 1: Draw one chip, put it back. Draw a chip again.

Draw 2 *is not* affected by draw 1.

Two events are **independent** when the outcome of the second *is not* affected by the outcome of the first.

If A and B are independent events,
$P(A \text{ and } B) = P(A) \times P(B)$.

Suppose 2 chips in the bag are red and 1 chip is blue. You draw 1 chip and then put it back before drawing a second chip. Find the probability that the chip color in both draws is red.

$$P(\text{red and red}) = P(\text{red}) \times P(\text{red})$$
$$= \frac{2}{3} \times \frac{2}{3}$$
$$= \frac{4}{9}$$

Experiment 2: Draw one chip. Then, draw another without replacing the first.

Draw 2 *is* affected by draw 1.

Two events are **dependent** when the outcome of the second *is* affected by the outcome of the first.

If A and B are dependent events,
$P(A, \text{then } B) = P(A) \times P(B \text{ after } A)$.

Suppose 2 chips in the bag are red and 1 chip is blue. You draw 1 chip and then another without putting the first chip back. Find the probability that both chips are red.

$$P(\text{red, then red}) = P(\text{red}) \times P(\text{red after red})$$
$$= \frac{2}{3} \times \frac{1}{2} = \frac{2}{6} = \frac{1}{3}$$

A bag has 3 green markers, 3 blue markers, and 2 yellow markers. You randomly choose one marker and then replace it. Then you choose a second marker. Find each probability.

1. $P(\text{green and yellow})$ _____
2. $P(\text{green and blue})$ _____
3. $P(\text{both yellow})$ _____

A drawer has 3 green socks, 4 blue socks, and 2 black socks. You pick one sock at a time and don't replace it. Find each probability.

4. $P(\text{blue, then black})$ _____
5. $P(\text{green, then blue})$ _____
6. $P(\text{black, then green})$ _____

Are the events dependent or independent?

7. flipping a coin twice _____
8. choosing a hammer and a paint color in a hardware store _____
9. selecting a can of corn and a container of juice in a supermarket _____
10. picking a board from a pile, nailing it on a fence, then picking another board from the pile _____

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Practice 1: Independent and Dependent Events

A shelf holds 3 novels, 2 biographies, and 1 history book. Two students in turn choose a book at random. What is the probability that the students choose each of the following?

1. both novels _____
2. both biographies _____
3. a history, then a novel _____
4. both history books _____

Meg flipped a penny the given number of times. What is the probability the results were as follows?

5. 2; two heads _____
6. 3; three tails _____
7. 2; a tail, then a head _____
8. 5; five tails _____

Two puppies are chosen at random from a box at the mall. What is the probability of these outcomes?

Free Puppies for Adoption!
5 black retrievers
3 brown hounds
4 black setters

9. both black _____
10. both brown _____
11. a setter, then a hound _____
12. a retriever, then a setter _____
13. both setters _____

Are the events independent or dependent? Explain.

14. A guest at a party takes a sandwich from a tray. A second guest then takes a sandwich.

_____

_____

15. Sam flips a coin and gets heads. He flips again and gets tails.

_____

You can select only two cards from the right. Find the probability of selecting a T and an N for each condition.

M	A	T	H
I	S		
F	U	N	

16. You replace the first card before drawing the second.

_____

17. You do not replace the first card before drawing the second.

_____

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Practice 2: Independent and Dependent Events

A bag contains 3 black and 2 white marbles. A marble is drawn at random and then replaced. Find each probability.

1. P(2 blacks) _____

2. P(black, white) _____

3. P(white, black) _____

4. P(2 whites) _____

Each letter from the word MISSISSIPPI is written on a separate slip of paper. The 11 slips of paper are placed in a sack and two slips are drawn at random. The first pick is not replaced.

5. Find the probability that the first letter is M and the second letter is I. _____

6. Find the probability that the first letter is I and the second letter is P. _____

7. Find the probability that the first letter is S and the second letter is also S. _____

Solve.

8. On a TV game show, you can win a car by drawing two aces from a standard deck of cards. The first card is not replaced. What is your probability of winning?

_____

9. You roll a number cube eight times, and each time you roll a 4. What is the probability that on the ninth roll, you will roll a 6?

