1. Match the equation with the appropriate picture. Record your answers in the chart below. **(24 points: One per correct answer)**

| Card and Match | | Card and Match | | Card and Match | |
|---|---|---|---|---|---|
| 1 | G | 9 | X | 17 | K |
| 2 | Q | 10 | F | 18 | C |
| 3 | I | 11 | U | 19 | P |
| 4 | O | 12 | R | 20 | J |
| 5 | B | 13 | A | 21 | W |
| 6 | T | 14 | M | 22 | S |
| 7 | E | 15 | V | 23 | N |
| 8 | L | 16 | H | 24 | D |

**(12 points: up to 3 points for each explanation)**

a) Explain how your know 1 and _G___ are a match.

The two on the left represent the first 2 in the equation and the array on the right I shows the 2 x 3.

b) Explain how you know that 2 and __Q___ are a match.

The two on the left represent the first 2 and the rectangle represents the plus $3^2$.

c) Explain how you know that 11 and __U__ are a match.

The three on the left represent the first 3 in the equation. The two blue and the four green columns represent the quantity (2 + 4) and the 5 rows of the blue and green represent the times 5.

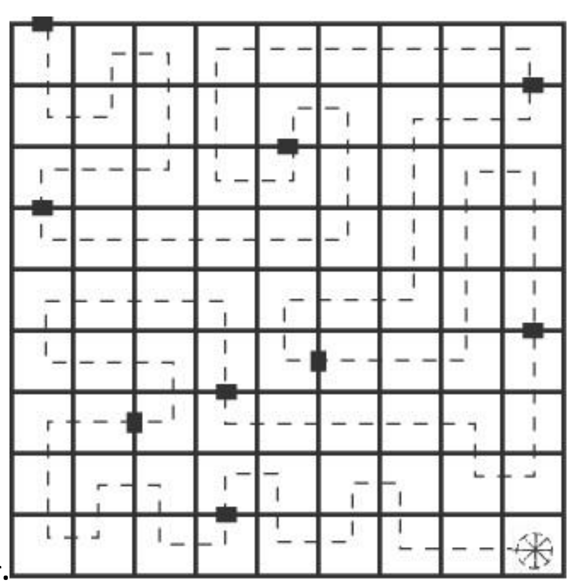
d) Explain how you know that 9 and __X____ are a match.

The yellow represents the $5^2$ and the red X's represent taking away $4^2$.

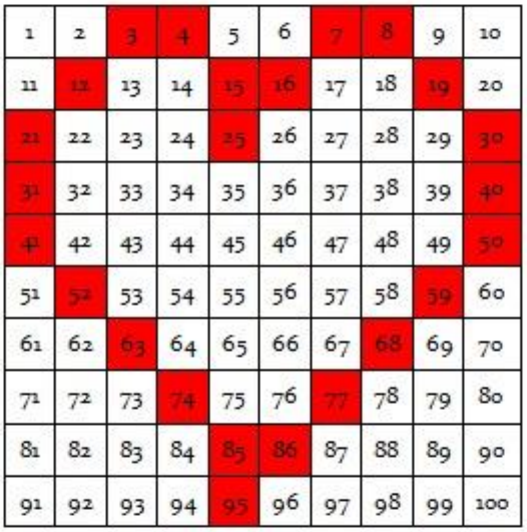
2. a) 22 + 2 + 2 + 2 = 28 **(3 pts for correct answer; order can vary)**

   b) 888 + 88 + 8 + 8 + 8 = 1,000 **(4 pts for correct answer; order can vary)**

3. **(9) One point for each locked (black rectangle) door correctly passed through.** Must pass 8 opened doors immediately prior to the locked door.



r.



(**24: one per correct answer**)

Answer should also appear next to the clue.

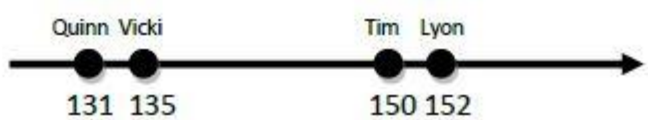
4. The answer for each clue is given below. When all of the answers are colored on the hundreds chart, a heart shape is formed as shown above.

The two positive odd numbers that have a sum of 40 and the largest possible product: **19, 21** .
The smallest square number that is the sum of two non-zero square numbers: **25** .
The next five numbers in the arithmetic sequence 8, 19, 30, **41** , **52** , **63** , **74** , **85** .
The maximum possible number of givens in a standard 9 × 9 Sudoku grid that does not render a unique solution:**77** .
Two different odd numbers, one of whose digits are the reverse of the other, whose sum is 154: **59** , **95** .
The two prime numbers whose product is 4 less than $5^2$ : **3** , **7** .
In a normal distribution, the percent of values within one standard deviation of the mean: **68** .
The 43 rd positive even number: **86** .
The first four positive multiples of 4: **4** , **8** , **12** , **16** .
The integer lengths of three sides of a right triangle whose area is 600 square units: **30** , **40** , **50** .
The value of the sum $2^0 + 2^1 + 2^2 + 2^3$ : **15** .
The value of the sum $2^0 + 2^1 + 2^2 + 2^3 + 2^4$ : **31** .

