Math 231 – HW 8 **Name:** KEY

Epp 2nd Ed. 5.1 1, 2, 3, 5, 6, 7, 10, 15
5.2 25a, b
5.3 1, 4 (explain why rather than give a formal proof), 6.

5.1 (1) Which of these sets are equal?

(a) {a,b,c,d}

(b) {d,e,a,c}

(c) {d,b,a,c}

(d) {a,a,d,e,c,e}

(a) = (c)

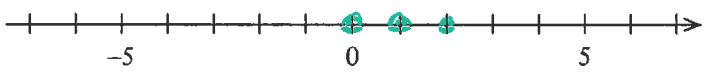
(b) = (d)

5.1 (2) Is 4 = {4}? Explain!

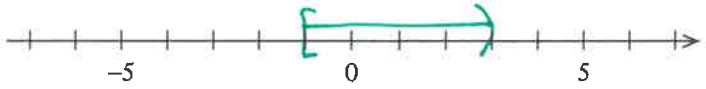
No! 4 is the individual number 4.
{4} is the set containing the number 4.
These are not the same.

5.1 (3) Graph each set on a number line.

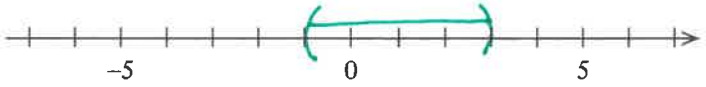
A={0,1,2}



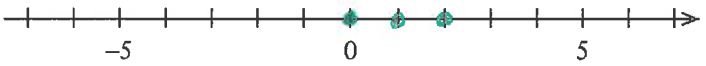
B={x∈ℝ|-1≤x<3}



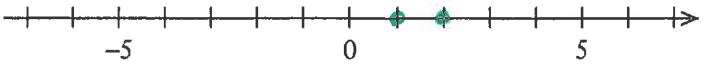
C={x∈ℝ|-1<x<3}



D={x∈ℤ|-1<x<3}



E={x∈ℤ⁺|-1<x<3}



Which of these sets were equal?

only A = D

5.1 (5) Let A={c,d,f,g}, B={f,j}, and C={d,g}. Answer each of the following questions.

(a) Is $B \subseteq A$? Explain. No. j is not in A.

(b) Is $C \subseteq A$? Explain. Yes. Every element in C is in A.

(c) Is $C \subseteq C$? Explain. Yes. Every element in C is in C.
(In fact, any set is a subset of itself.)

(d) Is C a proper subset of A? Explain.
Yes. Every element in C is in A, and there are elements of A that are not in C.

5.1 (6) Yes or no? Be ready to discuss your answers.

(a) Is $3 \in \{1,2,3\}$? Yes.

(b) Is $1 \subseteq \{1\}$? No.

(c) Is $\{2\} \in \{1,2\}$? No.

(d) Is $\{3\} \in \{1,\{2\},(3)\}$? Yes.

(e) Is $1 \in \{1\}$? Yes.

(f) Is $\{2\} \subseteq \{1,\{2\},\{3\}\}$? No.

(g) Is $\{1\} \subseteq \{1,2\}$? Yes.

(h) Is $1 \in \{\{1\},2\}$? No.

(i) Is $\{1\} \subseteq \{1,\{2\}\}$? Yes.

(j) Is $\{1\} \subseteq \{1\}$? Yes.

5.1 (7) Let A={b,c,d,f,g} and B={a,b,c}. Find each of the following:

(a) $A \cup B = \{a,b,c,d,f,g\}$

(b) $A \cap B = \{b,c\}$

(c) $A - B = \{d,f,g\}$

(d) $B - A = \{a\}$

5.1 (10) True or False? Be ready to discuss your answers.

(a) $\mathbb{Z}^+ \subseteq \mathbb{Q}$? True

(b) $\mathbb{R}^- \subseteq \mathbb{Q}$? False

(c) $\mathbb{Q} \subseteq \mathbb{Z}$? False

(d) $\mathbb{Z}^- \cup \mathbb{Z}^+ = \mathbb{Z}$? False
(where's 0?)

