# AP Statistics

## Chapter 5: Probability

## Day 4

**HW: p. 329-330, #63, 65, 67, 69, 71**

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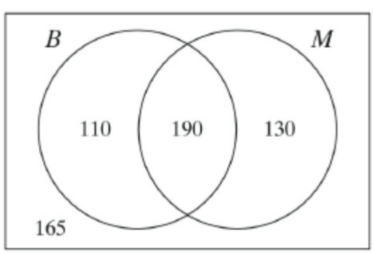
5.53 (a)




(b) $P(B \cup M) = \frac{110+190+130}{595} = \frac{430}{595}$. The probability of being either a male or someone who eats breakfast, or both is $\frac{430}{595}$. (c) $P(B^C \cap M^C) = \frac{165}{595}$. The probability of being neither male, nor someone who eats breakfast (therefore being a female who doesn't eat breakfast) is $\frac{165}{595}$.

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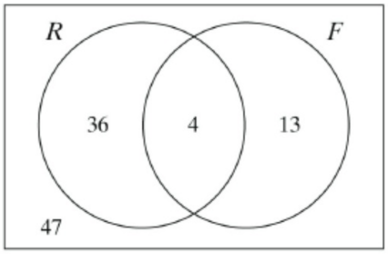
5.54 (a)




(b) $P(\mathrm{R} \cup \mathrm{F}) = \dfrac{36+4+13}{100} = \dfrac{53}{100}$. The probability of being either a Republican senator, a female senator or both is $\dfrac{53}{100}$. (c) $P(\mathrm{R}^{\mathrm{C}} \cap \mathrm{F}^{\mathrm{C}}) = \dfrac{47}{100}$. The probability of being neither a Republican senator or a female senator (therefore being a male Democrat) is $\dfrac{47}{100}$.

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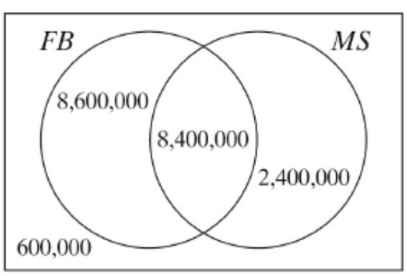
5.55 (a)

| | Facebook | Not Facebook | Total |
|---|---|---|---|
| MySpace | 8,400,000 | 2,400,000 | **10,800,000** |
| Not Myspace | 8,600,000 | 600,000 | **9,200,000** |
| **Total** | **17,000,000** | **3,000,000** | **20,000,000** |

(b)




(c) $P(\mathrm{FB} \cup \mathrm{MS})$. (d) $P(\mathrm{FB} \cup \mathrm{MS}) = \dfrac{8,600,000 + 8,400,000 + 2,400,000}{20,000,000} = \dfrac{19,400,000}{20,000,000}$.

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## Independent Events

**Two events A and B are considered <u>independent</u> if the occurrence of one event does not depend on the occurrence of the other.**

**In a deck of cards, the chance of getting an ace is the same across all four suits. The likelihood of getting an ace does not depend on the suit of the card.**

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## Independent Events

**Two events A and B are considered <u>independent</u> if and only if:**

$$\underbrace{P(A|B)}_{\text{conditional}} = P(A) \text{ and } P(B|A) = P(B)$$

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## Addition Rule (Union, "or")

The addition rule for probability helps in computing the chances of one or several events occurring at a given time.

Dog Cat

5 7 6

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

"union"

If events A and B are disjoint, then $P(A \cap B) = 0$.

$$P(A \cup B) = P(A) + P(B)$$

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## Multiplication Rule (Intersection, "and")

When we are interested in the probability of two events occurring simultaneously, we use the multiplication rule.

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

and

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## Conditional Probability

Sometimes we are interested in the probability of an event occurring given that another event has already occurred.

"given that"   intersection formula

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

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## Example

Imagine you shuffle a standard deck of 52 cards and draw a card at random.

Let:

| | |
|---|---|
| D = diamond | C = club |
| H = heart | S = spade |
| J = jack | Q = queen |
| K = king | 1 = ace |

A = Getting an ace = {D1, C1, H1, S1}
B = Getting a diamond = {D1 ...D10, DJ, DQ, DK}
C = Getting a club = {C1 ...C10, CJ, CQ, CK}

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## Example

**Find P(A), P(B), and P(C):**

$P(A) = 4/52 = 1/13$

$P(B) = 13/52 = 1/4$

$P(C) = 13/52 = 1/4$

**Find A':**

$P(A') = 1 - 1/13 = 12/13$

**Find B':**

$P(B') = 1 - 1/4 = 3/4$

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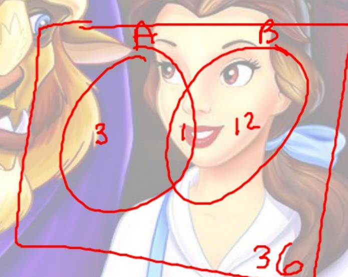
## Example

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

intersection

**Find** $(A \cap B)$**:**

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




**Find** $(B \cap C)$**:**

$\frac{13}{52} \cdot \frac{0}{52} = 0$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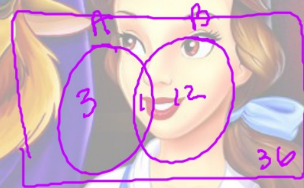
## Example

* or

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

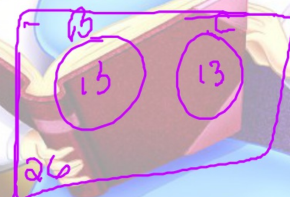
**Find** $(A \cup B)$**:**

$\frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$




**Find** $(B \cup C)$**:**

$\frac{13}{52} + \frac{13}{52} - \frac{0}{52} = \frac{26}{52} = \frac{1}{2}$

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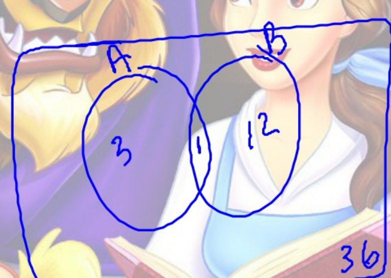
## Example

**Find** $(A|B)$ **:**

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

$= \frac{\frac{1}{52}}{\frac{13}{52}} = \frac{1}{\cancel{52}} \cdot \frac{\cancel{52}}{13}$

$= \frac{1}{13}$

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