1. **Short answer.** For each, answer the following question, filling in the blank with “yes” or “no”. Is the number 236,808 divisible by

2. (a) [9] Find the GCD for 510 and 690 using the Euclidean algorithm.

(b) [5] Find the LCM for 510 and 690.

(c) [5] Do any primes less than 23 divide the number $2 \cdot 3 \cdot 5 \cdot 7 + 11 \cdot 13 \cdot 17 \cdot 19$?
3. [10] Hot dogs come in packages of 10, buns in packages of 8, and paper plates in packages of 30. What is the least number of hot dogs, buns, and plates that can be purchased so that there is an equal number of each?

4. [10] Fill in each of the blanks so that the answer is nonnegative and the least possible number:

   (a) $27,457 \equiv \underline{\hspace{1cm}} \pmod{3}$

   (b) $27,457 \equiv \underline{\hspace{1cm}} \pmod{11}$

5. [10] If a fraction is equal to $\frac{1}{6}$, and the sum of the numerator and denominator is 28, what is the fraction?
6. [12] Find the simplest form for each of the following:

(a) \( \left( \frac{1}{3} \right)^3 + (-1)^4 \div 9 \cdot \frac{3}{2} + 3^{-2} \)

(b) \( \frac{a^2 - b^2}{ab - b^2} \)

7. [8] Which of the following represent terminating decimals? Circle all those that do.

\[
\frac{3}{2}, \frac{7}{3}, \frac{3}{5}, \frac{3}{20}, \frac{18}{72}, \frac{10}{57}, \frac{1}{140}, \frac{2}{256}
\]
8. [21] (True/False.) For each of the following statements, write “T” if it is true and “F” if it is false. (You need not give counterexamples for false statements.)

(a) ________ For all nonzero rational numbers $a, b$ and all integers $m, n$:

$$a^m \cdot b^m = (ab)^{2m}.$$  

(b) ________ For all integers $a, b,$ and $d$: If $d|a$ and $d|b$, then $d|(a - b)$.

(c) ________ For all integers $a$ and $b$: If $p$ is a prime and $p|ab$ then $p|a$ or $p|b$.

(d) ________ For all integers $a, b,$ and $d$: If $d|ab$, then $d|a$ or $d|b$.

(e) ________ For all integers $n$: If $3|n$ and $7|n$, then $21|n$.

(f) ________ For all integers $n$: If $4|n$ and $6|n$, then $24|n$.

(g) ________ For all integers $a, b$: If neither $a$ nor $b$ is even, then $\text{GCD}(a, b) \neq 2$. 