(e) $\mathbb{Q} \cap \mathbb{R} = \mathbb{Q}$? True

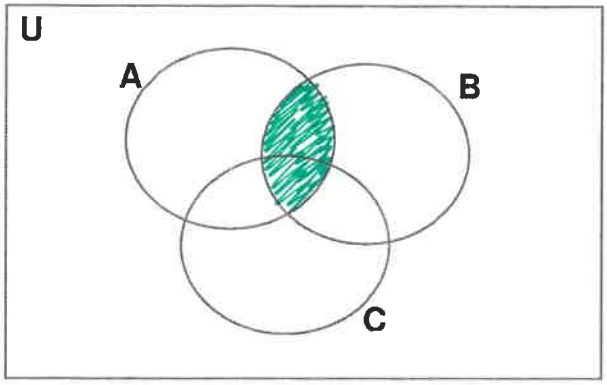
(f) $\mathbb{Q} \cup \mathbb{Z} = \mathbb{Q}$? True

(g) $\mathbb{Z}^+ \cap \mathbb{R} = \mathbb{Z}^+$? True

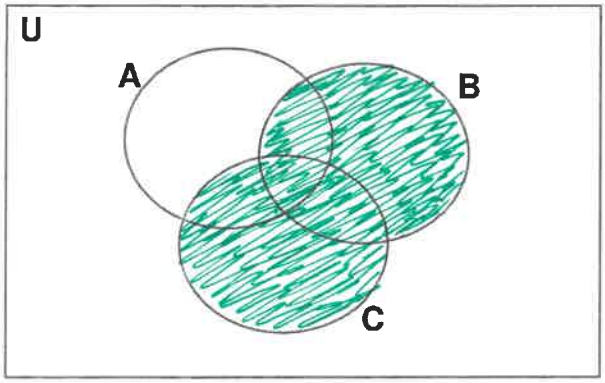
(h) $\mathbb{Z} \cup \mathbb{Q} = \mathbb{Z}$? False.

5.1 (15) Neatly shade the region corresponding to each set.

