Error Patterns and Algorithms.   name:_____

For each problem, analyze what the student is doing, do the next 2 computations *the way the student would do them*, and then explain.

Addition examples:

1.

$$\begin{array}{r} 3 4 \overset{1}{6} \\ + 5 7 2 \\ \hline 8 1 9 \end{array}$$
$$\begin{array}{r} 7 6 4 \\ + 1 3 5 \\ \hline 8 9 9 \end{array}$$
$$\begin{array}{r} 7 \overset{5}{8} \overset{4}{2} \\ + 8 1 9 \\ \hline 1 1 1 5 \end{array}$$
$$\begin{array}{r} 6 \overset{4}{2} 5 \\ + 8 3 7 \\ \hline 1 9 1 2 \end{array}$$

$$\begin{array}{r} 7 \; 4 \; 9 \\ + \; 8 \; 2 \; 5 \\ \hline \end{array}$$
$$\begin{array}{r} 3 \; 6 \; 2 \\ + \; 8 \; 5 \; 4 \\ \hline \end{array}$$

Explain the pattern, and why it works or doesn't work.

2.

$$\begin{array}{r} 4 6 7 \\ + 3 9 5 \\ \hline \end{array}$$ 767 → 857 → 862
$$\begin{array}{r} 7 4 3 \\ + 1 9 1 \\ \hline \end{array}$$ 843 → 933 → 934
$$\begin{array}{r} 6 2 1 \\ + 1 4 5 \\ \hline \end{array}$$ 721 → 761 → 766

$$\begin{array}{r} 7 \; 8 \; 1 \\ + \; 4 \; 6 \; 5 \\ \hline \end{array}$$
$$\begin{array}{r} 9 \; 3 \; 4 \\ + \; 1 \; 8 \; 9 \\ \hline \end{array}$$

Explain the pattern, and why it works or doesn't work.

3.

$$\begin{array}{r} 7 4 \\ + 1 3 \\ \hline 8 7 \end{array}$$
$$\begin{array}{r} 6 5 \\ + 4 9 \\ \hline 1 0 1 4 \end{array}$$
$$\begin{array}{r} 3 8 \\ + 1 6 \\ \hline 4 1 4 \end{array}$$
$$\begin{array}{r} 2 7 6 \\ + 1 9 3 \\ \hline 3 1 6 9 \end{array}$$

$$\begin{array}{r} 7 \; 4 \\ + \; 6 \; 8 \\ \hline \end{array}$$
$$\begin{array}{r} 7 \; 8 \; 1 \\ + \; 4 \; 6 \; 5 \\ \hline \end{array}$$

Explain the pattern, and why it works or doesn't work.

4.

$$523 + 678 = 1\,2\,0\,1$$
$$658 + 391 = 10\,0\,4\,9$$
$$792 + 186 = 9\,9\,7\,8$$
$$459 + 183 = 56\,3\,4\,2$$

	9 3 4			7 8 1
+	1 8 9		+	4 6 5

Explain the pattern, and why it works or doesn't work.

5.

$$46\overset{1}{8} + 394 = 7\,5\,13$$
$$7\overset{1}{8}\overset{1}{3} + 572 = 2\,6\,6$$
$$8\overset{1}{4}\overset{1}{9} + 387 = 1\,3\,17$$

	4 3 4			7 8 3
+	1 8 9		+	6 5 9

Explain the pattern, and why it works or doesn't work.

Subtraction Examples:

6.

$$356 - 179: \quad 200 - 23 = 177$$
$$412 - 172: \quad 300 - 60 = 240$$
$$32 - 18: \quad 20 - 6 = 14$$
$$439 - 145: \quad 304 - 10 = 294$$

	4 3 4			6 2 7
−	1 8 9		−	2 6 4

Explain the pattern, and why it works or doesn't work.

7.

```
   742        826        692          8 3 5          9 1 4
  -3 5 9      -3 5 2     -4 3 8      -  2 5 4       -  5 2 7
  ───────     ───────    ───────     ─────────      ─────────
   4 1 7       5 3 4       2 6 6
```

Explain the pattern, and why it works or doesn't work.

8.

```
   5                                                 8 0 3          5 0 1
   8'0'2      2'6'7       3'0'5                     -  2 6 9       -  1 3 5
  -2 5 9      -1 2 9      -1 3 7                     ─────────      ─────────
  ───────     ───────     ───────
   3 5 3       1 8 8       2 7 8
```

Explain the pattern, and why it works or doesn't work.

9.

```
   5                                                 2 9 4          2 5 4
   2'6'8      1'7'3      1'8'9      3'8'7           -    6 2       -    3 9
  - 5 4       -2 9       - 3 6      - 5 4           ─────────      ─────────
  ───────     ───────    ───────    ───────
   2 0 1 4     1 4 4      1 2 1 3    3 2 1 3
```

Explain the pattern, and why it works or doesn't work.

10. 743   74   439   231   6 2 7   4 2 5
    −152 −18 −125 −86   − 2 6 4   − 1 8 7
    ───── ── ──── ────
    643   64   339   151
    593 (56) 319 (145)
    (591)   (314)

Explain the pattern, and why it works or doesn't work.

11. 143   647   372   306   4 5 4   3 2 6
    − 30   −143 −130 −102   − 1 2 0   − 2 0 4
    ───── ──── ──── ────
    110   504   240   204

Explain the pattern, and why it works or doesn't work.

Multiplication

12.   3 6 4
        48   4 37   6 33   ×   7 8
      × 32   × 56   × 548
      ─────   ──────   ──────
        96   26 2 2   50 64
      1 2 4 0   20 5 5 0   24 2 2 0
      ───────   ────────   30 5 5 0 0
      1 5 3 6   24,4 7 2   ──────────
                              34 6,8 8 4

Explain the pattern, and why it works or doesn't work.