**You must show your work to receive full credit.**

1. a) Determine if are logically equivalent. Use Truth Tables.

b) Show that are logically equivalent.

Do **NOT** use Truth Tables.

3.. Bring the negation through the following statements:

a)

b) ( Ǝ x ∀ y Ǝ z , P(x, y) ˄ P(x, z) )

4. a) Give an example of a **tautology** using English. Explain why it is a **tautology**.

b) State the **contrapositive** of:

“If it snows today, then I will ski tomorrow.”

c) What is the **negation** of:

“No student in this class passes Discrete Mathematics.”

5. Let **W( x, y )** mean that **x** has visited **y** , where the domain for **x** is the set of

all students in school, and the domain for **y** is the set of all websites.

Express the following as an English statement:

a) Ǝ x, W( mark, x )

b) Ǝ x ∀ y , ( x ≠ Pete ) ˄ [ W( Pete, y ) W (x, y) ]

c) Translate into logical symbols: “There is a website that no student has visited”

6. Using T(x): x read their Textbook, N(x) : x read their Notes, C(x): x is in this class.

Translate the following using the domain given

“Someone in this class has read their textbook and read their notes.”

a) D: this class b) D: all students

7. Convert the following to a logical statement.

Using S(x): x is a snake L(x): x is a lizard D(x): x lives in the dessert

“Only Snakes and Lizards live in the dessert.”

8. Let Q(x, y) be the statement: x + y = x – y

Determine the truth values of the following statements. The Domain for both variables is the integers.

1. Ǝ x ∀ y Q(x, y)
2. Ǝ y ∀ x Q(x, y)
3. ∀ x ∀ y Q(x, y)

9. Determine whether each of the following is a valid argument

1. No math major passes this class. Bob does not pass this class.

Therefore, Bob is a math major.

1. Every math major can understand logic. If you understand logic then you will pass this class. Bob is a math major. Therefore, Bob passes this class.

10. Restate the following statement as if you were preparing to prove it by Contrapositive. ( You don’t need to prove it! )

**“For real numbers x and y, If x + y > 2 Then x > 1 or y > 1”**

11. If you were to use proof by contradiction to prove the following, what would you assume and what would you show? ( You don’t have to prove it! )

**“If x is irrational then x + 1 is irrational”**

12. Prove: If n2 + 5 is even then n is odd.

13. Prove: The product of two odd numbers is odd

14.. Prove or Disprove: for all x, 2x > x

15. A = {x, y, z} B = { 1, 2, 3, 4, 5 } C = { 1, 3, 5, 7, 9, 11, 13 } D={w, x} Find:

A B

| B C |

A X D

P( A )

D – A

1. Let R = { x | x 𝕫 and x < 10} and S = { 1, 2, … 17 }

Find S – R Find S R

1. Let S ⊆T. Find: a)  **S ∩ T** b)  **S – T**
2. Let Ai = { -i, … , -1, 0, 1, … , i } Find:

1. Determine if the following functions are one-to-one, onto, both or neither: (explain)

f: R + 🡪 R + f(x) = x2

f: Z 🡪 Z f(x) = x2

f: R+ 🡪 R f(x) = x2

1. If f(x) = x2 - 1 and g(x) = 2 – 4x , Find:

g(g(x)) = (f + g)(-2) =

1. For the following, find functions f(x) and g(x) so that h(x) = f(g(x))

h(x) = ( 2x + 10 )2 + 5

1. Prove the following function is one -to-one f(x) = 3 – 5x

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