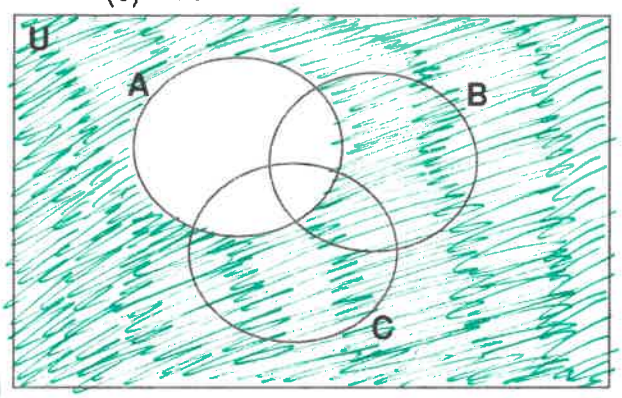
(a) $A \cap B$



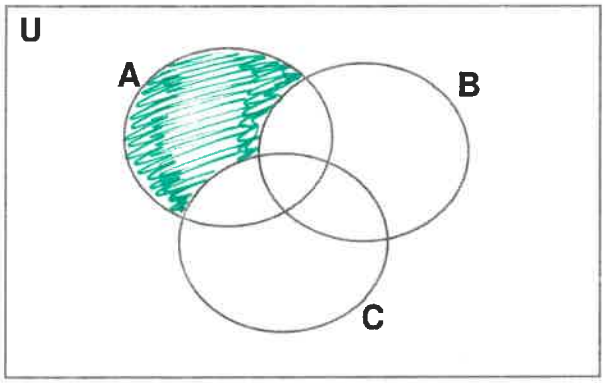
(b) $B \cup C$



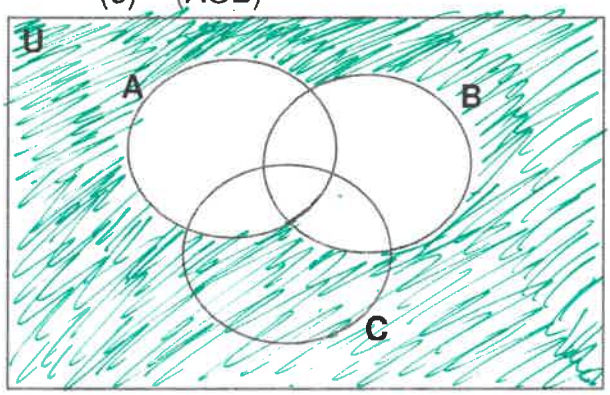
(c) A^C



(d) $A-(B \cup C)$

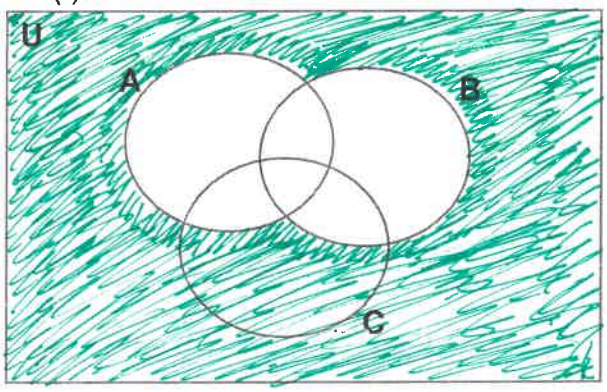


(e) $(A \cup B)^C$



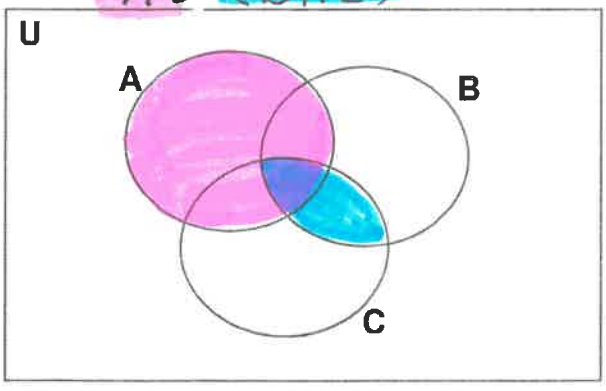
Same pic!

(f) $A^C \cap B^C$



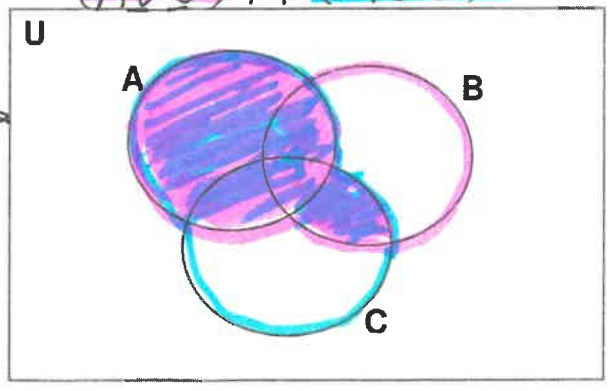
5.2 (25a) Illustrate one of the distributive laws by shading in the region corresponding to $A \cup (B \cap C)$ on one copy of the diagram and $(A \cup B) \cap (A \cup C)$ on the other. Label them!

$A \cup (B \cap C)$



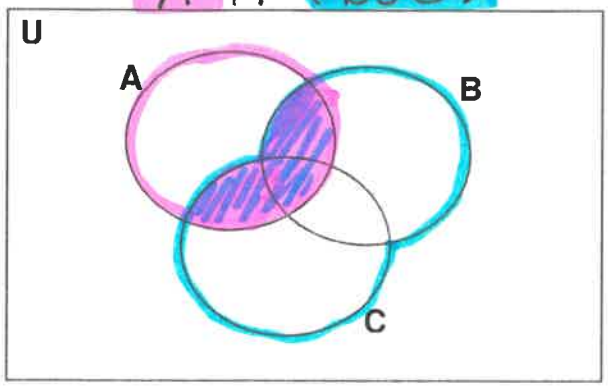
same pic!

