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Mathematics 130
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Name: _____

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FINAL EXAM

Problem 1 a) Find a fraction equal to $0.7423423423\ldots$

b) Write down a decimal expression which does not represent a rational number.

Problem 2 Use Venn diagrams to prove or disprove the statement

$$A \cap (\overline{B \cup C}) = (A \cap \bar{B}) \cap (A \cap \bar{C})$$

Problem 3 a) Find the prime trees for 21, 36, 40, and 45.

b) Use this information to find their GCF and LCM.

Problem 4 How much 60% solution should be mixed with how much 20% solution to get 6 gallons of 45% solution?

Problem 5 A collection of nickels and quarters is worth \$2.05. There are 17 coins. How many of them are nickels?

Problem 6 A frog, a turtle, and an alligator live in the pond. The frog surfaces every 45 seconds, the turtle every 65 seconds, and the alligator every 96 seconds. If they surface together at noon, what time do they surface together next?

Problem 7 The ratio of Tom's money and Sam's money was 5:3 at first. After Tom spent \$18 and Sam spent \$9, the ratio became 3:2. How much money did Tom start with?

Problem 8 A small plane can fly at 150 mph if there is no wind. On a given day the wind is blowing at 30 mph from the west. If the distance between Chicago and Detroit is 300 miles, how much longer does it take to fly into the wind from Detroit to Chicago than with the wind from Chicago to Detroit?

Problem 9 Let $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$, $A = \{1, 3, 6, 8\}$, $B = \{1, 2, 4, 7\}$, $C = \{2, 3, 4, 6\}$.
a) Draw a Venn diagram containing this information.

b) Find

$(A \cup \bar{B}) \cap C =$

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

$A \cap \bar{B} =$

$\bar{A} \cup \bar{C} =$

$A \cup \bar{B} \cup C =$

Problem 10 In a school 70% of the students take math, 50% take science, and 30% take both math and science.
a) Draw a Venn diagram with this data.

b) What percent of the science students don't take math?

Problem 11 (a) Construct the addition table in base seven.

(b) Construct the multiplication table in base seven.

Problem 12 Calculate in base seven:

(a)
$$\begin{array}{r} 515 \\ 452 \\ +\ 546 \\ \hline \end{array}$$

(b)
$$\begin{array}{r} 324 \\ \times\ 56 \\ \hline \end{array}$$

Problem 13 Convert the following:

(a) $643_{seven} =$ _____ $_{ten}$

(b) $643_{ten} =$ _____ $_{seven}$

Problem 14 Suppose p and r are true and q is false. Find the following truth values:

T F $(p \vee q) \wedge r$

T F $(p \wedge q) \vee r$

T F $\neg p \rightarrow (q \vee r)$

T F $(\neg p \wedge r) \rightarrow q$

T F $(\neg p \rightarrow \neg q) \rightarrow r$

Problem 15 If a number is **cute**, then it is less than 100 and it is divisible by either 5 or 8 (or both). Determine for each sentence below if it is true, false, or undecidable.

T F U 31 is cute.

T F U 24 is cute.

T F U There is no cute number ≥ 125.

T F U 40 could be cute.

T F U There are odd cute numbers.

Problem 16 Suppose that in a class of 30 students, exactly 1/2 have brothers and 2/3 have sisters. Half the students who have sisters also have brothers. How many students are only children?

Problem 17 Determine the postages that cannot be made with a supply of 4 and 7 cent stamps.

Problem 18 Find all numbers between 1 and 100 with exactly eight factors (including 1 and the number).

Problem 19 Determine the truth table for

$$\neg(p \wedge q) \rightarrow (\neg p \vee \neg q)$$

Problem 20 The distance from Madison to Chicago is 130 miles. When Fred drove to Chicago, the traffic was light and his average speed was 65 mph. On the return, there were several construction delays and his average speed was only 50 mph.

a) How long did each trip take?

b) What was Fred's average speed for the round trip?