Name: Key

Unit 2: Sets, Venn Diagrams, and Logic Test Review

1. A = {x: x ∈ Z, 0 < x ≤ 12}, B = {x: x ∈ Z, 5 ≤ x < 15}
Determine if the following statements are true or false

A: {1,2,3,4,5,6,7,8,9,10,11,12}
B: {5,6,7,8,9,10,11,12,13,14}

a: Sets A and B have 8 elements in common

A∩B: {5,6,7,8,9,10,11,12} True

b: 5 ∈ A and 5 ∈ B

True

c: 12 ∉ A or B

False

d: There are 12 unique elements in sets A and B
→ Not in common

False

2. U = {x: x ∈ N, x < 16}, A = {x: x ∈ U, x is even}, B = {x: x ∈ U, 3 < x < 10}, C = {x: x ∈ U, x ≤ 9}
Determine if the following statements are true or false

U: {1,2,3,4,5,6,7,8,9,10,11,12,13,14,15}
A: {2,4,6,8,10,12,14}
B: {4,5,6,7,8,9}
C: {1,2,3,4,5,6,7,8,9}

a: {2, 4, 6} ⊂ A

True

b: A ⊂ B

False 10,12,14 ∉ B

c: If x ∈ B, then x ∈ C

True b/c B ⊂ C

d: -1 ∈ C

False

3. U is the set of all integers greater than -2 and less than 11. Find A ∩ B' if: U: {-1,0,1,2,3,4,5,6,7,8,9,10}
a: A = {2, 4, 6, 8, 10} and B = {-1, 0, 1, 2, 3, 4} B': {5,6,7,8,9,10}

A∩B': {6,8,10}

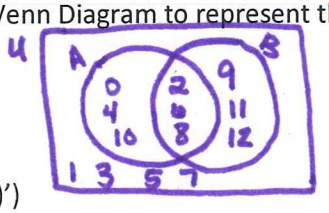
b: A = {x: x ∈ Z, 0 ≤ x ≤ 8} and B = {1, 3, 5, 7, 9} A: {0,1,2,3,4,5,6,7,8}
B': {-1,0,2,4,6,8,10}

A∩B': {0,2,4,6,8}

c: A = {-1, 0, 1, 2} and B = {x: x ∈ N, x < 11} B': {-1,0,11,12}

A∩B': {-1,0}

4. Given U = {x: x ∈ Z, 0 ≤ x ≤ 12}, A = {0, 2, 4, 6, 8, 10}, and B = {2, 6, 8, 9, 11, 12} U: {0,1,2,3,4,5,6,7,8,9,10,11,12}
a: Construct a Venn Diagram to represent the relationship between these sets



b: Find n(A ∪ B)')

10

5. In a recent survey of the latest 50 movies released from Hollywood, movie watchers claimed that:

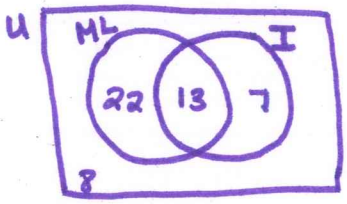
- 35 of the movies were shorter than 2 hours
- 20 of the movies were interesting
- 8 of the movies were two hours or more long and were not interesting

a: How many movies were both interesting and shorter than 2 hours?

13

b: Draw a Venn Diagram to represent this information

ML = Movie Length
I = interesting



Each Hollywood movie grosses $100 million dollars if it is interesting and $30 million dollars if it is not interesting.
c: What was the total earned on these 50 movies?

I = 20 NI = 30 20(100) + 30(30) = $2.9 Billion

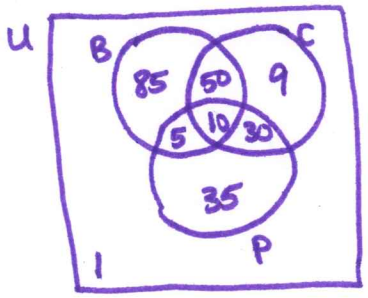
The movies cost $50 million dollars to make if they are shorter than two hours and $70 million dollars otherwise
d: How much money did these 50 movies cost to make in total?

35(50) + 70(15) = $2.8 Billion

6. There are three choices for science classes at an International High School, where all 225 students are required to take at least one science class.

- 150 take biology
- 100 take chemistry
- 80 take physics
- 15 take biology and physics
- 60 take biology and chemistry
- 40 take physics and chemistry
- 10 students take all three courses

a: Draw a Venn Diagram to represent this information



b: How many students do not take chemistry?

126

c: How many students do not take biology or chemistry?

36

7. Consider the following logical propositions
P: The temperature is less than 0 degrees Celsius
Q: The water is frozen
Write each of the following in words

a: $\neg P \wedge \neg Q$

The temp is greater than or = 0°C and the water isn't frozen.

b: $(P \wedge Q) \rightarrow P$

If The temp < 0°C and the water is frozen then the temp < 0°C.

c: $(P \wedge Q) \rightarrow \neg Q$

If the temp < 0° + the water is frozen then the water is not frozen.

8. Determine whether the following statements are true or false

a: $P \wedge Q$, given that P is true and Q is false.

False

b: $P \veebar Q$, given that both P and Q are true.

False

c: $\neg P \vee \neg Q$, given that P is true and Q is true.

False

d: $(P \wedge Q) \rightarrow P$, given that P is false and Q is false.

True

9. Let P, Q, and R be the statements:
P: x is a multiple of four
Q: x is a factor of 36
R: x is a square number

a: Write a sentence in words, for the statement $(P \vee R) \wedge \neg Q$

x is a multiple of 4 and a square # and x is not a factor of 36

b: Use the truth table below to determine the truth values of (P v R) ∧ ⌐Q

P	Q	R	⌐Q	P v R	(P v R) ∧ ⌐Q
T	T	T	F	T	F
T	T	F	F	T	F
T	F	T	T	T	T
T	F	F	T	T	T
F	T	T	F	T	F
F	T	F	F	F	T
F	F	T	T	T	T
F	F	F	T	F	T

c: Write down one possible value of x for which (P v R) ∧ ⌐Q is true.

16

P: Sarah eats lots of carrotts Q: Sarah can see well in the dark

c: Write the following statement in symbolic form: If Sarah cannot see well in the dark, then she does not eat lots of carrots.

$\neg Q \rightarrow \neg P$

d: Is the statement in part c the inverse, converse, or contrapositive of the statement in part a?

contrapositive

11. Use a truth table to show that P → Q and its contrapositive are logically equivalent.

P	Q	¬P	¬Q	P→Q	¬Q→¬P
T	T	F	F	T	T
T	F	F	T	F	F
F	T	T	F	T	T
F	F	T	T	T	T