What students need to know for…
AP STATISTICS 2016-2017 **NAME: ___________________**

This is a **MANDATORY** assignment that will be **GRADED**. It is due the first day of the course. Your teacher will determine how it will be counted (i.e. homework, quiz, etc.)

Students expecting to take Statistics at Cambridge Rindge and Latin High School should demonstrate the ability to…

General:

- keep an organized notebook
- take good notes
- complete homework every night
- be active learners
  - ask questions and participate in class
  - seek help outside of class if needed
- work with others
- work with and without a calculator

Specific Math Skills

1) **Algebra**
   - can manipulate with ease fractions, decimals and variables in a variety of settings including in equations and rational functions

2) **Graphing**
   - read and interpret the graphs of linear, quadratic, cubic, quartic, exponential, logarithmic, logistic and sinusoidal functions and their properties
   - identify the domain and range of functions
   - recognize end behaviors of graphs

3) **Exponents and logarithms**
   - be familiar with the exponent and logarithms rules
   - know how to work with negative and fractional exponents
   - be familiar with the graphs of exponential and logarithmic functions and their properties
   - solve equations involving logarithms and rational exponents

4) **Probability**
   - know how to calculate the probability of independent, dependent and conditional events.

5) **Data Representation**
   - Read and create bar graphs, and pie charts for categorical data
   - Read and create stem-and-leaf-plots, histograms and box plots for quantitative data.

Welcome to AP Statistics! Statistics will be challenging as well as beautiful. This semester long course requires that everyone work hard and study for the entirety of the semester. You will need a binder or notebook, a graphing calculator (the teachers can help you with TI-83 or 84 but with other models such as the TI-89 or HP or Casio, you will need your manual). Good luck – we look forward to a great semester!

- The CRLS Math Department

*NOTE: Show all of your work. Your teacher may count this packet as a quiz grade, a homework grade, or they may give a test or quiz on this material at the beginning of the semester.

I. Qualitative Data Representations

A) Display the data in the table below in both a **Bar Graph** (bars are separated, categories are on the x-axis, frequency is on the y-axis) and a **Pie Chart**. Then, write several sentences about what you notice.

Weekly Home Expenditures	
Mortgage	$2,100
Food	$435
Natural Gas	$83
Electricity	$105
Water	$79
TV/Internet/Phone	$150

II. Quantitative Data Representations

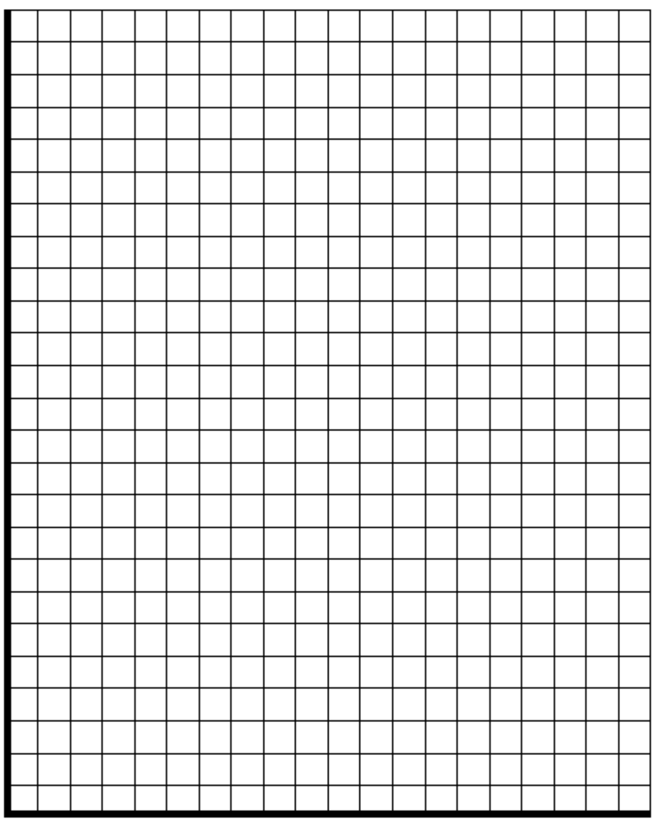
B) Display the data in the table below in both a **Box Plot** and a **Stem-and-Leaf Plot**. Identify the mean, median, and mode of the data set. Then, write several sentences about what you notice.

