## 3.5: Intro to Conditional Probability

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

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

**P(B|A)** represents the probability of event **B** occurring after it is assumed that event **A** has already occurred (read **B|A** as "**B** given **A**.")

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

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

## Favorite Winter Sport

| Grade | Snowboarding | Skiing | Ice Skating | TOTAL |
|-------|-------------|--------|-------------|-------|
| 6th | 68 | 41 | 46 | 155 |
| 7th | 84 | 56 | 70 | 210 |
| 8th | 59 | 74 | 47 | 180 |
| TOTAL | 211 | 171 | 163 | 545 |

P(7th grader, given ice skating)

B  A

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{\frac{70}{545}}{\frac{163}{545}} = \frac{70}{545} \cdot \frac{545}{163} = \frac{70}{163}$$

$$= .429$$

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

## Favorite Winter Sport

| Grade | Snowboarding | Skiing | Ice Skating | TOTAL |
|-------|-------------|--------|-------------|-------|
| 6th | 68 | 41 | 46 | 155 |
| 7th | 84 | 56 | 70 | 210 |
| 8th | 59 | 74 | 47 | 180 |
| TOTAL | 211 | 171 | 163 | 545 |

P(ice skating, given a 7th grader)

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{\frac{70}{545}}{\frac{210}{545}} = .333$$

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

## Favorite Winter Sport

| Grade | Snowboarding | Skiing | Ice Skating | TOTAL |
|-------|--------------|--------|-------------|-------|
| 6th | 68 | 41 | 46 | 155 |
| 7th | 84 | 56 | 70 | 210 |
| 8th | 59 | 74 | 47 | 180 |
| TOTAL | 211 | 171 | 163 | 545 |

P(snowboarding, given an 8th grader)

$$\frac{\frac{59}{545}}{\frac{180}{545}} = \frac{59}{180} = .328$$

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

## Favorite Winter Sport

| Grade | Snowboarding | Skiing | Ice Skating | TOTAL |
|-------|-------------|--------|-------------|-------|
| 6th | 68 | 41 | 46 | 155 |
| 7th | 84 | 56 | 70 | 210 |
| 8th | 59 | 74 | 47 | 180 |
| TOTAL | 211 | 171 | 163 | 545 |

P(skiing, given a 6th grader)
B            A

$$P(S \mid 6^{th}) = \frac{41}{155} = .265$$

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

### Favorite Winter Sport

| Grade | Snowboarding | Skiing | Ice Skating | TOTAL |
|---|---|---|---|---|
| 6th | 68 | 41 | 46 | 155 |
| 7th | 84 | 56 | 70 | 210 |
| 8th | 59 | 74 | 47 | 180 |
| TOTAL | 211 | 171 | 163 | 545 |

P(6th grader, given skiing)

$$P\left(6^{th} \mid Skiing\right) = \frac{41}{171} = .240$$

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

## Favorite Winter Sport

| Grade | Snowboarding | Skiing | Ice Skating | TOTAL |
|-------|--------------|--------|-------------|-------|
| 6th | 68 | 41 | 46 | 155 |
| 7th | 84 | 56 | 70 | 210 |
| 8th | 59 | 74 | 47 | 180 |
| TOTAL | 211 | 171 | 163 | 545 |

P(6th grader OR skiing)