_____

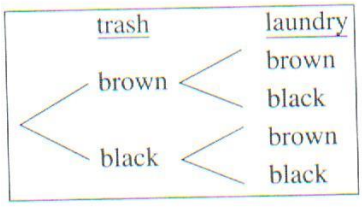
10. Two letters of the alphabet are chosen randomly without replacement. Find each probability.

    a. P(both vowels) _____

    b. P(both consonants) _____

11. There are 4 brown shoes and 10 black shoes on the floor. Your puppy carries away two shoes and puts one shoe in the trash can and one shoe in the laundry basket.

    a. Complete the tree diagram to show the probability of each outcome.



    b. What is the probability that there will be a brown shoe in both the trash and the laundry basket? _____

12. Use the data at the right to find P(right-handed male) and P(left-handed female) if one person is chosen at random.

_____

	Male	Female
Right-handed	86	83
Left-handed	14	17
Total	100	100

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Reteaching 1: Independent and Dependent Events

You can select only two cards from the right. Find the probability both are T if you replace the first card before drawing the second and if you do not.

S
T
A
T
I
S
T
I
C
S

If you replace the first card before drawing the second, then the two events of drawing a card are independent. The first draw *does not* affect the second draw.

Use $P(A \text{ and } B) = P(A) \cdot P(B)$.

$P(\text{T}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{3}{10}$

$P(2\text{T}) = P(\text{T and T}) = P(\text{T}) \cdot P(\text{T}) = \frac{3}{10} \cdot \frac{3}{10} = \frac{9}{100}$

If you do not replace the first card before drawing the second, the two events of drawing a card are dependent. The first draw *does* affect the second draw.

Use $P(A \text{ and } B) = P(A) \cdot P(B \text{ after } A)$.

For the first draw, $P(\text{T}) = \frac{3}{10}$.

If the card is not replaced, there are only 9 cards left on the second draw.

If a T is drawn the first time and not replaced, there are only 2 T's left on the second draw.

$P(\text{T after T}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{2}{9}$

$P(2\text{T}) = P(\text{T}) \cdot P(\text{T after T}) = \frac{\overset{1}{\cancel{3}}}{\underset{5}{\cancel{10}}} \cdot \frac{\overset{1}{\cancel{2}}}{\underset{3}{\cancel{9}}} = \frac{1}{15}$

So, with replacement, $P(2\text{T}) = \frac{9}{100}$ and, without replacement, $P(2\text{T}) = \frac{1}{15}$.

You randomly select a card from those above. You replace the card and select a second card. Find the probability of selecting each set of letters.

1. two I's _____
2. S and then I _____
3. C and then T _____
4. T and then S _____

You randomly select a card from those above and, without replacing the card, you select a second card. Find the probability of selecting each set of letters.

5. two I's _____
6. S and then I _____
7. C and then T _____
8. T and then S _____

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Practice 1: Combinations

Compute each number of combinations.

1. ${}_9C_1$ _____
2. ${}_8C_4$ _____
3. ${}_{11}C_4$ _____
4. ${}_{11}C_7$ _____
5. ${}_4C_4$ _____
6. ${}_9C_3$ _____
7. ${}_{12}C_6$ _____
8. ${}_8C_2$ _____
9. 3 videos from 10 _____
10. 2 letters from LOVE _____
11. 4 books from 8 _____
12. 5 people from 7 _____

Solve.

13. Ten students from a class have volunteered to be on a committee to organize a dance. In how many ways can six be chosen for the committee?

_____

14. Twenty-three people try out for extra parts in a play. In how many ways can eight people be chosen to be extras?

_____

15. A team of nine players is to be chosen from 15 available players. In how many ways can this be done?

_____

16. In a talent show, five semi-finalists are chosen from 46 entries. In how many ways can the semi-finalists be chosen?

_____

17. At a party there are 12 people present. The host requests that each person present shake hands exactly once with every other person. How many handshakes are necessary?

_____

18. In math class there are 24 students. The teacher picks 4 students to serve on the bulletin board committee. How many different committees of 4 are possible?

_____

19. Five friends, Billi, Joe, Eduardo, Mari, and Xavier, want one photograph taken of each possible pair of friends. Use B, J, E, M, and X, and list all of the pairs that need to be photographed.

_____

_____

20. Choose A, B, C, or D. Which situation described has ${}_8C_3$ possible outcomes?

A. Select three letters from 8 to form a 3-letter password.

B. Find the possible ways that first, second, and third prize winners can be selected from 8 contestants.

C. Arrange 8 people in 3 rows.

D. Pick a team of 3 people from 8 players.