Probability Formulas (these are the only ones that will be given to you)

The General Addition Rule

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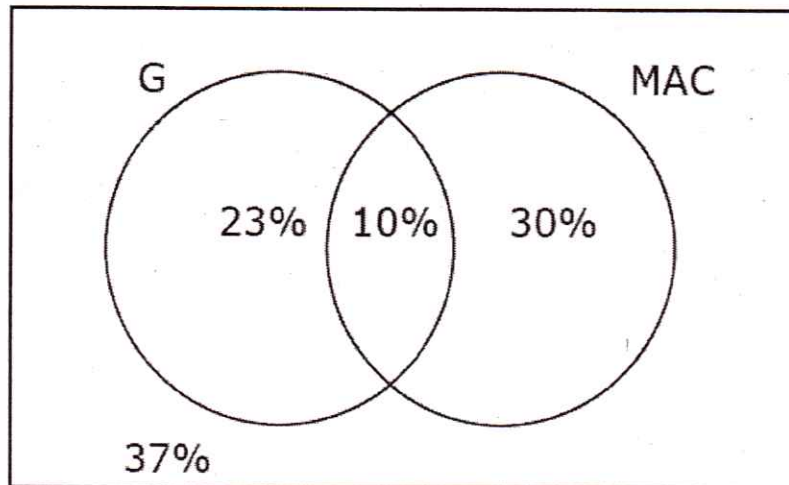
The Conditional Probability

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

The General Multiplication Rule

P(A and B) = P(A) * P(B|A)

In the Venn diagram below, let event G represent that someone is a graduate student and MAC represent that a someone primarily uses a Mac computer.

G   MAC

23%   10%   30%

37%

Find:

$P(G) = $ .23 + .10 = **.33**

$P(MAC) = $ .10 + .30 = **.40**

$P(G \cup MAC) = $ .23 + .10 + .30

= **.63**

$P(G \cap MAC) = $ **.10**

$P(G|MAC) = \dfrac{.10}{.10 + .30} = \dfrac{.10}{.40} = $ **.25**

$P(MAC|G) = \dfrac{.10}{.23 + .10} = \dfrac{.10}{.33} = $ **.3**

$P(G^c) = $ .30 + .37 = **.67**

$P(\overline{MAC \cup G}) = $ **.37**

STA 2e: Sect. 7.3 Worksheet #1   Name _____
MULTIPLICATION RULES

1. Determine if the events are independent or not independent.

   a. driving at age 16; having an automobile accident — *not independ.*

   b. drawing a King from a deck of 52 playing cards; rolling a 5 on a die — *independent*

   c. getting a raise in salary and losing at basketball — *independent*

   d. being over 7 foot tall and having a high IQ — *independent*

   e. having a high GPA and getting a college scholarship — *not independ.*

   f. parking in a no-parking zone and getting a parking ticket — *not independ.*

2. If a student guesses on all five questions on a true/false exam, find the probability that he or she will get them all wrong. *wrong + wrong + wrong + wrong + wrong*   *.03*

   $$(1/2) \cdot (1/2) \cdot (1/2) \cdot (1/2) \cdot (1/2)$$

3. An urn contains 2 red marbles, 4 blue marbles and 6 green marbles. Two marbles are drawn, one at a time, with no replacement.

   a. Finish the tree diagram for the drawing, showing probabilities. Include all possible outcomes (the sample space) and probabilities.
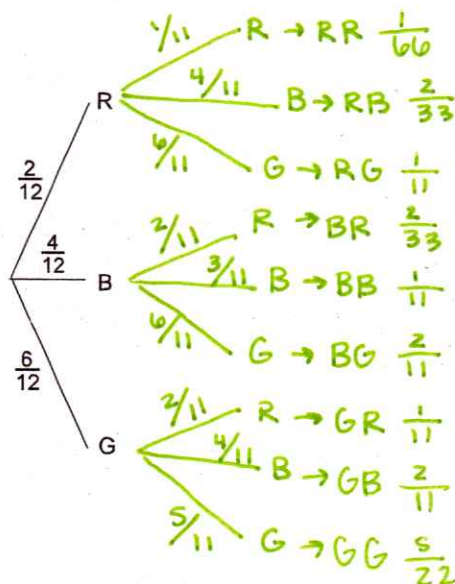
   Use your sample space to answer each of the following:

   b. What is the probability that you get at least one green marble?

   RG GB
   BG GG
   GR

   $$\frac{1}{11} + \frac{2}{11} + \frac{1}{11} + \frac{2}{11} + \frac{5}{22}$$
   $$= \frac{17}{22} = \boxed{.77}$$

   c. What is the probability that you get no blue marble?

   RR
   RG $$\frac{1}{66} + \frac{1}{11} + \frac{1}{11} + \frac{5}{22} = \frac{14}{33}$$
   GR
   GG $$= \boxed{.42}$$

   d. What is the probability that you get one green and one blue marble (either order)?

