Homework 1: Basic Logic, Sets

HW1 is Due September 28; submit to Google classroom 15 minutes before the class time.

I have substituted some of the Review problems we did in class with new ones, but the rest are going to stay the same. Solve the following problems from Logic and Sets topics

- **Basics of logic. Knights and knaves. NOT, AND, OR, IF.**

1. **(new)** On the island of knights and knaves, you meet two inhabitants: Sally and Zippy. Sally claims "I and Zippy are both knights or both knaves". Zippy says, "Sally and I are the same." So, who is a knight and who is a knave?
2. **(same as in class notes)** On the island of Knights and Knaves, you meet three inhabitants: Bozo, Carl, and Joe. Bozo says that Carl is a knave. Carl tells you, 'Of Joe and I, exactly one is a knight.' Joe claims, 'Bozo and I are different.'
3. **(none)**
4. **(new**) Evaluate:
   (**NOT** *P*) **AND** (P **OR** *Q*)
5. **(same as in class notes)** Write the truth table for each of the following formulas. Are they equivalent (i.e., do they always give the same value)?
   a. (*A* **OR** *B*) **AND** (*A* **OR** *C*)
   b. *A* **OR** (*B* **AND** *C*).
6. **(none)**

- **Sets. Notation. Union, intersection, complement. Cardinality.**

7. **(same as in class notes, started in class)** Let us take the usual deck of cards. As you know, there are 4 suits, hearts, diamonds, spades, and clubs, with 13 cards in each suit.
   - If we Denote:
     H=set of all hearts cards
     Q=set of all queens
     R=set of all red cards
   - Then, describe by formulas (such as $H \cap Q$) the following sets:
     a) all red queens
     b) all black cards
     c) all cards that are either hearts or a queen
     d) all cards other than red queens
   - How many cards are there in each set?
8. (**same as in class notes**) Let: *A*=set of all people who know French
   B=set of all people who know German
   C=set of all people who know Russian
   - Describe in words the following sets:

   (a) $A \cap B$ (b) $A \cup (B \cap C)$ (c) $(A \cap B) \cup (A \cap C)$ (d) $C \cap \bar{A}$.

9. (**same as in class notes**) In a class of 25 students, 10 students know French, 5 students know Russian, and 12 know neither. How many students know both Russian and French? ***Hint:*** use a Venn diagram.

- **Coordinates. Equation of the line. (Try your best and do not worry if you do not know or remember what to do. We will review these problems next week)**

19 Draw the graphs of the following functions (on a quadrille paper):

a. $2x + 3y = 1$

b. $2x - 1 = y$

c. $y = |x| - 2$

Hints: First, solve for *y* so that you have *y = function(x)*. Then, if you do not know any shortcuts, make a table with *x* and *y* columns, pick five values for *x*, and use them to calculate the corresponding value for *y* by plugging them into the equation. The *x* - values are <u>your choice</u>; for example, -3,-1, 0,1,3. Draw the (x,y) pairs on an x-y coordinate system, then draw the line(s)/curve(s) through the points.