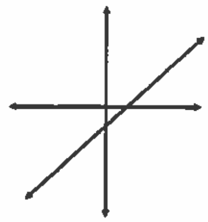
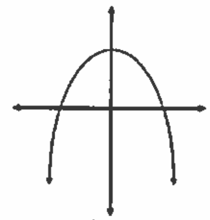
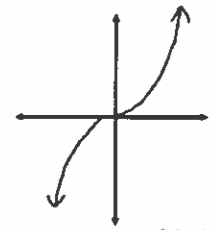
Unit 5 lesson 1

Warm Up:

Identify the following graphs as non-linear or linear.
(non-linear: graph is not a line; linear: graph is a line)


linear


non-linear


non-linear

Unit 5 – Linear Relations I
(Chapter 5 in textbook!)
Day 1 - First Differences

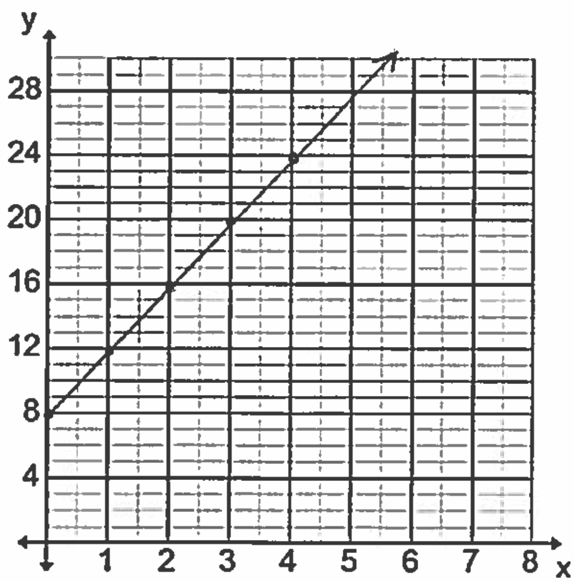
Example 1: How can we use a table of values to determine if a relationship is linear or non-linear?

a) Complete the table of values for the relation $y = 4x + 8$

$4(0)+8=8$
$4(1)+8=12$
$4(2)+8=16$

x	y	FIRST DIFFERENCES
0	8	
1	12	$12-8 = 4$
2	16	$16-12 = 4$
3	20	$20-16 = 4$
4	24	$24-20 = 4$

b) Graph the relation:



c) Classify the relationship as linear (straight) or non-linear (not-straight)? The graph is linear.

d) Describe the pattern in the x-values. (in the table)
The x values are going up by ones.
(We can only do a first difference column if the x's are going up by a constant.)

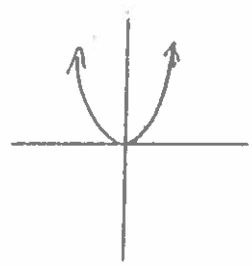
e) Add a third column to your table to record the change in the y-values (We call this the FIRST DIFFERENCES.)

If the first differences are all the same, the graph is linear.

Example 2) Is $y = x^2$ linear or non-linear?

Step 1: Create a table of values:

x	y	FIRST DIFFERENCES
-2	$(-2)^2 = 4$	
-1	$(-1)^2 = 1$	$1-4 = -3$
0	$(0)^2 = 0$	$0-1 = -1$
1	$(1)^2 = 1$	$1-0 = 1$
2	$(2)^2 = 4$	$4-1 = 3$



Step 2: Calculate the first differences:

Step 3: Conclusion The x's are going up by a constant but the first differences are not all the same so the graph is non-linear.

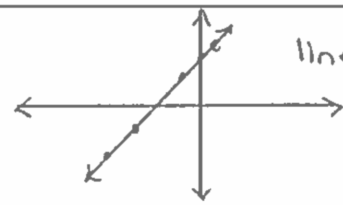
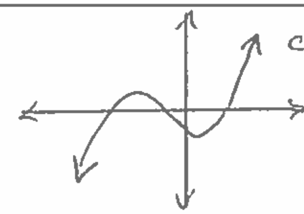
Example 3: Does the table of values represent a linear or non-linear relation?

i) Calculate the first differences:

	x	y	FIRST DIFFERENCES
	0	-3	
2	2	-1	$-1-(-3)=-1+3=2$
2	4	3	$3-(-1)=3+1=4$
2	6	9	$9-3=6$
2	8	17	$17-9=8$

ii) Conclusion:

The x's are going up by 2's, the first differences are not all the same so the graph is non-linear.

	LINEAR	NON-LINEAR
Graph	 line A straight line goes through every single point.	 curve You cannot draw a straight line that goes through every single point.
Table of Values	Provided the x's are going up by a constant, the first differences are all the same.	Provided the x's are going up by a constant, the first differences are not all the same.
Equation	Degree 1. (the exponent on x is one, the exponent on y is one). E.g.'s, $y=x$ $y=7x+3$ $2x-4y=12$ $y=-\frac{2}{3}x+\frac{1}{4}$	Degree other than 1. E.g.'s, $y=x^2-3$ ← degree 2. $y=3x^3$ $x^2+y^2=9$ $y=\sqrt{x}$ $y=\frac{1}{x}$ $y=2^x$ Google 'Desmos' www.desmos.com/calculator enter equation: y = 7x + 3 (linear) y = x ^ 2 - 3 (non-linear) y = 1 / x <enter> y = 2 ^ x <enter> y = √x <enter>

recall: Expression — Degree

- x^2y^3 — $2+3=$ (5) ← number of 'variables' if in expanded form. $xxyyy$ ← 5
- x — (1) ← x ← just 1
- xyz^2 — $1+1+2=$ (4) ← $xyzz$ ← 4
- 7 — no variable (0)
- x^2+7x+2 — largest of 2, 1, 0 (2)