Name: **KEY**   Hour: _____   Date: _____

NOTES: Section 10.5 – Find Probabilities of Independent and Dependent Events

Goals: #1 - I can find the probability of independent and dependent events.

Homework: Lesson 10.5 Worksheet   😎   😐   😢

Warm Up:

1. A card is randomly selected from a standard deck of 52 cards. What is the probability that it is a queen or an ace? **Disjoint**

$$\frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \boxed{\frac{2}{13}}$$

2. Of 200 students at school, 58 play football, 40 play basketball, and 93 play both. What is the probability that a randomly selected student plays either football or basketball but NOT both?

$$P(F \text{ or } B) = \frac{58}{200} + \frac{40}{200} - \frac{93}{200}$$
$$P(F) + P(B) - P(F \text{ & } B)$$
$$P(F \text{ or } B) = \frac{5}{200} = \boxed{\frac{1}{40}}$$

Notes:

Two events are **independent** if the occurrence of one has **no** effect on the occurrence of the other.

     Example: flip a coin & roll a dice

- If A and B are independent events, then the probability that both A and B occur is:

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

Example #1:

Events A and B are independent. Find the probability.

1. $P(A) = 0.3$
   $P(B) = 0.4$
   $P(A \text{ and } B) = ?$

$$P(A \text{ and } B) = 0.3 \cdot 0.4$$
$$P(A \text{ and } B) = \boxed{0.12}$$

2. $P(A) = \frac{3}{4}$
   $P(B) = ?$
   $P(A \text{ and } B) = \frac{3}{5}$

$$\frac{3}{5} = \frac{3}{4} \cdot P(B)$$
$$P(B) = \boxed{\frac{4}{5}}$$

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Example #2:

For a fundraiser, a class sells 150 raffle tickets for a mall gift certificate and 200 raffle tickets for a booklet of movie passes. You buy 5 raffle tickets for each prize. What is the probability that you win <u>both</u> prizes?

$$P(M \cdot B) = \frac{5}{150} \cdot \frac{5}{200} = \frac{25}{30000}$$
$$P(M) \cdot P(B) = \boxed{\frac{1}{1200}}$$

You practice:

During a high school track meet, each race consists of 9 competitors who are randomly assigned lanes from 1 to 9. What is the probability that a runner will draw lanes 1, 2, or 3 in the three races in which he competes?

$$\frac{3}{9} \cdot \frac{3}{9} \cdot \frac{3}{9} = \frac{9}{729}$$
$$= \boxed{\frac{1}{243}}$$

Example #3:

A manufacturer has found that 2 out of every 500 coffee pots produced are defective. What is the probability that at least one coffee pot is defective in the first 300 coffee pots made?

$$P\left(\begin{smallmatrix}at\ least\\1\ defective\end{smallmatrix}\right) = 1 - P(none\ defective)$$
$$= 1 - \left(\frac{498}{500}\right)^{300}$$
$$\approx \boxed{0.6995}$$

Notes:

Two events are _____ **dependent** _____ if the occurrence of one ~~one~~ affects

the occurrence of the other.

   Example: draw a card, keep it, draw another card

- If A and B are dependent events, then the probability that both A and B occur is:

$$P(A\ and\ B) = P(A) \cdot P(B|A)$$

The probability that B will occur, given that A has occurred is called the

___**conditional probability**___: $P(B|A)$

Example #4:

Events A and B are dependent. Find the probability.

1. $P(A) = 0.6$

   $P(B|A) = ?$

   $P(A \text{ and } B) = 0.45$

   $0.45 = 0.6 \cdot P(B|A)$

   $\boxed{P(B|A) = 0.75}$

2. $P(A) = \frac{7}{10}$

   $P(B|A) = \frac{1}{2}$

   $P(A \text{ and } B) = ?$

   $P(A \text{ and } B) = \frac{7}{10} \cdot \frac{1}{2}$

   $\boxed{P(A \text{ and } B) = \frac{7}{20}}$

Example #5:

You randomly select two marbles from a bag containing 15 yellow, 10 red, and 12 blue marbles. What is the probability that the first marble is yellow and the second marble is not yellow if: IND

1. You replace the first marble before selecting the second.

   $\frac{15}{37} \cdot \frac{22}{37} = \boxed{\frac{330}{1369}} \approx 0.241$

   DEP
2. You do *not* replace the first marble.

   $\frac{15}{37} \cdot \frac{22}{36} = \frac{330}{1332}$

   $= \boxed{\frac{55}{222}} \approx 0.247$

You practice:

You randomly select two cards from a standard deck of 52 cards. What is the probability that the first card is a spade and the second card is a club if: IND

1. You replace the first card before selecting the second.

   $\frac{13}{52} \cdot \frac{13}{52} = \frac{169}{2704}$

   $= \boxed{\frac{1}{16}} \approx 0.0625$

   DEP
2. You do *not* replace the first card.

   $\frac{13}{52} \cdot \frac{13}{51} = \frac{169}{2652}$

   $= \boxed{\frac{13}{204}} \approx 0.0637$

Example #6:

Your teacher passes around a box with 10 red pencils, 8 pink pencils, and 13 green pencils. If you and the two people in your group are the first to randomly select a pencil, what is that probability that all three of you select pink pencils?

$$\frac{8}{31} \cdot \frac{7}{30} \cdot \frac{6}{29} = \frac{336}{26970}$$

$$= \boxed{\frac{56}{4495}} \approx 0.0125$$

Fun example to end the unit:

What is the probability that at least 2 people in our class have the same birthday?

$$P\left(\begin{smallmatrix}\text{at least 2 have}\\\text{same Bday}\end{smallmatrix}\right) = 1 - P\left(\begin{smallmatrix}\text{No one has}\\\text{same bday}\end{smallmatrix}\right)$$

$$= 1 - \frac{\frac{365}{1} \cdot \frac{364}{2} \cdot \frac{363}{3} \cdot \frac{362}{4} \cdots \cdot \frac{336}{30}}{(365)^{30}}$$

$$= 1 - \frac{_{365}P_{30}}{(365)^{30}}$$

$$= 1 - 0.29368\ldots$$

$$\approx 0.7063$$

$$\approx \boxed{70.6\%}$$