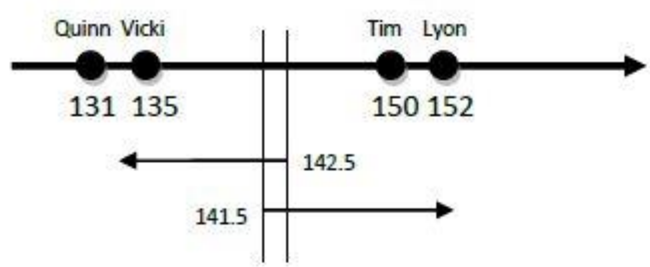
**5. (2pts answer: 5 pts. Explanation)**

**142 marbles** Vicky won with a guess of 135. 2nd place (Tim) is 15 points higher. 3rd place (Lyon) is 17 points higher and 4th place (Quinn) is 4 less. As Quinn was fourth we know the actual number must be higher than 135 because he was less points away but less. 2nd place (Tim) is 15 points higher so the actual number must be app. Half way between the two. Half would be 7.5 so the actual number must be 7 points higher than 135. This would make the 1st place 7 away, 2nd place 8 away, 3rd 10 away and 4th 11 away.

Or, We draw a number line to mark all 4 guesses.




Vicki beat Tim, so the number has to be less than 142.5 (the middle point between Vicki and Tim). Lyon beat Quinn, so the number has to be greater than 141.5 (the middle point between Quinn and Lyon).




The number of marbles is less than 142.5, greater than 141.5, and it is an integer. So, it has to be 142.

**6. (2 pts. Answer: 5 pts. Explanation)**

**Good Grape**

There are several ways to approach this problem:

**Approach 1:** One way is to determine how much concentrate each recipe uses for 1 cup of water. The one that uses the most concentrate should have the strongest grape taste.

| RECIPE | Cups of Concentrate per Recipe | Cups of Water per Recipe | Ratio of Concentrate to Water | Ratio of Concentrate to 1 cup of Water |
|---|---|---|---|---|
| Jerry's Juice | 2 | 3 | 2/3 | $\frac{2 \div 3}{3 \div 3} \approx \frac{0.67}{1}$ |

| | | | | |
|---|---|---|---|---|
| **Grapeade** | 5 | 8 | 5/8 | $\frac{5 \div 8}{8 \div 8} \approx \frac{0.63}{1}$ |
| **Good Grape** | 3 | 4 | 3/4 | $\frac{3 \div 4}{4 \div 4} \approx \frac{0.75}{1}$ |
| **Jane's Juice** | 4 | 7 | 4/7 | $\frac{4 \div 7}{7 \div 7} \approx \frac{0.56}{1}$ |

**Good Grape has the most concentrate (0.75) for 1 cup of water. It should have the strongest grape taste.**

**Approach 2:** Another way is to find out how much water each recipe uses for 1 cup of concentrate. Here, the recipe that uses the least water should have the strongest grape taste.

| **RECIPE** | **Cups of Concentrate per Recipe** | **Cups of Water per Recipe** | **Ratio of Concentrate to Water** | **Ratio of 1 cup of Concentrate to Water** |
|---|---|---|---|---|
| **Jerry's Juice** | 2 | 3 | 2/3 | $\frac{2 \div 2}{3 \div 2} = \frac{1}{1.5}$ |
| **Grapeade** | 5 | 8 | 5/8 | $\frac{5 \div 5}{8 \div 5} = \frac{1}{1.6}$ |
| **Good Grape** | 3 | 4 | 3/4 | $\frac{3 \div 3}{4 \div 3} = \frac{1}{1.3}$ |
| **Jane's Juice** | 4 | 7 | 4/7 | $\frac{4 \div 4}{7 \div 4} = \frac{1}{1.8}$ |

**Good Grape has the least amount of water, 1.3 cups, to 1 cup of concentrate, and so should have the most grape flavor.**

7. **(2 pts answer; 5 pts explanation)**
**No** because if you express all three in terms of K you can solve the equation. The answer does not come out even if set equal to 45 telling us that 45 is not a possible number.

(K +9) + (K + 1) + (K + 4) =45 ? Not a true statement

T = K + 9

J = R – 3 Substitute K + 4 for R J = K + 4 – 3 or J = K + 1

R = K + 4

8. **(2 pts answer; 5 pts explanation)**
Suppose C is even. We know that the sum of the 5 consecutive counting numbers is odd. Thus, 3 of the 5 numbers must be odd. This means that when A + C + D is odd B + C + D must be even. Hence, A + C + E cannot equal B + C + D when C is even. Thus C is odd.

9. **(2 pts answer; 5 pts explanation)**
If you are paid $20 per day for seven days, the you earn **$20 × 7 or $140** . If you are paid $2 the first day and your salary doubles every day for the next six days, then you earn **$2 + $4 + $8 + $16 + $32 + $64 + $128, or $254** . The second scheme earns you more money by the end of the week.