Introduction

The Locker Number problems are designed to develop number sense, a necessary prerequisite for algebraic thinking. "Guess and check" is certainly one of the main problem solving strategies to use in finding solutions to locker problems with number tiles. Additionally, showing possible solutions with the tiles and then writing equations are strategies used with these problems. In the discussion that follows, both a "mathematical reasoning" solution and an algebraic solution are provided for Problem 1, and thereafter, only an algebraic solution. *Locker Numbers 1* has unique locker numbers, while *Locker Numbers 2* has more than one locker number for some problems. The first digit refers to the digit in the hundreds place, whereas the third digit refers to the digit in the ones place.

Looking at the Algebra

Locker Numbers 1

Problem 1

In Problem 1, the ones digit (or third digit) is 0, 2, 4, 6, or 8, since the number is even. The third digit is 3 times the first digit. There is only one possibility for the first digit and the third digit. Since $0 \times 3 = 0$, a second 0 tile would be needed. Multiplying 4, 6, or 8 by 3 produces a 2-digit product. Therefore, the first digit must be 2 and the third digit is 6. The second digit is 3 more than the first, so $2 + 3 = 5$. The locker number is 256.
Algebraically, if the locker number is xyz, then:

$x + y + z < 15$ $\quad z = 3x$ $\quad y = x + 3$

Substituting gives $x + y + 3 + 3x < 15$, or $5x < 12$, or $x < 12/5$.

So $x = 0, 1$, or 2.

With $x = 0$, z would be 0.

With $x = 1$, the locker number would be 143, which is odd.

So, $x = 2$, $y = 5$, and $z = 6$.

The locker number is 256.

Problem 2

For Problem 2, if the locker number is xyz, then:

$y = z - 7$ $\quad x = y + 2 = z - 7 + 2 = z + 5$ $\quad z = 0, 2, 4, 6$, or 8

With $z = 0, 2, 4$, or 6, y is a negative integer.

So $z = 8$, $y = 1$, and $x = 3$.

The locker number is 318.

Problem 3 For Problem 3, if the locker number is xyz, then:

$x + y + z = 7$ $x = 2y$ $x, y, z \neq 0$

So, $2y + y + z = 7$, or $3y + z = 7$.

Since the sum is 7, $y = 1$ or 2; otherwise, the sum would be greater than 7.

If $y = 1$, then $x = 2$ and $z = 4$.

The locker number would be 214, which is even.

Therefore, $y = 2$, $x = 4$, and $z = 1$.

The locker number is 421.

Problem 4 For Problem 4, if the locker number is xyz, then:

$xyz > 200$

So $x = 2, 3, 4, 5, 6, 7, 8$, or 9 $y = 3x$

So $y = 6$ or 9 and $x = 2$ or 3

$z = y - 4 = 3x - 4$

So $z = 2$ or 5

Since $x \neq z$ (there is only one 2-tile), the locker number must be 395.

Problem 5 For Problem 5, if the locker number is xyz, then:

$x + y + z > 15$ $x = z + 1$ $y = x + 2 = z + 1 + 2 = z + 3$

So $z + 1 + z + 3 + z > 15$, or $3z + 4 > 15$, or $z > 3\ 2/3$

Since the locker number is odd, $z = 5, 7$, or 9.

If $z = 7$, then y is a 2-digit number.

If $z = 9$, then both x and y are 2-digit numbers.

Therefore, $z = 5$, $x = 6$, and $y = 8$.

The locker number is 685.

Problem 6 For Problem 6, if the locker number is xyz, then:

$y = z - 4$ $x = y + 7$

So $x = z - 4 + 7 = z + 3$

Since the locker number is odd, $z = 1, 3, 5, 7$, or 9.

With $z = 1$ or 3, y is a negative integer.

With $z = 7$ or 9, x is a 2-digit number.

So $z = 5$, $y = 1$, and $x = 8$.

The locker number is 815.

LOCKER NUMBERS 1

Use the number tiles 0 through 9 to find the 3 digit locker numbers.

1. The sum of the digits is less than 15.
The third digit is 3 times the first.
The second digit is 3 more than the first.
The number is even.

2. The first digit is 2 more than the second digit.
The second digit is 7 less than the third digit.
The number is even.

3. The sum of the digits is 7.
No digit is 0.
The first digit is twice the second digit.
The number is odd.

4. The second digit is triple the first digit.
The locker number is greater than 200.
The third digit is 4 less than the second digit.

5. The locker number is odd.
The sum of the digits is greater than 15. The first digit is 1 more than the third.
The second digit is 2 more than the first.

6. The locker number is odd.
The second digit is 4 less than the third.
The first digit is 7 more than the second.