

**Patterns in Mathematics (012-01)**  
**First Exam**  
**Spring 2013**

Please do all work on this paper. Points are written to the left of each problem,

10 pts 1. Answer True or False

(a)  $\{1, 2, 3\} = \{2, 1, 3, 1, 2\}$ .

(b)  $\{0\} = \emptyset$ .

(c)  $(1, 3) = (3, 1)$ .

(d)  $4 \in \{2, 6, 8\}$ .

(e)  $\{1, 2, 3\} \cap \{4, 5, 6\} = \emptyset$ .

11 pts 2. List all subsets of  $\{2, 4, 6\}$ .

/33

12 pts 3. Let  $D = \{1, 2\}$  and  $E = \{2, 3, 4\}$ .

(a)  $D \times E =$

(b) How many one-to-one correspondences are there between  $D$  and  $E$ ?

21 pts 4. Let  $A = \{1, 2, 4, 5\}$ ,  $B = \{2, 3, 5, 6\}$ , and  $C = \{4, 5, 6, 7\}$ .

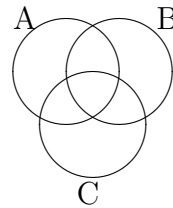
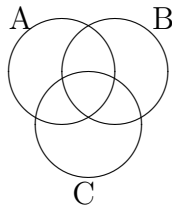
(a)  $A \cap B =$

(b)  $B \cup C =$

(c)  $A - B =$

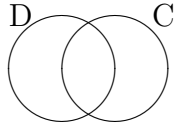
8 pts 5. In the following Venn diagram, shade  $(A \cup C) \cap B$ . (I'm giving you two copies in case you mess one up. Circle the diagram you want me to grade.)

/35



6 pts 6. Add parentheses so that  $\sim P \wedge Q \vee R$  becomes a disjunction.

12 pts 7. A group of people had a dog or a cat or both. Of these 30 had a cat, 25 had a dog, and 15 had both a dog and a cat. How many had just one kind of pet? (You may assume they had no canaries, goldfish, hamsters, etc.) You may find the following Venn Diagram useful.



/32

20 pts 8. Fill in the following truth tables. In each case, circle the column with the final truth values for the given statement.

$P$	$Q$	$P \wedge \sim Q$
T	T	
T	F	
F	T	
F	F	

$P$	$Q$	$\sim P \vee (P \wedge Q)$
T	T	
T	F	
F	T	
F	F	