## CC Algebra 2H 7-3 Notes

### *Independent and Dependent Events*

April 24

Two events, *A* and *B*, are **independent** if the occurrence of one event has no effect on the probability of the occurrence of the other.

> **Multiplication Rule for the Probability of Independent Events**
>
> If A and B are independent events, then $\boxed{P(\text{ A and B}) = P(A) \cdot P(B).}$

**Example 1**: There are 3 red pens, 4 blue pens, and 5 black pens in a box. Suppose you choose a pen at random from the box, replace it, and then choose a second pen. Find the probability of choosing a blue pen and then a red pen, in that order.

$$P(B \& R) = \underbrace{\frac{4}{12}}_{P(B)} \cdot \underbrace{\frac{3}{12}}_{P(R)} = \frac{1}{3} \cdot \frac{1}{4} = \frac{1}{12}$$

**Example 2:** What is the probability of rolling a 3 and then an even number on a cube numbered 1-6?

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$$P(3 \text{ and even}) = \underbrace{1/6}_{P(3)} \cdot \underbrace{\frac{3}{6}}_{P(\text{even})} = \frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$$

Two events, *A* and *B*, are **dependent** if the occurrence of one event affects the probability of the occurrence of the other. The probability of *B* given that *A* has occurred is called the **conditional probability** of *B*, given *A*. It is denoted P(B | A).

> **Multiplication Rule for the Probability of Dependent Events**
>
> If A and B are dependent events, then $\boxed{P(\text{ A and B}) = P(A) \cdot P(B \mid A).}$

**Example 3:** A deck of cards has 12 face cards and 40 number cards. A card is drawn from the deck and not replaced. A second card is drawn. Find the probability of drawing a number card and then a face card from the deck.

$$P(\#\text{card and face card}) = \underbrace{\frac{40}{52}}_{P(\#\text{card})} \times \underbrace{\frac{12}{51}}_{P(\text{face card})}$$

$$\frac{10}{13} \cdot \frac{4}{17} = \frac{40}{221}$$

**Example 4:** There are 3 red pens, 4 blue pens, and 5 black pens in a box. Suppose you choose 3 pens, one at a time, without replacement. Find the probability of choosing 1 blue, 1 black, and 1 blue pen, in that order.

$$P(\text{blue} \& \text{black} + \text{blue}) = \underbrace{\frac{4}{12}}_{P(\text{blue})} \times \underbrace{\frac{5}{11}}_{P(\text{blk} \mid \text{blue})} \times \underbrace{\frac{3}{10}}_{P(\text{blue} \mid \text{blk})}$$

$$\frac{1}{\cancel{3}} \cdot \frac{\cancel{5}}{11} \cdot \frac{\cancel{3}}{\cancel{10}_{2}} = \frac{1}{22}$$