5.5 – First Differences Worksheet
MPM1D
Jensen

1. For each table, create a third column to record first differences. Classify each relation as linear or non-linear.

a)

x	y
0	5
1	6
2	8
3	12

b)

x	y
3	−4
4	−1
5	2
6	5

c)

x	y
−1	1
0	0
1	1
2	4

d)

x	y
−5	8
−3	4
−1	0
1	−4

2. Each table shows the speed of a skydiver before the parachute opens. Without graphing, determine whether the relation is linear or non-linear.

a) There is no air resistance.

Time (s)	Speed (m/s)
0	0
1	9.8
2	19.6
3	29.4
4	39.2
5	49.0

b) There is air resistance.

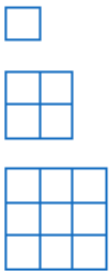| Time (s)	Speed (m/s)
0	0
1	9.6
2	16.6
3	23.1
4	30.8
5	34.2

3. Use first differences to determine which relations are linear and which are non-linear. Write an equation representing each linear relation. Extrapolate the relation to predict the outcome for the seventh step.
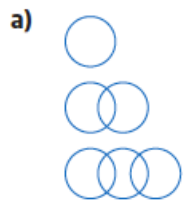
a)

Number of Houses	Number of Segments
1	
2	
3	
4	

b)

Base Side Length	Total Number of Tiles
1	
2	
3	
4	

4. Use first differences to determine which relations are linear and which are non-linear. Write an equation representing each linear relation. Extrapolate the relation to predict the outcome for the seventh step.

a)

Number of Circles	Number of Intersection Points
1	
2	
3	
4	

b)

Number of Sides	Number of Diagonals
4	
5	
6	
7	

5. A pattern is made from toothpicks as shown.

Diagram 1   Diagram 2   Diagram 3

a) Complete the following table.

Diagram Number	# Of Toothpicks
1	
2	
3	
4	

b) Use first differences to show that the pattern is a linear relation.

c) Write an equation for the relation

d) Extrapolate the relation to predict the outcome for the 10th step.

Answers

1) a) 1,2,4 non-linear b) 3,3,3 linear c) -1,1,3 non-linear d) -4,-4,-4 linear
2) a) linear b) non-linear
3) a) linear, $S = 5h + 1$, 36 segments b) non-linear, 49 tiles
4) a) linear, $I = 2c - 2$, 12 intersection points b) non-linear, 35 diagonals
5) a)

Diagram Number	# Of Toothpicks
1	4
2	7
3	10
4	13

b) first differences are the same, 3.
c) $T = 3d + 1$
d) 31 toothpicks