$(A \cup B) \cap (A \cup C)$

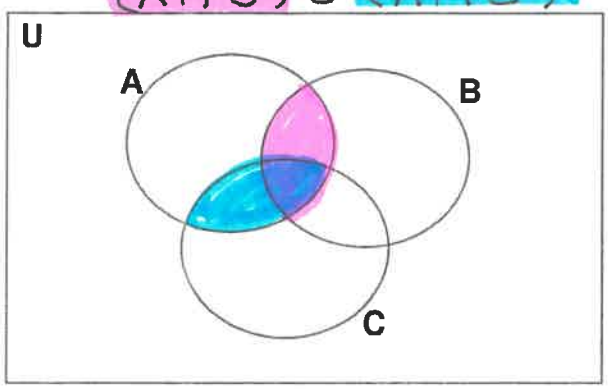


5.2 (25b)
Illustrate the other distributive law by shading in the region corresponding to A∩(B∪C) on one copy of the diagram and (A∩B) ∪ (A∩C) on the other. Label them!

A ∩ (B∪C)



(A∩B) ∪ (A∩C)



5.3 (1)

(a) Is the number 0 in ∅? Explain.

No. Nothing is in the empty set, $\emptyset = \{\}$, not even zero.

(b) Is ∅={∅}? Explain.

No. The empty set ($\emptyset$) is not the same as the set containing the empty set ($\{\emptyset\}$).

(c) Is ∅∈{∅}? Explain.

Yes. The empty set is an element of the set containing the empty set.

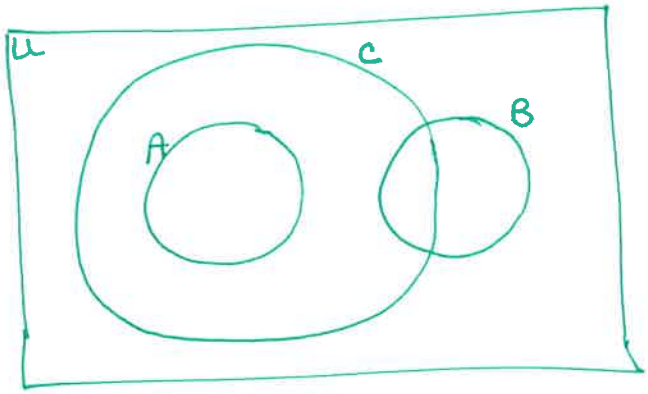
5.3 (4) Show that (explain informally) that for all subsets A of a universal set U, $A \cap A^C = \emptyset$, and $A \cup A^C = U$.

$A \cap A^c = \emptyset$ This makes sense, since A is a set, and A^c is everything not in the set, so there is nothing in their intersection. (any element is either in the set or not in the set – it can't be both)

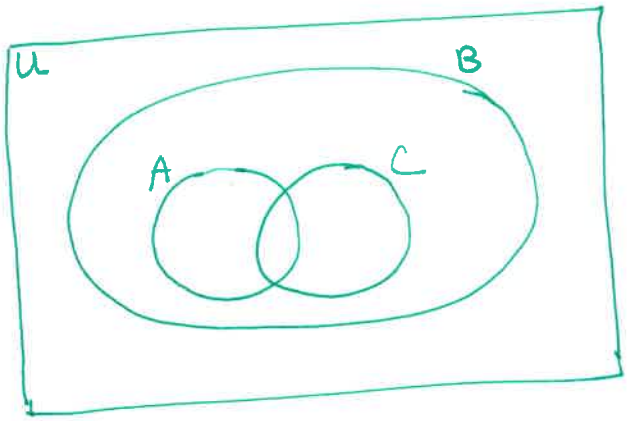
$A \cup A^c = U$ this makes sense, since A is a set, and A^c is everything that's in the universe but not in A. Put together, that's everything in the universe!

5.3 (6) Draw Venn diagrams to describe the sets A, B, and C that satisfy the given conditions:

(a) $A \cap B = \emptyset$, $A \subseteq C$, $C \cap B \neq \emptyset$.



(b) $A \subseteq B$, $C \subseteq B$, $A \cap C \neq \emptyset$.



(c) $A \cap B \neq \emptyset$, $B \cap C \neq \emptyset$, $A \cap C = \emptyset$.