Batting Averages for the top 30 MLB and AL players
.328 .322 .321 .320 .313 .311 .311 .309 .308 .307 .306 .305 .304 .304 .304 .303 .303 .302 .301 .300 .299 .298 .297 .297 .296 .296 .296 .295 .295 .294 .294

Display the data in the table below in a **Histogram** (bars are touching to show that x is a continuous variable). Make sure to label your x-axis with your data ranges, and your y-axis with the corresponding frequencies. Then, identify the mean, median, and mode of the data set.

Teen Pregnancy Rates	
1. New Mexico 93/1,000	13. Tennessee 76/1,000
2. Mississippi 90/1,000	14. Alabama 73/1,000
3. Texas 85/1,000	15. Florida 73/1,000
4. Nevada 84/1,000	16. North Carolina 72/1,000
5. Arkansas 82/1,000	17. California 72/1,000
6. Arizona 82/1,000	18. New York71/1,000
7. Delaware 81/1,000	19. Kentucky 71/1,000
8. Louisiana 80/1,000	20. Alaska 69/1,000
9. Oklahoma 80/1,000	21. Illinois 68/1,000
10. Georgia 78/1,000	22. Wyoming 68/1,000
11. South Carolina 76/1,000	23. Colorado 66/1,000
12. Hawaii 76/1,000	24. West Virginia 65/1,000

Frequency



Pregnancy Rate

III. Relevant Data and Interpreting

For each experiment, specify who or what is the experiment being done to, what is being experimented, why, where and how the experiment is being done, and how the results will be measured.

Members of the research and development division of a bicycle tire manufacturer are investigating tread life of rubber bicycle tires. They have suggested that a study be conducted to determine whether bicycle tires produced using a new synthetic rubber compound have a longer tread life than the tread life of bicycle tires produced using the standard rubber compound.

A researcher in the division suggested the study be designed in the following way. Select 60 identical bicycles and randomly assign 30 of those bicycles to one group, A, and the rest to a second group, B. All 60 bicycles will be equipped with front tires produced using the standard rubber compound. However, the bicycles in group A will be equipped with rear tires produced using the new synthetic rubber compound, while the bicycles in group B will be equipped with rear tires produced using the standard rubber compound.

A total of 60 bicyclists will be randomly selected from the population of students at a local university who regularly ride a bicycle. The 60 bicycles will be randomly assigned to the 60 students (with a different bicycle assigned to each student), and the students will be asked to ride the bicycles for a six-month period. At the end of the six-month period, the researcher will compare the mean amounts of rear tire tread wear for the bicycles in the two groups.

A drug company currently sells a prescription pain reliever that has been shown to be effective at lowering arthritis pain. However, since the drug also causes stomach irritation in some patients, the company has created a new formulation that it hopes will reduce that side effect.

To see if the new formulation reduces the occurrence of stomach irritation for users of the pain reliever, the company conducted a small preliminary study to compare the new formulation with the current pain reliever. In the preliminary study of 100 subjects with arthritis, 50 were randomly assigned to take the current pain reliever and 50 were randomly assigned to take the new formulation.

IV. Combinations and Permutations

In English we use the word "combination" loosely, without thinking if the **order** of things is important. In other words:

"My fruit salad is a combination of apples, grapes and bananas" We don't care what order the fruits are in, they could also be "bananas, grapes and apples" or "grapes, apples and bananas", it's the same fruit salad.

"The combination to the safe was 472". Now we **do** care about the order. "724" would not work, nor would "247". It has to be exactly **4-7-2**.

So, in Mathematics we use more *precise* language:

- If the order **doesn't** matter, it is a **Combination** (${}_nC_r$).

  (${}_nC_r$) = □!□!□−□ !

- If the order **does** matter it is a **Permutation** (${}_nP_r$).

  (${}_nP_r$) = □!□!

Write the following in <u>factorial form</u> and then simplify if possible.

1. ${}_nC_{n-2}$ 2. ${}_nC_2$ 3. ${}_nP_{n-1}$ 4. ${}_nP_2$

7. How many permutations of 3 **different** digits are there, chosen from the ten digits 0 to 9 inclusive?

8. A password consists of two letters of the alphabet followed by three digits chosen from 0 to 9. Repeats are allowed. How many different possible passwords are there?