   BG
   GB $$\frac{2}{11} + \frac{2}{11} = \frac{4}{11} = \boxed{.36}$$

4. Twenty-six percent of all deaths are caused by heart disease. If three randomly selected deaths are chosen what is the probability that they all died from heart disease.

   died + died + died   *.02*

   $$(.26) \cdot (.26) \cdot (.26)$$

5. The newspaper printed an article stating that 60% of all people in the state had graduated from college. If you randomly select 10 people on the street and ask them if they graduated from college, what is the probability that all 10 people did.

   grad. + grad. + grad (10 times)   *.006 or .01*

   $$(.6)^{10}$$

   same as (.6)(.6) 10 times

STA 2e: Sect. 7.3 Worksheet #1 p. 2

6. The two-way table at the right categorizes students by gender and grade level. If one student is randomly selected, find the probability of:

	Male	Female	
Soph.	45	35	80
Junior	42	46	88
Senior	38	34	72
	125	115	240

a. getting a male junior $\frac{42}{240} = .18$

b. getting a male, given that the student is a senior $\frac{38}{72} = .53$

c. getting a junior, given that the student is a female $\frac{46}{115} = .4$

d. getting a female, given that the student is a junior $\frac{46}{88} = .52$

7. In 1912 the luxury liner Titanic, on its first voyage across the Atlantic, struck an iceberg and sank. Some passengers survived by using lifeboats, but many died. Let S be the event that a person survived and let F be the event that a person was female.

		GENDER		
		Male	Female	Total
SURVIVED?	Yes	367	344	711
	No	1364	126	1490
	Total	1731	470	2201

a. Write in symbols: probability that a person survived, given that the person was female

$P(S|F)$

Find this probability. $\frac{344}{470} = .73$

b. Write in symbols: probability that a person is a male, given that the person survived. $P(M|S)$

Find this probability. $\frac{367}{711} = .52$

~~c.~~ Write in sentence form: $P(S^C F^C)$

SKIP

Find $P(S^C F^C)$ ....

8. What is the probability that you roll three 6's in a row with 1 die? $(\frac{1}{6})(\frac{1}{6})(\frac{1}{6})$ $.005$ or $.01$

9. Four aces and four 2's are mixed and then drawn one at a time at random. Two cards are drawn. Find the probability that both cards drawn are aces if:
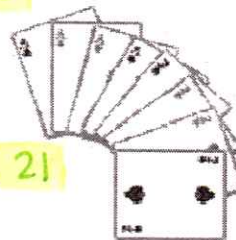
a. the card is replaced before the next draw $(\frac{4}{8})(\frac{4}{8}) = .25$

This is an example of events that are ....**independent**....
(independent / not independent)

b. the card is not replaced before the next draw $(\frac{4}{8})(\frac{3}{7}) = .21$

This is an example of events that are ....**not independent**....
(independent / not independent)

10. Use the Conditional Probability Formula to solve the following:

33% of all registered voters are Republican. 97% of Republicans believe in God. What percent of registered voters believe in God and are Republican?

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \qquad P(believe|Rep.) = \frac{P(believe \text{ } \& \text{ } Rep)}{P(Rep)}$$

$$.97 = \frac{x}{.33} \qquad x = .32$$

Name : _____   Score : _____

Teacher : _____   Date : _____

Probability with a Deck of Cards

These questions are based on a 52 card deck without Jokers.

1) Find the probability of drawing a black card on the first draw, replacing it and drawing
a black card on the second draw. $\left(\frac{26}{52}\right)\left(\frac{26}{52}\right)$ .25

2) Find the probability of drawing a Heart. $\left(\frac{13}{52}\right)$ .25

3) Find the probability of drawing a black face card on the first draw, replacing it and
drawing a Spade card on the second draw. $\left(\frac{6}{52}\right)\left(\frac{13}{52}\right)$ .03

4) Find the probability of drawing a Queen of Hearts on the first draw, replacing it and drawing
a 2 card on the second draw. $\left(\frac{1}{52}\right)\left(\frac{4}{52}\right)$ .001

5) Find the probability of drawing a Diamond 6 through 10 on the first draw, replacing it and
drawing a face card on the second draw. $\left(\frac{5}{52}\right)\left(\frac{12}{52}\right)$ .02

6) Find the probability of drawing a red face card on the first draw, replacing it and
drawing a Ace card on the second draw. $\left(\frac{6}{52}\right)\left(\frac{4}{52}\right)$ .008 or .01

7) Find the probability of drawing a face card that is a Diamond on the first draw, replacing it and
drawing a 5 card on the second draw. $\left(\frac{3}{52}\right)\left(\frac{4}{52}\right)$ .004

8) Find the probability of drawing a black 6 through 8 on the first draw, replacing it and
drawing a 3 card on the second draw. $\left(\frac{6}{52}\right)\left(\frac{4}{52}\right)$ .009 or .01

9) Find the probability of drawing a black card on the first draw, replacing it and drawing
a Heart card on the second draw. $\left(\frac{26}{52}\right)\left(\frac{13}{52}\right)$ .13

10) Find the probability of drawing a 8 card on the first draw, replacing it and drawing
a Spade card on the second draw. $\left(\frac{4}{52}\right)\left(\frac{13}{52}\right)$ .02

Math-Aids.Com