MATH 320
Exam 1
Fall 1994

Name ______________________________

Show all work. Be neat, clear and complete.

1. If \( A = \{1, 2, 3, c, f\} \), \( B = \{a, 4, d, c, b\} \), \( C = \{2, c, d, f, 7\} \), \( D = \{1, 2\} \), \( U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, a, b, c, d, e, f, g, h\} \), list the elements of the following:

   (4) (a) \( A \cup B \)

   (4) (b) \( C \cap B \)

   (4) (c) \( (A \cap B) \cap C \)

   (4) (d) \( C' \)

   (4) (e) \( (A \cup \phi) \cup (B \cap \phi) \)

   (4) (f) \( A \cup D \)
(5) 2. (a) Write the definition of set union ∪.

(5) (b) Write the definition of \( a + b \) for whole numbers.

(5) (c) Use the definition in part (a) to show that \( 2 + 4 = 6 \).

(5) (d) Give the definition of \( a - b \) for whole numbers.

(5) (e) Use the definition in part (c) to show that \( 9 - 5 = 4 \).

3. State which property is illustrated by each of the following: (be sure to name the operation)

(5) (a) \( x + y = y + x \)

(5) (b) \( x \cdot (y + z) = (y + z) \cdot x \)

(5) (c) \( (a + (b + c)) + d = a + ((b + c) + d) \)
(5) (d) \( 0 \cdot (x + y) = 0 \)

(5) (e) \( a \cdot (bc + d) = a \cdot bc + a \cdot d \)

4. Let \( A = \{0, 2, 4, 8, 16, 32, \ldots\} \). Answer each of the following and supply a reason for your answer:

(5) (a) Is \( A \) closed under addition?

(5) (b) Is \( A \) closed under multiplication?

(6) 5. Which whole numbers satisfy the inequality

\[
2x + 8 > 40
\]

Write your answer as an inequality. Also, graph the solution set on a number line.
(5) 6. State the law of Trichotomy.

(5) 7. Exhibit a 1 − 1 correspondence between the sets \( \{a, b, c, d\} \) and \( \{1, 2, 3, 4\} \).

(5) EXTRA CREDIT: Exhibit a 1 − 1 correspondence between the set of all even whole numbers and the set of all whole numbers that are multiples of three.