1. (3 points each) Circle either "True" or "False" for each of the following:

a) True False: In the "understand the problem" step, it is helpful to restate the problem in your own words. That way, you weed out any unnecessary information and you make sure that the problem makes sense to you.

b) True False: 2 + 3 = 3 + 2 is an example of the commutative property for whole number addition.

c) True False: Numeration system attributes tell us about how we take a string of symbols in a numeration system (such as MCMXLI) and convert this string to a number (an actual value).

d) True False: 3₂ is a base 2 numeral.

2. (4 points each) Find the missing term in each of the sequences below. Also circle the sequence type. (The missing term is worth 3 points and the sequence type 1 point.)

a) 2, 1, ½, ¼, __________ Arithmetic Geometric Neither

b) 1, 2, 2, 3, 3, 3, 4, 4, 4, __________ Arithmetic Geometric Neither

3. a) (5 points) Convert 135₆ to base 10. Show your work.

\[
\begin{array}{c|c|c}
3 & 6 & 1 \\
\hline
1 & 3 & 5 \\
\end{array}
\]

\[
135₆ = (1 \times 3₆) + (3 \times 6) + (5 \times 1) = 36 + 18 + 5 = 59
\]

b) (5 points) Convert 74 to base six. Show your work.

\[
\begin{array}{c|c|c|c|c}
3 & 6 & 6 & 6 & 6 \\
\hline
2 & 1 & 6 & 0 & 2 \\
\end{array}
\]

\[
36 \div 74 < 216 \text{, so start at } 6^2 \text{ place}
\]

\[
\frac{36}{74} \div 2 = 1 \text{ with remainder } 12
\]

\[
202₂ = (2 \times 36) + 2 = 72 + 2 = 74
\]
4. (5 points) Which base seven numeral follows 566? 

5. You are a student teacher at an elementary school. Let our universe \( U \) be the set of students at this school. Let \( A \) be the set of students in your class, \( B \) be the set of students in the school who take music lessons, and \( C \) be the set of students in this school who participate in city sports leagues after school. Toby, Sara, Terry, and Tim are four of the students in your class. Toby only takes music lessons, while Tim only participates in the city sports leagues. Sara takes music lessons and participates in the city sports leagues. Terry neither takes music lessons nor participates in the city sports leagues.

a) (10 points) Draw a Venn diagram representing this information. Indicate the four named students in the diagram. Shade the set \( A - (B \cup C) \).

b) (5 points) Describe (in words) the set \( C \). (In other words, describe in terms of the story problem given.) 

The students in this school who do not participate in city sports leagues after school.

6. a) (4 points) Illustrate the addition of 2 and 3 on the whole number line.
b) (4 points) Illustrate 5 - 2 on the whole number line using the take away approach.

\[ \begin{array}{cccccc}
0 & 1 & 2 & 3 & 4 & 5 \\
\end{array} \]

\[ \begin{array}{c}
\downarrow 2 \\
\uparrow 3 \\
\end{array} \]

\[ \begin{array}{c}
\downarrow 5 \\
\end{array} \]

\[ \begin{array}{c}
\downarrow 1 \\
\end{array} \]

c) (4 points) Write a short story problem which would be solved by 5 - 2 and where the situation is best represented by the missing addend approach.

Sue has $2. She needs $5 to buy lunch. How much more money does she need to ask her parents for to buy lunch?

\[ 2 + x = 5 \]

7. We will define \( f \) by the following table:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

a) (4 points) Draw an arrow diagram summarizing this information.

\[ \text{Diagram of arrow diagram} \]

b) (2 points) What is the domain of \( f \)?

\( \{1, 2, 4\} \)

c) (4 points) Does \( f \) define a function on its domain? If \( f \) is not a function, how would you modify the table defining \( f \) so that \( f \) would be a function?

\[ \text{NO (1 is sent to two different values). To make } f \text{ a function, let's delete the row } x=1, f(x)=5. \text{ Then 1 is sent to exactly one value.} \]
8. (10 points) Determine the validity of the following argument. Justify your answer with a Venn diagram or a truth table.

**Hypothesis:** If a student's score on the first midterm were 90% or higher, then that student got an A on the first midterm.

**Fact:** Terry did not get an A on the first midterm.

**Conclusion:** Therefore, Terry's score on the first midterm was below 90%.

(The Venn diagram illustrates that each student with a score ≥ 90% must get an A on the test — per the hypothesis.)

9. You are told that the fifth term in an arithmetic sequence is 10 and that the seventh term is 14.

   a) (6 points) What is the common difference \( d \) for this arithmetic sequence? Show your work.
   b) (4 points) What is the first term in this arithmetic sequence? Show your work.

**Hint:** You don't need a formula for solving this problem. Think about the definition of an arithmetic sequence and draw a picture.

\[
\begin{array}{c}
10 \\
\hline
\frac{4}{d}
\end{array} \quad \begin{array}{c}
14 \\
\hline
\frac{4}{d}
\end{array}
\]

\[
\begin{array}{c}
2d = 14 - 10 = 4, \quad \therefore d = 2
\end{array}
\]

\[
\begin{array}{c}
2 + 2 + 2 + 2 + 2 + 2 + 2 = 14
\end{array}
\]

\begin{array}{c}
\text{First term is 2}
\end{array}

10. (4 points each) Calculate the following mentally. Do not erase or cross out any of your calculations.

   a) \(999 + 847 = 1000 + 846 = 1846\)

   b) \(7083 - 29 = 7084 - 30 + 7054\)