9. There are fourteen juniors and twenty-three seniors in the Service Club. The club is to send four representatives to the State Conference.

a.) How many different ways are there to select a group of four students to attend the conference?

b.) If the members of the club decide to send two juniors and two seniors, how many different groupings are possible?

V. Probability

Union: the union of any collection of events is the event that at least one of the collections occurs.

General Addition Rule for Unions of Two Events: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

General Multiplication Rule for Any Two Events: P(A and B) = P(A)P(B given A)
in symbols $P(A \cap B) = P(A)P(B \mid A)$, where $P(B \mid A)$ means the conditional probability that B occurs, given the information that A occurs (see below).

Conditional Probability: Assuming $P(A) > 0$, $P(B \mid A) = \dfrac{P(A \text{ and } B)}{P(A)}$

Intersection: the event that *all* of the given events occur. For example, the intersection of *A*, *B*, and *C* is $P(A \text{ and } B \text{ and } C) = P(A)P(B \mid A)P(C \mid A \text{ and } B)$

Independence: Two events *A* and *B* that both have positive probability are independent if $P(B \mid A) = P(B)$

1. Given a standard deck of 52 cards, 3 cards are dealt. If each card is replaced in the deck (and the deck is well shuffled) after being dealt answer the questions below.
   a) What is the probability that all three cards are queens?

   b) Let the first card be the queen of hearts and the second card be the queen of diamonds. Is the probability of drawing the two cards independent? Explain.

   c) If the first card is a queen, what is the probability that the second card will not be a queen?

   d) If the first two cards are queens, what is the probability that you will be dealt three queens?

   e) If two of the three cards are queens, what is the probability that the other card is not a queen?

2. A bag contains 3 red marbles, 5 green marbles, and 2 blue marbles. Two consecutive draws are made from the bag (**with replacement**). Find the probability of each event:

   a) p(red, blue) = ______

   b) p(blue, blue) = ______

   c) p(both draws were neither red or green) = ______

   d) p(red, not red) = ______

3. A bag contains 3 red marbles, 5 green marbles, and 2 blue marbles. Two consecutive draws are made from the bag (**without replacement**). Find the probability of each event:

a) p(green, then blue) = ______

b) p(blue, then blue) = ______

c) p(both draws were neither red or green) = ______

d) p(red, not red) = ______

4. You are dealt two cards (without replacement) from a standard deck of 52 cards.

a) What is the probability that the first card you are dealt is an ace?

b) If the first card was an ace, what is the probability that the second card you are dealt is a Jack?

c) What is the probability that you are dealt an Ace and a Jack in any order?

d) If an ace is worth 11 points and a 10, Jack, Queen, and King are worth 10 points each, what is the probability that you will obtain 21 points with two cards?

5. You survey your classmates to determine their favorite flavor of ice cream. You think males may prefer vanilla and females may prefer chocolate, so you tally their responses separately. You found the following results:

	Vanilla	Chocolate	Other
Identify as Male	23	10	10
Identify as Females	8	17	9
Other	0	2	

a) What is the probability that a randomly selected student prefers chocolate?

b) What is the probability that a randomly selected student is a female and prefers chocolate?

c) If the student chosen is a female, what is the probability that she prefers chocolate?

d) Are the events "female" and "prefers chocolate" independent or dependent? Explain.

6. Matthew shoots 6 free throws. Let x = # shots that Matthew makes. Let p(x) represent the probability of making that many shots. Use the table below to answer the following.

X	0	1	2	3	4	5	6
P(x)	*0.0*	*0.01*	*0.06*	*0.19*	*0.32*	*0.30*	*0.12*

a) What is the probability that Matthew makes 3 free throws?

b) What is the probability that Matthew makes at least 3 free throws?

c) What is the probability that Matthew **misses** at least 2 free throws?

7. If you roll a regular 6-sided die, the probability that you land on a "one" is 1/6. If you roll the same die twice, what is the probability that:

a) You roll two "ones" in a row?

b) You never roll a "one"?

c) You roll at least one "one"?

8. The American Diabetes Association estimates that 5.9% of Americans have diabetes. Suppose that a medical lab has developed a simple diagnostic test for diabetes that is 98% accurate for people who have the disease and 95% accurate for people who do not have it. The medical lab gives the test to a randomly selected person.

a) Create a probability tree of the situation.

b) What is the probability that the person has diabetes given a positive test?

c) What is the probability that the test is positive given the person has diabetes?

d) What is the probability that a diagnosis is correct?