Answer each of the following questions. Make sure to leave answers in fraction form. If you choose, you may reduce the fraction and/or write it in decimal form. You should not leave answer as a fraction of decimals (a decimal over a decimal).

0.1 Total number of Absences ____________ Turned in HW yes/no __________

1. Use the name that best fits each of the following sets:

- set of integers, set of irrational numbers, set of natural numbers, set of prime numbers, set of rational numbers, set of real numbers, set of whole numbers,

a) \{ 1, 2, 3, … \} ➔ ______________

b) set of real numbers that can be written as fractions ➔ ______________

c) the set of integers that are not negative can also be called the set of ______________

2. Recall that in the set of numbers \( ab = ba \) is called the commutative law of multiplication. and \( (ab)c = a(bc) \) is called the associative law of multiplication.

Write similar examples for the commutative law of sets (using intersections only) ➔ ______________

Write similar examples for the associative law of sets (using unions only) ➔ ______________

3. De Morgan’s laws allow you to write statements using complements in a different form.

\[( A \cap B )' = A' \cup B' \quad \text{or} \quad (A \cup B)' = A' \cap B'\]

Use these laws and the properties of complements to rewrite the following without parenthesis

a) \( ( A \cap B )' = \) ______________

b) \( ( A' \cup B' )' = \) ______________
4. Let $U =$ set of whole numbers less than or equal to 5, $A = \{ x \mid x$ is an even natural number $\}$, $B = \{ \text{set of odd numbers} \}$, $C = \{ x \mid x$ is a positive integer $\}$, $D = \{ x \mid x$ is a negative integer $>-2$ $\}$

Find

a) $A \cup B = \{ \} $  

b) $C' = \{ \} $

c) $A \times B =$ 

d) $n(D) = $ 

d) $n(A \times B \times C \times A) =$ 

5. Shade the following sets. All your drawing should begin with a Venn Diagram with all three sets $A, B,$ and $C$.

a) $A' \cap B'$ 

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

6. Fill in the blank.

a) The ________ of sets A and B is the set that contains all elements that can be classified as being in A or in B or in both A and B.

b) We say that A and B are equal in terms of sets and elements if

___________ and ____________

c) The complement of a set A is the set that contains all elements in the universal set $U$ that

______________

e) Two sets are said to be mutually exclusive or ________________ if $A \cap B = \phi$

f) We say that A and B are ______________ if $P(A \mid B) = P(A)$. 

7. Complete the following **formulas**.

   a) \( n(A \cup B ) = \) _________________  
   b) \( P( A^c ) = 1 - \) _____________  

   c) \( P(A | B ) = \) _________________  
   d) \( P(A \cap B ) = P(A) \cdot \) _____________  

8. True or False.

   ______ a) \( 2 \subset \{ 1, 2, 4 \} \)  
   ______ b) \( \{ a, b, c \} \cup \{ b, d, e \} = \{ b \} \)  
   ______ c) \( \phi \in A \), for any set A  
   ______ d) In any sample space S, then every sample point of S has the same probability.  
   ______ e) \( n(S ) = 1 \)  
   ______ f) If A and B are disjoint, then \( P(A \cap B ) = 0 \)  

9. Let \( S = \{ s1, s2, s3, s4 \} \) with \( P( s1 ) = 1/5 \), \( P(s2) = 1/5 \), and \( P(s3) = 1/5 \). If \( E = \{ s1, s3, s4 \} \), then find \( P( E^c ) = \) _____________  

10. Let E and F be given events of some universal set U with \( P( E ) = 0.2 \) and \( P( F ) = 0.4 \). Can E and F be mutually exclusive? Why or Why not?  

    yes  no  \( \rightarrow \) Why or Why not? ________________________________  

11. Write a sample space for each of the following. Determine if your sample space has uniform probability or not --

    A 10-sided die is rolled – the faces are labeled as: 1, 1, 2, 3, 3, 3, 4, 4, 5, 6

    \( S = \{ \) ____________________________ \}  

    Write out the probability distribution for your model.
12. Four students show up for a review session. The teacher decides to give a five point bonus to every student that attended the session that can answer a question about what color shirt he was wearing.

How many different groups of students could possibly get the bonus? ______________

13. Use the following Venn-Diagram to answer the questions that follow.

P( A − B ) = 0.2
P( B − A ) = 0.3
P( A ∩ B ) = 0.2

(HINT: A − B : all objects in that are outside of B.)

a) Find P(A). ______________

b) Find P( A ∩ B'). ______________

c) Find the probability of event A occurring if you know that B has occurred. ________

d) Determine if A and B are independent. SHOW WORK!

14. A four-sided (fair: distinct faces) die is rolled three times and the sequence of outcomes is recorded. How many different sequences are possible? __________

What is the probability that all three rolls are identical? ______________

What is the probability that at least one is a four? ______________
15. A production facility describes objects as being irregular, defective, perfect. It is possible for an object to be classified as both irregular and defective but an object that is classified as being perfect can be neither of the other two classifications. The last crate of 100 objects were inspected and

55 were classified as perfect, 25 were defective but not irregular, 10 were irregular but not defective

a) How many were both irregular and defective? _________

b) If one of these objects was selected at random, then what is the probability that the object is defective, if the object is known to be irregular? _________

16. A recent survey of 25 students indicated the following information

- 14 lived on campus
- 8 were on time every day
- 6 smoked
- 4 lived on campus and smoked
- 6 lived on campus and were on time every day
- 3 smoked and were on time every day

There was an even prime number of students that smoked, lived on campus, and were on time every day.

a) How many of the students did not satisfy any of the three classifications? ______________
   (did not live on campus, did not smoke, were not on time)

b) If one of these students were selected at random, what is the probability that the student smoked and was late? ______________

c) If a student was known to be on time every day, what is the probability that he lived on campus? ______________
17. A card is selected at random. What is the probability that the card is
   a) is a face card? ___________   
   b) a diamond if it is known to be a face card? _____
   c) a diamond or a face card? ___________

18. What are the odds in favor of an ace being drawn in a single draw of a card from a standard deck?
   __________

19. A box contains 4 red marbles, 6 white, 7 blue, and 3 green marbles. A marble is selected at random
   What is the probability that the marble is
   a) green? ___________
   b) green if it is known not to be blue? _______

20. Same box from #19 (but this a brand new problem – nothing has been drawn)
    If two marbles are drawn
    a) what is the probability that they are both blue if none is replaced? _______
    b) one is blue and the other is red (no replacement)? _______

21. A sample space S has uniform probability with \( E = \{s_1, s_5, s_{10}, s_{20}\} \). If \( P(E) = 1/25 \), then find
    \( n(S) \). __________
22. An experiment has three different outcomes. The second outcome is twice as likely to occur as the first and the third outcome is three times as likely to occur as the first outcome.

Find a sample space $S$ that describes the possible outcomes. Find a probability model with the actual numerical values for each outcome.

27. A student completes a five problem multiple choice quiz. There are five questions with four possible choices for each question. What is probability that the first question is answered correctly? 

What is the probability that at least one question is right? 

What is the probability that one question is right? 

Use $P(A) = 0.2$ and $P(B) = 0.6$ on the next two problems

28. If $A$ and $B$ are mutually exclusive, then $P(A \mid B) = \_\_\_\_\_\_\_\_\_\_\_$, $P(A \cup B) = \_\_\_\_\_\_\_\_\_\_$

29. If $A$ and $B$ are independent, then $P(A \mid B) = \_\_\_\_\_\_\_\_\_\_$, $P(A \cup B) = \_\_\_\_\_\_\_\_\_\_$