Name: ______________________ Date: Key

Independent and Dependent Events

Independent Events

- Event A occurring does NOT affect the probability of Event B occurring.
- $P(A \text{ and } B) = P(A \cap B) = P(A) \bullet P(B)$ "And" means multiply

1. A coin is tossed and a 6-sided die is rolled. Find the probability of landing on the head side of the coin and rolling a 3 on the die.

   P(head and 3)

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

2. A card is chosen at random from a deck of 52 cards. It is then replaced and a second card is chosen. What is the probability of choosing a jack and an eight?

   P(Jack and 8)

   $\frac{4}{52} \cdot \frac{4}{52} = \boxed{\frac{1}{169}}$

3. A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. After replacing it, a second marble is chosen. What is the probability of choosing a green and a yellow marble? Total # of marbles = 16

   P(green and yellow)

   $\frac{5}{16} \cdot \frac{6}{16} = \boxed{\frac{15}{128}}$

4. A school survey found that 9 out of 10 students like pizza. If three students are chosen at random with replacement, what is the probability that all three students like pizza? P(like and like and like)

   $\frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10} = \boxed{\frac{729}{1000}}$

Dependent Events

- Event A occurring AFFECTS the probability of Event B occurring.
- Usually you will see the words "WITHOUT REPLACING."
- $P(A \text{ and } B) = P(A \cap B) = P(A) \bullet P(B|A)$ "And" means multiply

5. A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. A second marble is chosen without replacing the first one. What is the probability of choosing a green and a yellow marble?

$P(\text{Green}) \cdot P(\text{yellow} \mid \text{Green})$

$\frac{5}{16} \cdot \frac{6}{15} = \boxed{\frac{1}{8}}$

6. An aquarium contains 6 male goldfish and 4 female goldfish. You randomly select a fish from the tank, do not replace it, and then randomly select a second fish. What is the probability that both fish are male?

$P(\text{male}) \cdot P(\text{male} \mid \text{male})$

$\frac{6}{10} \cdot \frac{5}{9} = \boxed{\frac{1}{3}}$

7. A random sample of parts coming off a machine is done by an inspector. He found that 5 out of 100 parts are bad on average. If he were to do a new sample, what is the probability that he picks a bad part and then, picks another bad part if he doesn't replace the first? $P(\text{Bad}) \cdot P(\text{Bad} \mid \text{Bad})$

$\frac{5}{100} \cdot \frac{4}{99} = \boxed{\frac{1}{495}}$

How to Determine If 2 Events Are Independent:

- Substitute in what you know in to **P(A ∩ B) = P(A) ● P(B)** and check to see if left side equals right side.
  - If it's equal, then it's independent.
  - If it's not equal, then it's not independent (or dependent).

8. Let event M = taking a math class. Let event S = taking a science class. Then, M and S = taking a math class and a science class. Suppose **P(M) = 0.6, P(S) = 0.5,** and **P(M and S) = 0.3.** Are M and S independent?

$P(M \cap S) \stackrel{?}{=} P(M) \cdot P(S)$

$.3 = .6 \cdot .5$

$\boxed{.3 = .3 \checkmark}$ → Taking a math class and taking a science class are independent of each other.

9. In a class, 60% of the students are female. 50% of all students in the class have long hair. 45% of the students are female and have long hair. Of the female students, 75% have long hair. Let F be the event that the student is female. Let L be the event that the student has long hair. One student is picked randomly. Are the events of being female and having long hair independent?

$P(F \cap L) = P(F) \cdot P(L)$

$.45 \stackrel{?}{=} .6 \cdot .5$

$\boxed{.45 \neq .3}$ → Being a female and having long hair are not independent.