

## Identifying Quadratic Relations from Table of Values

### STEPS:

1. Look at the **table of values**, check to make sure the x values are increase/decreasing by **equal increments**

2. Calculate the first differences by

$$\text{F.D.} = y_{\text{row2}} - y_{\text{row1}} = y_{\text{row3}} - y_{\text{row2}} = y_{\text{row4}} - y_{\text{row3}}, \text{ etc....}$$

• If the numbers are all the **SAME**, then  $\rightarrow$  **Linear**

• If the numbers are **NOT** all the same, then  $\rightarrow$  **NON-Linear**

3. If the F.D.'s are **NOT** all the same, then calculate the 2<sup>nd</sup> Diff.

$$\text{Second.D.} = \text{FD}_{\text{row2}} - \text{FD}_{\text{row1}} = \text{FD}_{\text{row3}} - \text{FD}_{\text{row2}} = \text{FD}_{\text{row4}} - \text{FD}_{\text{row3}}, \text{ etc....}$$

• If the numbers are all the **SAME**, then.....  $\rightarrow$  **Quadratic**

• If the numbers are **NOT** all the same, then...  $\rightarrow$  **NON-Quadratic**

### Example #1

X	y	First Differences	Second Differences
0	27		
1	24	$24 - 27 = -3$	—
2	21	$21 - 24 = -3$	—
3	18	$18 - 21 = -3$	

F.D are equal  
 $\therefore$  linear

### Example #2

X	y	F.D.	S.D
-3	11		
-2	6	$6 - 11 = -5$	$-3 - (-5) = -3 + 5 = 2$
-1	3	$3 - 6 = -3$	$-1 - (-3) = -1 + 3 = 2$
0	2	$2 - 3 = -1$	$1 - (-1) = 1 + 1 = 2$
1	3	$3 - 2 = 1$	$3 - 1 = 2$
2	6	$6 - 3 = 3$	$5 - 3 = 2$
3	11	$11 - 6 = 5$	

S.D are equal  
 $\therefore$  Quadratic

## Example #3

X	y	F.D.	S.D
-4	17		
-2	21	$21 - 17 = 4$	$4 - 4 = 0$
0	25	$25 - 21 = 4$	$5 - 4 = 1$
2	30	$30 - 25 = 5$	$8 - 5 = 3$
4	38	$38 - 30 = 8$	$-6 - 8 = -14$
6	32	$32 - 38 = -6$	

F.D are not equal  
 $\therefore$  not linear.  
 S.D. not equal  
 $\therefore$  not quadratic.

## Identifying Quadratic Relations from and Equation

### STEPS:

1. Look at the exponent of x, in the equation

- If the highest exponent is 1  $\rightarrow$  then **LINEAR**
- If the highest exponent is 2  $\rightarrow$  then **QUADRATIC**
- If the highest exponent is 3 (or a fraction)  $\rightarrow$  then **NEITHER**

### Examples

Which of these relations are linear and which are quadratic and which are neither? Explain why.

a)  $y = 5x - 3$

Linear - highest exp is 1

e)  $y = -0.5x^2 - 2$  Quadratic - highest exp. 2.

b)  $y = 9x^2 + 2x + 5$  Quad

f)  $15x - 12y + 7 = 0$  Linear

c)  $y = -5x^2 + 6x - 4$  Quad.

g)  $y = 9x^3 + 2x^2 + 5$  Neither - highest exp is 3 or more

d)  $y = -7x + 9$  Linear

h)  $y = -5x^2 + 6x - 4$  Quad.

## Word Problem Example

A fountain of sparks from a Canada Day rocket follows an arc in the air. This table shows the height of the sparks at various distances from the launching point.

a) Determine the first and second differences and record your answers below.

Distance (m)	Height	F.D.	S.D.
5	43		
		$75 - 43 = 32$	
10	75		$22 - 32 = -10$
		$97 - 75 = 22$	
15	96		$12 - 22 = -10$
		$108 - 96 = 12$	
20	108		$2 - 12 = -10$
		$110 - 108 = 2$	
25	110		$-8 - 2 = -10$
		$102 - 110 = -8$	
30	102		

b) What type of function does this represent and how do you know?

*Quadratic - S.D are same*

c) Complete the scatterplot on the graph to the right.

d) ~~How long were the sparks in the air?~~

d) e) At what distance did the sparks reach the maximum height?

*Approx. 25 m from launching point.*

e) f) What was the height of the sparks when the launching point distance was 25m away? *110 m*

